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# Port Infrastructure and Supply Chain Integration under the Belt and Road Initiative: Role of Colombo Port in the Apparel Industry in South Asia

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## Abstract

This paper analyzes the role of port infrastructure in supply chain integration of the South Asian apparel industry through a case study of Colombo Port. Key factors for improving supply chain integration are first identified, such as reducing lead time production, increasing diversity of product lines and higher value-added products. The case study shows that the Colombo Port transshipment hub and its multi-country consolidation services have played a role in improving supply chain integration in these key factors. Nevertheless, there is a need to improve internal logistics and to improve matching port and logistics infrastructure in the rest of South Asia. We discuss policies for further improving port and logistics infrastructure that could be implemented under the Belt and Road Initiative.

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*Keywords:* Port infrastructure; supply chain integration; global value chain; apparel industry; South Asia

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## 1. Introduction

As part of China's regional development policy to enhance global supply chains, 'Belt and Road Initiative (BRI),' infrastructure building projects in various developing countries are underway (EI Unit, 2016). This study investigates how the goals of the BRI can be achieved in South Asia to improve the apparel supply chain and pinpoints which aspects of port management can be improved to facilitate such integration. South Asia, critically located at the center of the Silk Road trading routes between the Middle East, Africa and Asia, is one of the focus areas of the Chinese state's efforts to connect its economic corridors. The apparel supply chain is selected for study as the apparel industry, along with textiles, is by far the most important industry in South Asia. It is the largest sector in terms of production and employment and represents 15.31% of total exports from India, 59.38% from Pakistan, 47.89% from Sri Lanka, and 94.36% from Bangladesh, while accounting for 12% as a South Asian regional group in the global apparel market (Lopez-Acevedo & Robertson, 2016).

The Port of Colombo has been by far the most critical in processing container traffic flow in the region (Suárez-Alemán, 2016). Situated in the East-West shipping route, Sri Lanka has long provided a shipping channel to South Asia. Bangladesh, India, and Pakistan, which rely on seaborne operations for approximately 75% of their total trade, depend critically on Colombo's transshipment capacities (Suárez-Alemán, 2016). This is true for the apparel industry as well, for both imports and exports. Given this, we explore the role of ports generally and Colombo Port in particular in supply chain management of the apparel industry in South Asia, and discuss recommendations for improvement under the Belt and Road Initiative.

This paper proceeds as follows. Section 2 shows the importance of infrastructure to supply chain management in the apparel industry. Section 3 discusses the supply-chain of the South Asian apparel industry. Section 4 discusses the importance of port infrastructure, and Sections 5 and 6 focus on Colombo Port and its future challenges. Section 7 highlights some key policy implications. Section 8 provides a concluding discussion.

## 2. Data and Methodology

Data are mostly reconstructed based on the information released by official websites of institutions and the literature. In section 5 and 6, key logistic factors and challenges of Colombo Port in supply-chain of the South Asian apparel industry are based on the interviews taken by four practitioners working in the global logistics companies and apparel industry, as well as one trade journalist. The questionnaire used for the interviews is included in the appendix.

## 3. The Link between the Supply Chain and Port Facilities.

The table below shows that the apparel trade of South Asia is highly dependent on maritime transport [Table 1]. The selected countries in the table below are major participants in the global apparel industry, the United States and EU highlighted as buyers and the rest as suppliers. The table does not include China or major Southeast Asian apparel exporters such as Vietnam and Indonesia due to data unavailability.

**Table 1 Transport Modes by Major States in Apparel Industry Trade**

Transport Modes Share, %	Export			Import		
	Sea	Air	Others	Sea	Air	Others
Turkey (2015)	9.5	76.9	13.1	46.8	47.6	5.0
Cambodia (2014)	53.0	31.0	14.3	44.3	36.8	16.5
Myanmar (2014)	69.3	30.0	...*	98.4	1.5	...
European Union 28 (2014)	53.0	31.0	14.3	44.3	36.8	16.5
United States (2015)	22.0	72.9	5.1	38.5	57.3	4.1
India (2015, 2014)	68.2	30.1	1.7	82.2	17.5	0.3
Sri Lanka (2015, 2014)	47.4	52.6	0.0	22.5	23.0	...
Pakistan (2014)	20.4	79.3	0.3	66.1	32.9	1.0
Bangladesh (2014)	40.9	58.2	0.9	88.0	9.4	2.6

Source: World Trade Organization Country Profiles (2014, 2015)

\* Missing data.

While prices are important in terms of supply and demand, low prices and adequate quality do not necessarily guarantee trade (Lopez-Acevedo & Robertson, 2016). Even in an industry with such tight margins as the apparel industry, production cost is not the sole factor to consider. Various factors such as lead time and reliability affect total costs, while sustainability, including fair trade, is also significant. Indeed, as South Asia already enjoys a competitive advantage in production costs, the region must focus on improving total costs and moving up in quality and sustainability.

This claim is supported by a World Bank Group survey of buyers and stakeholders in the global apparel value chain that points to factors other than cost that significantly impact performance [Figure 1]. From [Figure 1], it can be inferred that countries that there is a very close link between lead time and reliability on the one hand, and quality on the other. Given the low ranking of South Asian countries in the lead time and reliability list, it appears that the South

Asian apparel industry must continue to improve the lead time and reliability of its supply chain if it is to rise up in the quality rankings.

Figure 1 South Asia Competitiveness versus Southeast Asia in Apparel Industry in the Non-Cost Areas

Country	Buyer's perceptions of:					
	Quality		Lead time and reliability		Social compliance and sustainability	
China	1	●	1	●	3	▲
Bangladesh	5	◆	5	◆	6	◆
India	6	◆	6	◆	5	◆
Vietnam	2	●	2	●	2	●
Cambodia	4	▲	4	▲	4	▲
Indonesia	3	▲	3	▲	1	●

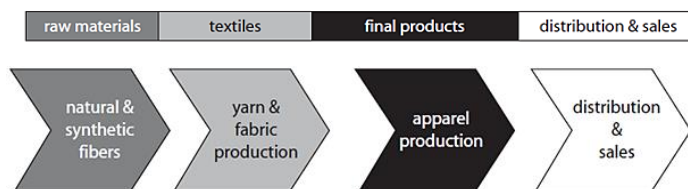
Source: Lopez-Acevedo & Robertson (2016)

Note: Countries were ranked from 1 to 6 on each factor, with 1 being the best and 6 being the worst. Ranks for quality and lead time/reliability are the same. Green indicates top two countries (factor is not an issue); orange is for the middle two countries and indicates caution; blue is used for the bottom two ranking countries (factor is an issue).

The argument that lead time and reliability matter for quality is partly because buyers are willing to pay more for goods that can be turned around in a shorter period of time with adequate reliability. Buyers are willing to pay more because this allows them to reduce inventory. A shorter lead time further allows buyers to be more sensitive to end-customer requirements, which are usually the requirements of higher-end customers. Thus, they are more likely to outsource high-end work to locations that offer reliable, low lead-time turnarounds.

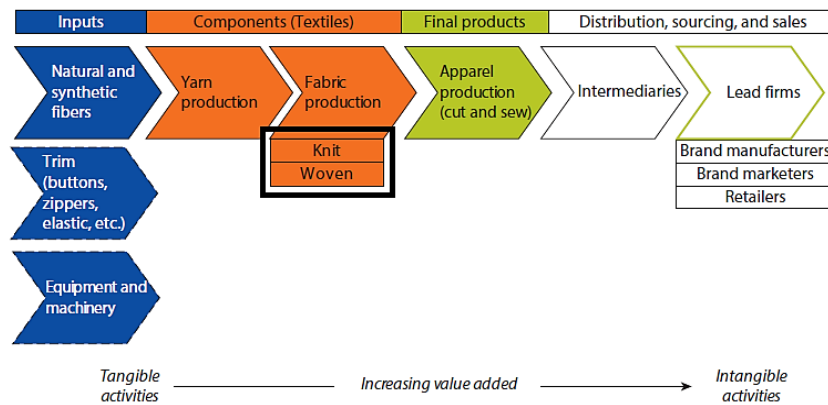
While there are various definitions of supply chain management, it is most commonly defined as the sequence of firm activities from production level to the distribution stage involving value-adding services (Mentzer et al., 2001). The supply chain apparel industry can be simply depicted below [Figure 2]. In general, supply chain integration can be realized by improving operational performance and productivity. (Lopez-Acevedo & Robertson, 2016) In the apparel industry, including textile as part of the apparel production, for instance, its supply chain integration can be realized by increasing the function ranges in production or shifting or changing the mix of activities to higher-value tasks, or building backward manufacturing links to the textile industry. (Lopez-Acevedo & Robertson, 2016)

Figure 2 Supply Chain of Apparel Industry



Source: Frederick (2010), modified.

In this paper, shifting to a more sophisticated level of products with higher unit prices in the final product apparel production level is the indicator for higher degree of supply chain integration. For example, if countries export more woven apparel, which are sold at higher unit cost and at a more expensive price than knitted apparel, we can say the country is more integrated to the higher value of apparel supply chain [Figure 3].

**Figure 3 Indicator of Supply Chain Integration: Moving from Knitted Apparel Export to Woven Apparel**

Source: Lopez-Acevedo & Robertson (2016), modified.

In commercial activities, especially those in countries at the lower development stage, with cheaper labour costs, ports directly engage in firms' participation in the supply chain and attract ships from multiple countries of origin. More efficient and productive ports allow each firm to specialize in certain products and facilitate importing and exporting of the necessary materials to the firms and contribute to producing the higher value-added items more efficiently. For example, if a country's port is efficient, countries without raw materials can import the ingredients and, after using their specialized skills, re-export them, possibly allowing product diversity with higher productivity. With an inefficient port, however, firms would tend to make more limited kinds of products at which they are more likely to be in their full production capability. To state the key hypotheses,

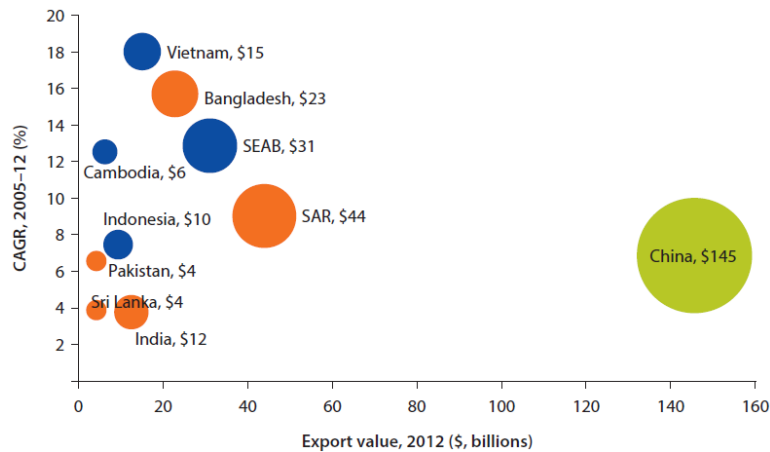
- Good quality port infrastructure helps to reduce the lead time production.
- Good quality port infrastructure helps to maintain product diversity by allowing export of various materials of foreign origin.
- The more higher-value-added products a firm/country produces, the more it is integrated in the supply chain.

Thus, the question is how ports may contribute to supply chain integration and which seaport infrastructure development domestically and regionally matter. Export dependency on the apparel industry is higher in South Asian national economies than in Southeast Asia and the rest of countries in the world. Seeing room for South Asian apparel industry to move into the higher value-added, woven apparel exports, we can examine more closely the apparel industry of South Asia: which port in South Asia could facilitate the industry best and what can ports do to improve? What are the policy implications?

#### 4. Supply Chain of the Apparel Industry in South Asia

##### 4.1. South Asia at Global Apparel Export Market

The apparel and the textile industry are by far the most important labor-intensive industry in the region. It is the largest sector in terms of production and employment and represents 12% of the total global apparel market (Lopez-Acevedo & Robertson, 2016). In the global apparel supply chain, South Asia is the location of production networks that source to retailers in the United States and Europe and constantly competes with production firms in Southeast Asia and China. [Figure 4]

**Figure 4 Direct Competitors to South Asia in Global Apparel Market**

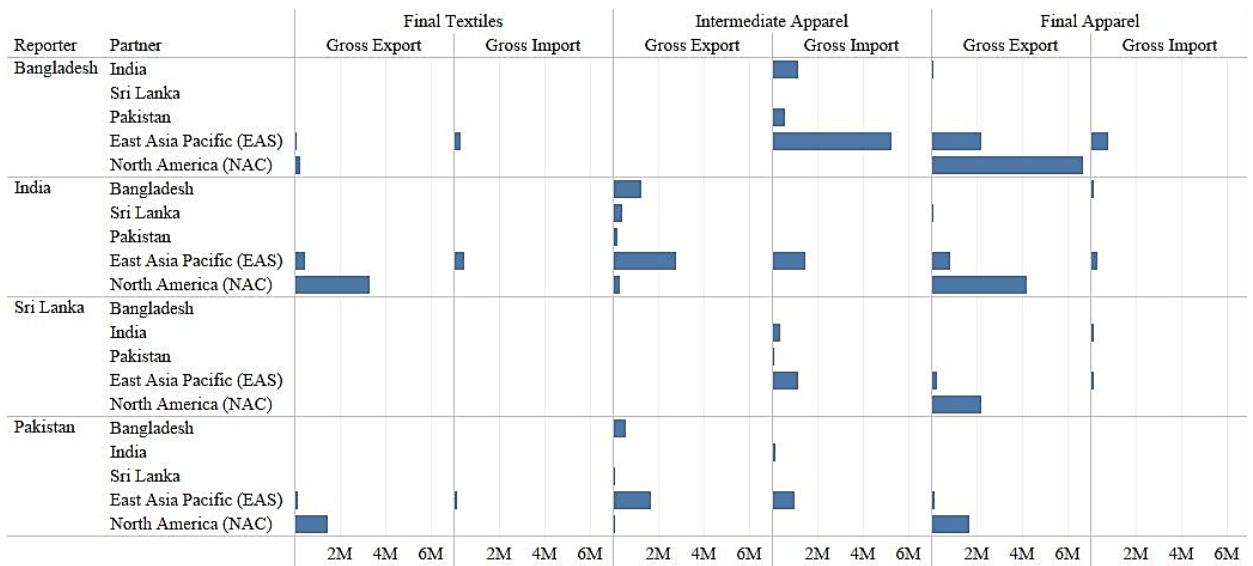
Source: UNSDUNSD (United Nations Statistics Division) (2014). *World Apparel (HS1992 61+62) Imports (1990–2012)*.

Note: Exports based on world (aggregate) apparel imports (HS92 61+62). Number next to country name represents 2012 apparel export value (\$, billions); Orange: SAR (South Asia sample) country; Blue: SEAB (Southeast Asian benchmark) country; Green: China, Size of bubble based on share of global apparel exports in 2012. In 2012, the value of global apparel trade was approximately \$355 billion (UNSD 2014a). CAGR=compound annual growth rate.

#### 4.2. Apparel Industry within South Asia

Within South Asia, the apparel industry is comprised of very different profiles for each country. Within the industry, the countries have specialized in different products at different production levels, ranging from low-end raw textile material suppliers to high-end intimate apparel suppliers. The following figures show the apparel trade structure of South Asian countries. Based on the UN COMTRADE Global Value Chain Analysis, [Figure 5] shows gross export and gross import of final textile, intermediate apparel, final apparel produced by South Asian countries. By apparel production level, India and Pakistan export final textiles the most. Bangladesh and Sri Lanka mostly export final apparel products. In reporter country-specific, India, as the most widely-ranged line of apparel producer in South Asia, imports final textiles from China and exports apparel to the United States. It also imports intermediate apparel from China and Taiwan, and then exports the final product mostly back to China as well as to Bangladesh, Sri Lanka, Pakistan and the United States. It mostly exports final apparel to the United States. In contrast, Bangladesh mostly imports intermediate apparel from China, produces them into final apparel and exports to the United States as well as back to China. Pakistan exports final textiles and final apparel to the United States and intermediate apparel mainly to China as well as to Bangladesh, while importing intermediate apparel from China. Fairly simply, Sri Lanka imports intermediate apparel from China and India and exports the final apparel to the United States. Seeing from the trade flows, we can infer the reducing the lead time in production through good quality of port infrastructure can significantly help the supply chain of South Asian apparel industry.

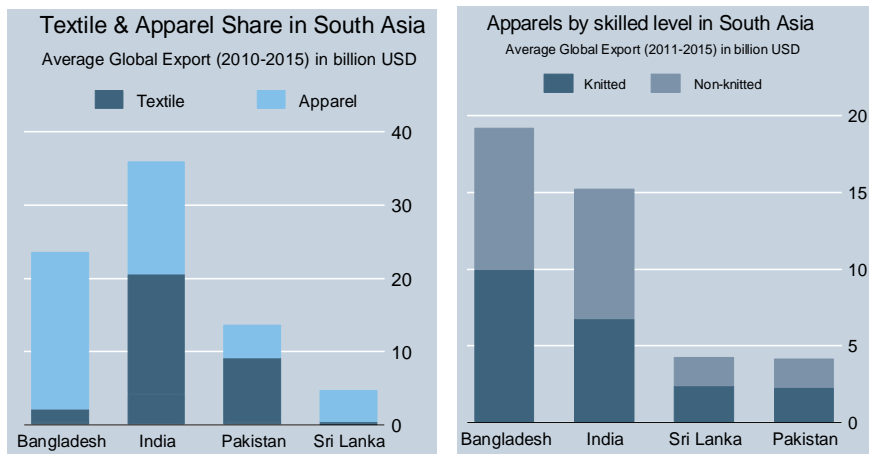
Figure 5 Value Chain of South Asian Apparel Industry (2015, in 1000 USD)



Source: UN Comtrade data on gross exports and imports to construct the trade indicators related to country’s participation in Global Value Chains (GVCs) using the informed classifications based on Sturgeon and Memedovic (2011).

As the tables below show, South Asian countries differ in their composition of textile and apparel exports. To some extent, this reflects factor endowments – both India and Pakistan are large raw cotton producers. However, compared to Bangladesh and Sri Lanka, they have a relatively low share of apparel, including in absolute terms (India’s apparel exports are less than that of Bangladesh, and Pakistan’s is similar to Sri Lanka). Within apparel production, the countries appear to have a fairly equal distribution in terms of knitted (i.e., less sophisticated) and non-knitted (i.e., more sophisticated) apparel exports [Figure 6.a., 6.b.].

Figure 6.a. Average Global Textile & Apparel Export 6.b. Apparel Export Structure in South Asia (2011-2015), billion USD

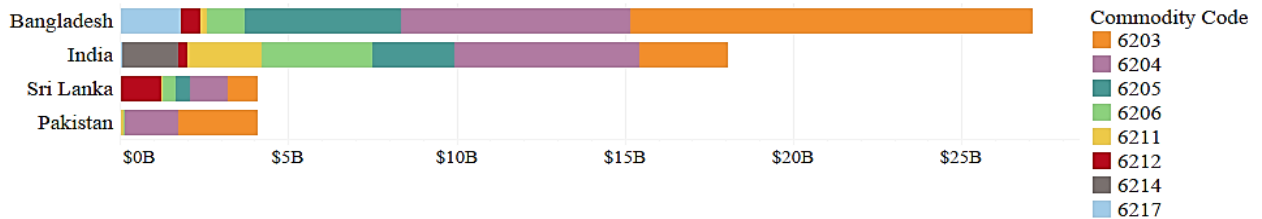


Source: 6.a. UNCTAD and 6.b. UN Comtrade

However, looking more closely at just the not-knitted woven apparel, the differences in the countries’ apparel industry profiles can be seen even more starkly. [Figure 7] identifies the specialization of each country within not-knitted, woven apparel exports under HS code 62. HS code refers to the Harmonized Commodity Description and Coding Systems (HS) as an international nomenclature used to classify the products for customs purposes, specifying the items within the category by adding digits. While all four of them export men’s suits and shirts (6203, 6205) and

women's dresses and blouses (6204, 6206), what is more interesting is that, there are unique specialties that distinguish themselves from others. These suggest that Sri Lanka produces the highest value-added items. For example, Bangladesh's specialization is in producing clothing accessories (6217) whereas India is specialized in producing shawls and mufflers (6214). Sri Lanka produces the most brassieres and lingerie (6212), however, Pakistan hardly specializes its product line.

**Figure 7 Not-knitted Apparel Export of South Asia (in USD)**



Source: UN Comtrade (2015, See appendix for the detailed HS chapters).

Note: Top 8 commodity codes were selected to distinguish national competitiveness in not-knitted apparel export.

This conclusion is further supported by data on revenue/employee, as shown below [Table 2].

**Table 2 South Asian Garment Exports, 2012**

Country	Bangladesh	India	Pakistan	Sri Lanka
Exports (\$ billion)	20.0	10.7	3.6	4.0
Employment	20,000,000	7,000,000	1,760,000	400,000
Revenue/Employee (\$)	1,000	1,500	2045	10,000

Source: Dossani and Tkacheva, 2013. RAND Working Paper.

From these figures, it can be noted that South Asian countries have a lot of room to expand their woven apparel lines. For instance, Pakistan, instead of mass production of lower-end woven apparel such as jeans and shirts using its cheap labor cost, could increase in higher-end woven apparel such as lingerie, as Sri Lanka does.

While there are several factors that affect a country's position on the value-chain, such as internal transportation facilities, access to capital and labor quality, an important component is the external trade and transportation infrastructure. This can be a significant cost, as we discuss further below.

## 5. The Importance of Port Infrastructure

In the shipping industry, shippers, freight forwarders and ocean carriers consider port competitiveness when choosing which port to ship to (Martínez Moya & Feo Valero, 2016). Port competitiveness usually refers to the market utility and attractiveness of the port over other ports. The port competitiveness is determined by port performance (efficiency and effectiveness), port connectivity, port location, port charges and infrastructure. (Martínez Moya & Feo Valero, 2016)

### 5.1. Port Location

Geographic location of the port and the shipping route on which it is located are critical in determining the transit time, shipping distance, and costs. The shipping line companies consider both the land distance to the main production/consumer centers (Chang et al., 2008; Lirn et al., 2003; Ng, 2006; Park & Min 2011; Wiegman et al., 2008; Yuen et al., 2012) and the location of the port with respect to major shipping routes, (Castillo-Manzano, González-Laxe, & López-Valpuesta, 2013; Lirn et al., 2003, 2004; Onut et al., 2010) land-based shippers and freight-forwarders, on the other hand, are, for the most part, solely interested in minimizing the distance/cost. (De Langen, 2007; Steven & Corsi, 2012; Ng et al., 2013; Tiwari et al., 2003; Tongzon, 2009)

## 5.2. Port Performance

Port performance is a very broad term and it touches upon many dimensions in sectors and stakeholders ranging from the infrastructure facilities to the port authorities' administrative services. It can be mainly divided into port efficiency and port effectiveness. Port efficiency is directly influenced by port operation and accessibility to the ocean. (Martínez Moya & Feo Valero, 2016) From the shippers' perspective, the number of moorings and cranes are priorities for efficiency (Tiwari et al., 2003) but, from the freight forwarders' perspective, crane productivity is most critical. (Tongzon et al., 2009) Port effectiveness is generally defined by the quality of the service and is determined by traffic congestion, reputation, cargo damage, quick response to customers' needs, service quality, customs handling, port safety and security and port management. (Martínez Moya & Feo Valero, 2016)

## 5.3. Port Charges

Port charges generally include the mooring costs and port services. (Tongzon et al., 2009) The importance placed on port charges varies for shippers/freight-forwarders and ocean carriers. The ocean carriers are sensitive to the cost for either commercial traffic (Chang et al., 2008; Wiegman et al., 2008; Yuen et al., 2012) or transshipment (Caillaux, Sant'Anna, & Meza, 2011; Chou, 2010; Lirn et al., 2003, 2004; Ng, 2006; Park & Min, 2011; Tai & Hwang, 2005), which is more price-elastic. Hence, the hub port's price competitiveness also depends on the value of the cargo and price-elasticity of the industry. (Martínez Moya & Feo Valero, 2016) On the contrary, for shippers and freight-forwarders, if more higher-value-added cargo is being shipped, less significance is placed on port charges. (Tongzon et al., 2009)

## 5.4. Port Connectivity

In much of the literature, port connectivity is determined by connections to hinterlands and inter-modality. (Acosta et al., 2007; Chang et al., 2008; Chou, 2010; De Langen, 2007; Tongzon & Sawant, 2007; Wiegman et al., 2008; Yeo et al., 2008; Yuen et al., 2012). Ports play a role in connecting the sea to land for changing modality. Hub ports like the port of Singapore connect smaller feeder ports for processing trade. Also, the frequency of maritime calling at the port and the number of services available at the port are seen as critical port choice factors for shippers and freight forwarders. (Steven & Corsi, 2012; Tai and Hwang, 2005; Tongzon, 2009; Ugboma et al., 2006; Yuen et al., 2012).

## 6. Container Ports in South Asia

Based on the above port competitiveness criteria for port choice, major container ports in South Asia can be comparatively examined: Mundra and Jawaharlal Nehru Port (JNPT) of India, Chittagong of Bangladesh, Karachi of Pakistan and Colombo of Sri Lanka [Table 3]. For the competitiveness factors, only 11 items are selected by aggregating the total amount of capacity and number of equipment from each terminal of respective port for general port description.

**Table 3 Descriptive Statistics of Top 5 Container Ports in South Asia (2015)**

Competitiveness	Factors	COLOMBO	MUNDRA	JNPT	CHITTAGONG	KARACHI
<b>Location</b>		South Sri Lanka	West India	West India	Southeast Bangladesh	Southwest Pakistan
	Number of Container Terminals	5	3	5	1	3
	Channel depth at berth	20m	11m	16.5m	9.1m	12.5m
<b>Infrastructure</b>	Container Handling Capacity (TEUs)	7.05 million (ADB 2015)	3.1 million	5.3 million	4.02 million (2011)	1.45 million
	Number of Cranes					
	Ship-to-Shore Gantry Cranes	51	16	34	4	17



	Rubber Tire Gantry	150	50	99	19	49
<b>Port charges</b>	Terminal Handling Charges (\$/TEU, May 2015)	151 37 (transshipment)*	116	95	85	115
	Turnaround time (days)	0.86	2.57	2.02	3.23	1.45
<b>Performance Efficiency</b>	Waiting time (days)	0.09	0.47	0.96	0.57	0.29
	Idle time at berth (%)	6.9	27.2	8.1	8.6	4.8
	Container Handling Throughput (TEUs)	5.1 million	1.75 million	4.47 million	2.02 million	1.96 million (2015-16)

Sources: 1) Turnaround time, waiting time and idle time from Competitiveness of South Asia's Container Ports (2016); 2) the rest is from ADB 2015 and Sri Lanka Port of Authority, Mumbai Port Trust, Jawaharlal Nehru Port Trust, Adany Group, Chittagong Port Authority, Karachi Port Trust and their annual reports for details.

\* The transshipment tariff rate of Colombo Port is \$37 per TEU.

Across the items, Colombo Port maintains the most advantages over other ports in the region. In particular, the competitiveness of the Colombo port can be explained through three big categories: Deep-sea access, Transshipment and Efficiency.

## 7. Why Colombo Port

### 7.1. Deep-sea access

The Port of Colombo is the deepest port in South Asia, which is determined by the depth of water of the channel to get to the terminal. In order to meet a higher demand for cost reduction, the ship building companies have been building bigger ships for higher capacity at single consignment. The biggest size is called the Post-Panamax ship and has dimensions of 366m-49m-15.2m, which could contain 13,000 TEUs. Usually, terminals are constructed to guarantee enough capacity in terms of length and width. However, providing great depth requires high-end technology. The Panamax requires 12.8m of depth whereas the Post-Panamax needs at least 18.3m. Therefore, any ports deeper than 15m are labelled as deep-sea ports that can harbor these mega vessels. There are currently two deep-sea ports in South Asia, the Port of Colombo and the JNPT. The Port of Colombo was the biggest until the JNPT's port expansion project, following significant investment by the Singapore Port Authority.

### 7.2. Efficient Operation

The Colombo Port infrastructure outdoes other ports in South Asia by having 51 ship-to-shore gantry cranes and 150 rubber tire gantry cranes across its terminals. [Table 3] The number of cranes is crucial particularly for transshipment cargo as such cargo is not required to go through the customs and requires fewer port services in general. Port infrastructure, in the case of transshipment cargo, is most important for loading and unloading the cargo from the vessels at berth. Other indicators of efficient port performance include: turnaround time, waiting time, percentage of idle time at the berth and container handling throughput. Effectiveness can also be studied by reviewing the customs clearance process, port agreement service, etc.

### 7.3. Transshipment

Just like passengers transferring at airports due to an absence of direct lines or for more economical reasons, container cargos, for similar reasons, make multiple transfers. However, transshipment was initially developed to service the smaller ports or ports with poor infrastructure who cannot afford bigger vessels (Rodrigue, 2015). Likewise, the Colombo Port is also competitive as a transshipment hub port in South Asia with its geographic location and well-developed infrastructure facility. The port imposes terminal handling charges at \$ 151 per TEU but for transshipment only \$ 37 per TEU is charged [Table 4]. Transshipment is especially important to the Colombo Port as its major investment has been mostly driven by transshipment traffic. (Suárez-Alemán, 2016) About 73 percent of Colombo's cargo is for transshipment, a rate much higher than transshipment percentages at other South Asian ports [Table 5].

**Table 4 Terminal Handling Charges at Selected Ports, May 2015 (dollars/TEU)**

Port	Charge
Chennai	65
Chittagong	85
JNPT	95
Karachi and Qasim	115
Mundra	116
Colombo	151
Singapore	161
Salalah	194
Dubai	215
Rotterdam	268
Los Angeles	390
Malé	415

Sources: www.safmarine.com and port authorities. (Suárez-Alemán 2016).

Note: The terminal handling charge is a charge to the shipping lines' customers that is supposed to cover the container-handling charges paid to the ports plus minor additional costs.

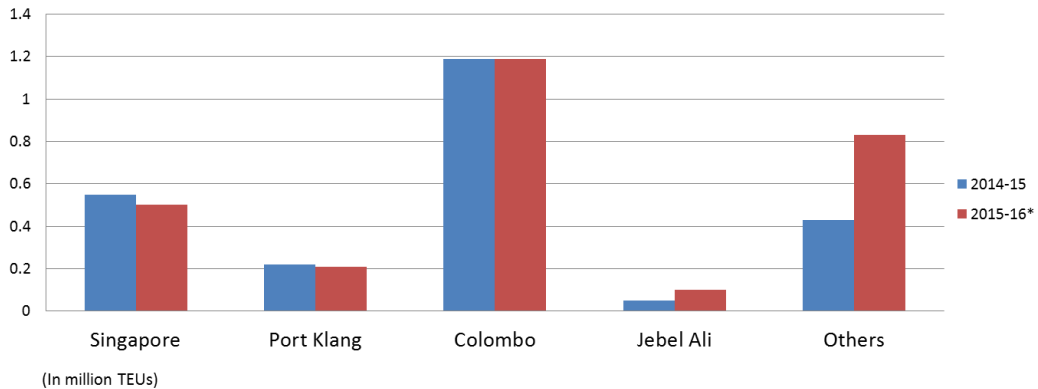
**Table 5 Annual Share of Cargo Volume That Is Transshipped at Selected South Asian Ports, 2003-12 (%)**

Port	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Colombo	66	66	67	73	73	76	76	75	73	73
Cochin	0	0	0	0	0	0	0	0	3	2
Kandla	0	0	0	1	3	2	0	2	1	0
Kolkata	5	6	6	5	5	5	4	2	2	1
JNPT	9	9	6	5	6	6	4	3	2	1
Mumbai	8	9	16	22	27	21	36	34	31	31
Tuticorin	0	0	0	0	0	0	3	0	3	2
Visakhapatnam	16	15	8	9	8	7	8	3	8	6

Sources: Based on data from Ministry of Road Transport and Highways of India 2013 and Sri Lanka Port Authority.

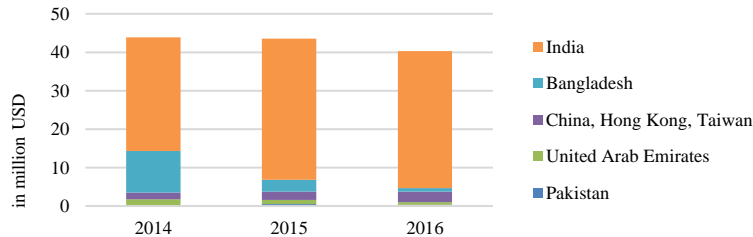
Note: Figures are based on volume. Only ports with some transshipment traffic over the period are included.

The importance of transshipment escalates as global supply chains develop and as values at each production level by multiple producers add up to create final products. Since only 17 to 18% of pairs of countries are connected with each other through a direct service, mainly due to insufficient volume between the sites, all other country pairs need to use transshipment for bilateral containerized trade. (Fugazza, 2015; Fugazza, Hoffmann, & Razafinombana, 2013) Naturally, transshipment ports face higher pressures from other international ports, naturally reacting to the international shipping industry's market fluctuations. This is because transshipment port competition relies not only on neighboring facilities but also on international hubs. (Suárez-Alemán, 2016) As the hinterlands may not be of relevance, ports struggle to maximize efficiency and minimize costs to better serve deep-sea traffic needs. In fact, the biggest transshipment rival to Colombo is Singapore [Figure 8], where the second most Indian transshipment is handled. Indian transshipment, the cargo bound to and from India, is very crucial to Colombo Port and, conversely, Colombo Port is also crucial to India as 42% of Indian transshipment is handled at the Colombo Port. [Figure 8] Transshipment cargo destined for and departing from India does not merely indicate the size of Indian commercial activities. Transshipment cargo to India represents a diverse range of products that go far beyond textile and apparel items. Inferring from the fact that Sri Lanka's biggest importer and re-exporting destination is India [Figure 9], we can conclude that transshipment at Colombo Port is also contributing to Sri Lanka's apparel production.

**Figure 8 Colombo's Share of Indian Transshipment (flat year-over-year)**

(In million TEUs)  
Source: Indian Ministry of Shipping (2016).

\* Provisional

**Figure 9 Re-export of Sri Lanka's Textile & Apparel Products (HS 50-63)**

Source: UN Comtrade.

#### 7.4. Multi-Country Consolidation Services and Value-adding Services

Importantly, Colombo Port works as a logistics hub in South Asia and enables firms to process trade through multi-country consolidation services (MCC) that consolidate products from various countries within a single hub port. Before cargo is transhipped to smaller vessels enroute to final destinations, containers from different countries are consolidated and value-adding activities such as sorting out defective products, packaging/repacking and labelling may be undertaken (Erich, 2017). In most cases, packaging and labelling is completed in factories (Kirwel, 2017). However, smaller companies, whose shipments are smaller and that use Less Container Lead (LCL) rather than Full Container Lead (FCL), can save on costs through MCC services (Krulish, 2017). Also, firms from countries that are not party to trade agreements may enjoy lower or zero tariffs. Skipping the customs process allows them to moderately participate in the supply chain and benefit from the port's MCC service. Colombo Port maintains its advantage through these channels in South Asia but there are other ways to improve port effectiveness in order to compete with international transshipment rivals.

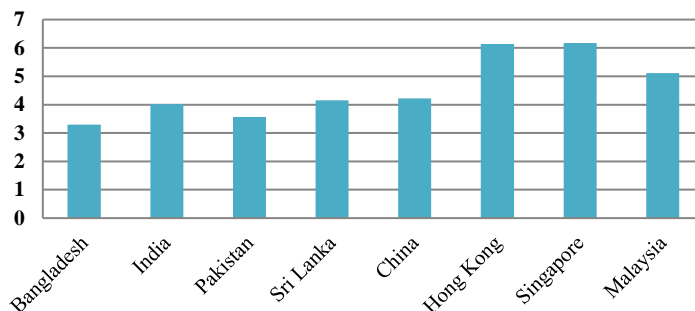
## 8. Future Challenges for Port of Colombo

### 8.1. Customs Procedures

The internationally fragmented textile and apparel supply chain is especially vulnerable to inefficient customs clearance procedures in two stages. First is when intermediary goods are imported to be manufactured into final products. Second is when the final products are imported to retail countries (OECD, 2004). For time-sensitive products especially, customs clearance procedures can largely determine a firm's delivery abilities. For instance, in Sri Lanka, one clothing firm failed to earn a long-term contract with a major retail chain in Europe as input shipments were jammed in the local port (Mann, Eckert, & Knight, 2000) The order would have been completed within 72 hours but the deadline was missed due to bureaucratic red tape in customs, causing the firm to lose its higher value-added

products. Sri Lanka, in fact, has the least cumbersome customs procedures in South Asia. Although South Asian countries generally show poor scores in the Burden of Customs Procedure Score of the World Bank Development Indicator data [Figure 10].

**Figure 10 Customs Burden Score, Average of 2012-2016 (1: most inefficient – 7: most efficient)**



Source: Data from World Economic Forum's (WEF) Executive Opinion Survey (World Bank Development Indicator) (2016): Measuring business executives' perceptions of their country's customs procedures efficiency. The rating ranges from 1 to 7, with a higher score indicating greater efficiency.

Among South Asian countries, Bangladesh shows the lowest score, indicating the most cumbersome customs procedures, and is followed by Pakistan, India and Sri Lanka. Considering that Singapore is the biggest international transshipment competitor and far exceeds Sri Lanka in customs procedures (Horwitch, 2017), customs procedure reform is even more crucial. The documentation process, which requires submission of request forms for import and export service orders, is partially responsible for the customs delays (Dassanayake, 2017). However, from the perspective of port operations, there are necessary documents for effective management. For example, port service agreements, documents that record vessel schedules for turnaround times and berth times enable optimal operation within the given infrastructure (Dassanayake, 2017). In South Asia, the Sri Lanka Port Authority is the only organization that implements port service agreements (Dassanayake, 2017). The efficiency of this documentation procedure is also determined by the degree of port automation.

8.2. Automation

In order to achieve full automation of documentation in port operations, the following steps are required [Figure 11]. To begin with, the business process for vessel scheduling should be analyzed with the Port service agreement. By simplifying and harmonizing administrative procedures within South Asia, document requirements can be simplified under regional agreement alignment. Once the cross-border data is collected and exchanged, E-Single window and paperless trade can be realized.

**Figure 11 Approach to Developing an Electronic Single Window and Paperless Trade Environment**



Source: South Asia Trade Facilitation Report(ESCAP & ADB) using UNESCAP data (2012) ADB (2014), modified

Automation at the documentation level goes through the above process [Figure 11]. However, port automation in cargo handling is still in the early stages of development and it is one of the key investment areas for future strategies (Dassanayake, 2017). Since automation ranges from electronic documents procedure to vessel scheduling to crane movement in cargo handling, it can determine the fundamental efficiency of port operation. Autonomous port operation is managed by the Terminal Operating System (TOS) for the planning and executed movement of all vehicles on the terminal and for the scheduling of container movement in order to get best throughput at the terminal (Nelmes, 2006). Ranked as the best operating port in Europe, the Port of Rotterdam is 100% automated (Dassanayake,

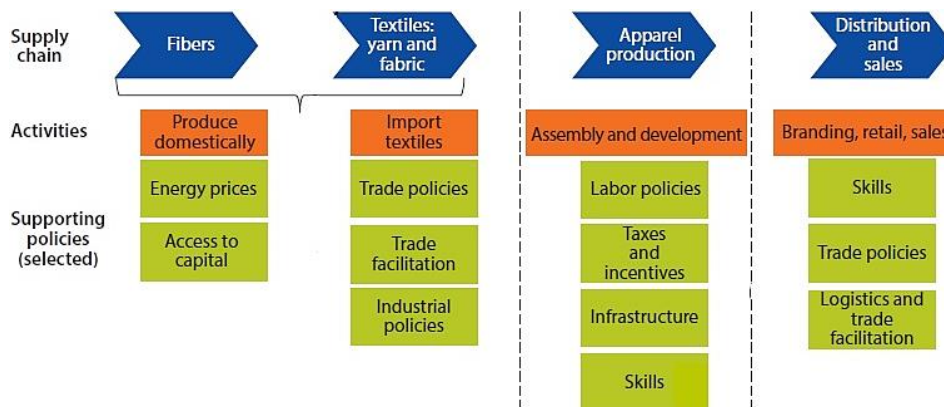
2017). The port also boasts remote crane operation, where operators may control up to three cranes simultaneously. The cranes lift containers onto self-driving, battery-powered automated guided vehicles (AGVs), which then deliver the containers to stacks to be later distributed by truck, train or barge (The Economist, 2016). The automation reduces costs tremendously not only in terms of shipping time but also in terms of delays and reduces the chances of accidents and worker strikes.

In South Asia, port operations mostly remain attached to the conventional management system and are dominated by human labor (Dassanayake, 2017). However, Colombo Port has been developing an automation system by adopting the real-time Container Terminal Management System (CTMS) in 2009. This includes a Differential Global Positioning System (DGPS)-based PDS (Position Detection System) solution (SLPA, n.d.). Those systems are used for real-time container tracking on the vessels, an active tag network for container movement with gate control, a terminal-wide handheld and vehicular-mounted wireless network and a web-based Terminal Operating System (SLPA, n.d.). Even after overcoming such technical challenges, the supply chain still faces obstacles in non-tariff barrier areas, which can only be systematically fixed through relevant policy measures.

## 9. Policy Implications

In order to understand how different policy measures matter for different production stages, Lopez-Acevedo and Robertson identify the selected supporting policy areas and the infrastructure policy impacts at all stages of the supply chain, especially in the apparel production stage and the final distribution stage [Figure 12]. To the production firms, government policy is critical as it shapes industry structures. Policy objectives are of key importance and may range from developing domestic capabilities to facilitating imports. At the first stage, raw material production within the supply chain, infrastructure policy plays an important role in domestic production. Often these policies include fuel price subsidies or affect capital availability for machinery purchase. Trade and industrial policies affect the supply chain in a different way, directly impacting textile importers by waiving import duties and reducing bureaucratic procedures for shorter lead time. (Lopez-Acevedo & Robertson, 2016)

Figure 12 Respective Policy Area according to the Stage of Apparel Supply Chain



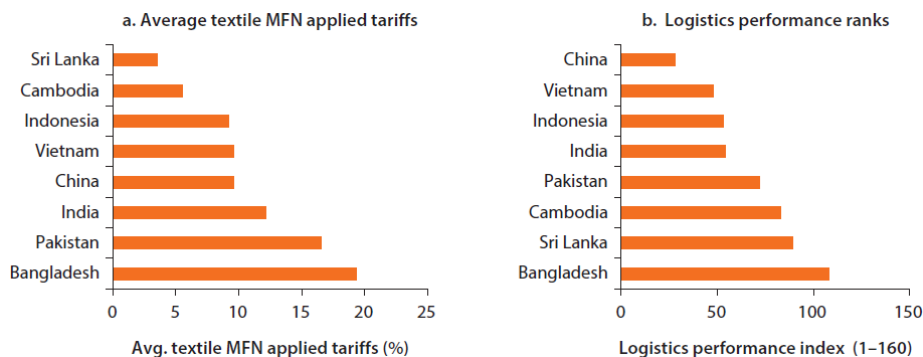
Source: Lopez-Acevedo & Robertson (2016), modified.

In the apparel production stage, where final products are developed and assembled, labor policies for competitive wage levels are important to potential new investors. The national minimum wage laws are critical to a firm's margins and competitiveness, especially in the tight marginal structure of the apparel industry. Industrial policies, such as the efficient infrastructure for lead times, corporate taxes, exchange rates, and incentives for foreign investment are also very relevant.

In the final stage, where the final apparel is distributed and sold to consumers, policies for developing a workforce with soft skills and providing access to new end markets and buyers are necessary. Those policies affect the apparel

supply chain as a whole but are especially relevant to the South Asian region, as opposed to Southeast Asia, where there are generally higher import tariffs and less developed infrastructure [Figure 13].

**Figure 13 Tariff and Logistics Performance comparison between South Asia and Southeast Asia, 2014**



Sources: Textile Import Tariffs: WTO, UNCTAD, and ITC 2014. Logistics Performance Index (LPI) Rank: Logistics Performance Index, World Bank.

Note: Textiles including yarn, fabric and textile products but not apparel. MFN=Most Favored Nation Principle of WTO. Logistics Performance Index is weighted average of the country scores following these six dimensions: 1) Efficiency of the clearance process (i.e., speed, simplicity and predictability of formalities) by border control agencies, including customs; 2) Quality of trade and transport related infrastructure (e.g., ports, railroads, roads, information technology); 3) Ease of arranging competitively priced shipments; 4) Competence and quality of logistics services (e.g., transport operators, customs brokers); 5) Ability to track and trace consignments; 6) Timeliness of shipments in reaching destination within the scheduled or expected delivery time.

Excluding Sri Lanka, average textile tariffs after applying MFN rules in South Asia are significantly higher than in Southeast Asia and China. Bangladesh imposes more than 60% higher tariffs on textiles than Southeast Asian countries on average. As seen previously in the South Asian apparel industry structure, as the final apparel production mostly relies upon imports for textile sourcing, tariffs are a huge obstacle not only to the textile importers but also to industrial efficiency as a whole. In addition, the logistics performance index from the World Bank indicates that South Asian countries are far less competitive than Southeast Asian countries. This means they lose their advantage in low labor costs to an extent due to relatively poor logistics. This appears to be true even for Sri Lanka, a situation that offsets, to some extent, the relatively superior port operations in Colombo (see Table 3). Since Logistics Performance Index rankings are based on the nation-wide scale of a country, there can be some gap between the solo performance of Colombo Port and overall Sri Lanka's competitiveness in logistics compared to other South Asian countries.

### 9.1. Implication for Sri Lanka

- *Port-Road Connectivity*

The port is the main infrastructure for the logistics of the apparel supply chain, however, connections to the hinterlands remain critical and are an area in which Colombo Port must improve (Dassanayake, 2017). In order to establish seamless connectivity between transportation modes from ports to roads to airports, Sri Lanka has been developing a '30-year Mega Plan'. As part of this plan, the 25.8 km-long Colombo-Katunayake expressway opened to the public in October 2013 so as to provide a high speed link between Bandaranaike International Airport and Colombo (Expressway Authority, n.d.). The highway reduces the travel time between Peliyagoda and Katunayake to 20 minutes from an earlier travel time of 90 minutes using Peliyagoda-Puttalam road.

- *Colombo Port City Building Project*

More recently, the Colombo Port City Building Project conducted by the China Harbor Engineering Corporation (CHEC) under the Belt and Road Initiative, took an investment of 1.4 billion USD to renovate port infrastructure by building streamlined-land water transport channels, port co-operation transport routes, liner sailings, etc. One of the

first steps in this project was to reclaim 233 hectares of land from the sea at the breakwater of the Colombo Port Expansion project by Galle Face Green (Central Bank of Sri Lanka, 2013).

Of the total land development, 170 hectares is identified as sellable land, while the rest is to be used for the development of roads, parks and other public spaces (SLPA, n.d.). The objective of this development is to avoid some of the constraints of further development in Colombo city such as environmental pollution due to overcrowding, blockage of drainage systems and road traffic congestion. The project is to be carried out under the two phases: Phase I of the project includes construction of the wave protection breakwater, reclamation of 233 hectares of land, ground improvement and infrastructure development (Central Bank of Sri Lanka, 2013). The construction of office buildings, hotels, commercial buildings, a convention center, residential apartments and development of other facilities required for the commercial operation of the port city is expected under Phase II. The initial stage of the project is expected to be completed within three years of the effective date of the agreement. The overall port city is to be separated into four zones: hotel and residential, office, cultural and commercial areas. It was originally initiated in 2011 but put on hold due to political opposition from India and only resumed in March 2016, following new elections in Sri Lanka (EI Unit, 2016).

The Colombo Port City is aiming to become an Export Processing Zone (EPZ) that, under its own legislation, can maintain favorable trade, investment, and tax policies (Shepard, 2016). With legislation more favorable to trade than regions of Sri Lanka outside the EPZ, Colombo Port City would rise as an international business hub, a major financial center of South Asia, and a knowledge hub that employs a skilled work force. But building an Export Processing Zone at Colombo Port could contribute to the customs burden problem in South Asia and result in other trade issues by not improving upon regional trade policy.

## *9.2. Implications for South Asia*

Due to the complexity of customs, effecting regional trade policies is beyond a single government's authority and it cannot overhaul a whole region's supply chain. One way, however, to lower import tariffs is through regional, bilateral, and multilateral trade agreements. Trade agreements are crucial, yet South Asia trade is one of the least integrated regions in terms of intra-trade, with intra-trade share accounting for less than 10 percent of total trade in 2012 (Lopez-Acevedo & Robertson, 2016). Globally, the restrictiveness of South Asia's trade regimes is only ahead that of Sub-Saharan Africa's on the World Bank's Overall Trade Restrictiveness index (Rama 2014). South Asia's most important trade agreement is the South Asian Free Trade Area (SAFTA) Agreement but, given political tensions, particularly between India and Pakistan, there is little progress in its implementation.

Examining all relevant policies in apparel supply chain, we can see where South Asia stands in terms of trade, labor, infrastructure, industrial and compliance policies, with Southeast Asia and China as benchmarks [Table 5]. Notably, Sri Lanka has nearly zero duties on textile imports, while the other three South Asian countries impose relatively higher tariffs in comparison to its benchmarking competitors. When it comes to lead time and reliability, indicated by the logistics performance and trade across borders (doing business) rank, Bangladesh and India ranked much lower than Sri Lanka and Pakistan. Recently, social compliance issues have been raised by buyers over child labor. This influences contracts dramatically if supplying countries are not in accordance with labor regulations. Compliance issues have been rising and there have been national initiatives for social compliance in Sri Lanka and Bangladesh but, in India and Pakistan, little has been done to meaningfully address this problem. These issues are illustrated in the table below.

**Table 6 Labor, Trade and Industrial Policies of Apparel Industry in South Asia in comparison to China and Southeast Asia**

Factor/ country	Cost			Lead time and reliability		Compliance	
Policy area	Trade		Labor	Industrial/infrastructure		Labor	
Benchmark indicator	Apparel market access preferences	Textile import tariffs	Import tariff reduction policies	Min. wages	Logistics Performance Index (LPI) rank	Trading across borders (doing business) rank	National compliance initiative (if any)
China	4	4	EPZ	8	28	98	Chinese social compliance (CSC) 9000P
Cambodia	1	2	EPZ	3	83	124	Better work (2001)
Indonesia	3	3	DD	7	53	62	Better work (2011)
Vietnam	2	4	EPZ, DD	5	48	75	Better work (2009)
Bangladesh	1	8	DD, BWH	1	108	140	Accord & alliance (2013); Better work (2014)
India	2	6	DD	4	54	126	—
Pakistan	3	7	DD	6	72	69	—
Sri Lanka	3	1	—	2	89	108	Garments without guilt (2006)

Sources: Apparel Market Access Preferences: updated from Frederick and Staritz (2012), table 3.11, p. 77. Textile Import Tariffs: WTO, UNCTAD, and ITC 2014. Import Tariff Reduction Policies: section below on “Import Tariffs and Tariff Reduction Schemes for Exporters.” Minimum wages: Donaldson 2014. Logistics Performance Index (LPI) Rank: Logistics Performance Index, World Bank. National Compliance Initiative: compiled by World Bank.

Note: Textiles include yarn, fabric, and textile products, but not apparel. Light grey cells are best, dark gray cells are worst, gray cells are in the middle. Textile import tariffs rank from lowest (1) (best) to highest (7) (worst). Minimum wages similarly rank from lowest to highest. World Bank Logistics Performance Indicators (2014), 160 countries ranked, with 1 being the highest. World Bank Doing Business Indicators: 189 countries are ranked, with 1 being the highest. National compliance initiative: WRAP (Worldwide Responsible Accredited Production) and SAI Global Compliance are also both very active in China and India. (1) = GSP beneficiary; LDC-EBA duty-free access to EU; (2) = GSP beneficiary; reduced tariffs in EU, plus FTAs with other key end markets; (3) = GSP beneficiary, but limited FTAs; (4) = non-GSP beneficiary in most countries and limited FTAs; BW = bonded warehouses; DD = duty drawback; EBA = everything but arms; EPZ = export processing zones; FTA = free trade agreement; GSP = generalized system of preferences; LDC = least-developed country; — = Not available.

The fundamental challenge to creating regional policies in South Asian is that trade in the region is highly asymmetrical. India accounts for the large majority of production, consumption, and trade. Even though there is some transfer of the textile trade from India to Bangladesh and, to a lesser extent, to Sri Lanka, it is hard to classify this as a regional value chain. In contrast, Southeast Asia has been successfully integrating regionally to reduce tariffs not only between themselves but also with the apparel end buyers such as Australia, China, Japan and Korea through multilateral trade agreements. Southeast Asian countries formed the Association of South East Asian Nations (ASEAN) in 1967 and have now developed into an ASEAN economic community (AEC) (Lopez-Acevedo & Robertson, 2016). Although asymmetries in economic development also exist in Southeast Asia, ASEAN countries have strongly committed to a philosophy of collectiveness and have built multi-lateral trade agreements based upon the shared interests.

## 10. Concluding Discussion

This paper attempted to identify the domestic and regional impact of port infrastructure development on the apparel supply chain integration of South Asia. Our hypothesis is that the sophistication of a country’s supply chain depends in significant part on port infrastructure. Better quality ports reduce lead time of production, enable product diversity and supply-chain integration with more options from foreign sources, and thereby allow countries to produce higher-end products. As a case study, the Colombo port and apparel supply chain of South Asia were examined due to the economic importance of apparel on the regional economy and the key role of the Colombo Port in the region. In comparison to the other major South Asian container ports, Colombo Port stands out as the most efficient logistic hub port and as the only deep-sea port which can facilitate transshipment services between East and West for feeder ports. Also, Colombo Port provides multi-country consolidation services for Less Container Lead (LCL), reducing the shipment cost for smaller units of production and value-adding services in the warehouses for final packaging and sorting. Despite challenges from international transshipment rivals, a longstanding customs burden and a lack of



automation, Colombo Port is still expected to contribute greatly to regional supply chain integration and lead Sri Lanka's 'Mega Plan', improving the connectivity between the port, roads and airports, along with the Colombo Port City Project funded through Chinese Foreign Direct Investment. Regionally, non-cost factors of supply chain integration such as regional trade agreements, domestic industrial policies and social compliance should be further coordinated by South Asia community as a whole.

Despite the sophistication of Colombo Port, there are some significant constraints that prevent moving up the value-chain in South Asia. The first is that port infrastructure in other parts of South Asia remain weak. In a situation where two countries have equally sophisticated port infrastructure, supply-chain integration between them would be a more natural outcome. However, if one country has a sophisticated port infrastructure and the other does not, the more natural outcome will be that the country with the sophisticated port infrastructure will become a transshipment point for the less sophisticated country's port. Supply-chain integration may not occur in such a situation. This appears to be what has happened in South Asia.

A second constraint is that integration of supply-chains within each of the countries of South Asia is hampered by relatively poor internal logistics infrastructure (Figure 13).

A third constraint is the differential implementation of social compliance policies, with Bangladesh and Sri Lanka somewhat ahead of India and Pakistan. Integration of the supply chain between countries with different levels of implementation of social compliance policies would be significantly hampered by buyers' unwillingness to accept low standards of social compliance in some components of the end-product.

Suppliers in the apparel industry in South Asia should follow buyers by streamlining their sourcing strategies and focus on reducing the cost and complexity of the supply chain (Lopez-Acevedo & Robertson, 2016). This requires significant investment in both port infrastructure and domestic logistics infrastructure in South Asia. So far, South Asia maintains an advantage in low labor costs but other factors such as customs clearance times, lead time reductions and social compliance issues indicate that South Asia will have to systematically improve in these respects.

The Belt and Road Initiative offers the possibility of helping South Asia integrate its supply-chain and improve value-addition through the improvement of port infrastructure (South Asia excluding Sri Lanka) and domestic logistics infrastructure (all South Asia). As discussed above, there are several such initiatives under way in Sri Lanka to improve the domestic logistics infrastructure under the BRI. Given that Sri Lanka is already a leader in both port infrastructure and fair labor policies in South Asia, policies should be designed to support these projects.

## Acknowledgements

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## Appendix 1. Detailed HS Chapters Described in Figure 7

6201	Overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar articles, men's or boys', other than those of heading no. 6203 (not knitted or crocheted)
6202	Coats; women's or girls' overcoats, carcoats, capes, cloaks, anoraks, ski-jackets, wind-cheaters, wind-jackets and similar articles, other than those of heading no. 6204 (not knitted or crocheted)
6203	Suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts (other than swimwear); men's or boys' (not knitted or crocheted)
6204	Suits, ensembles, jackets, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and shorts (other than swimwear); women's or girls' (not knitted or crocheted)
6205	Shirts; men's or boys' (not knitted or crocheted)
6206	Blouses, shirts and shirt-blouses; women's or girls' (not knitted or crocheted)
6207	Singlets and other vests, underpants, briefs, night-shirts, pyjamas, bathrobes, dressing gowns and similar articles; men's or boys' (not knitted or crocheted)
6208	Singlets and other vests, slips, petticoats, briefs, panties, nightdresses, pyjamas, negligees, bathrobes, dressing gowns and similar articles; women's or girls' (not knitted or crocheted)
6209	Garments and clothing accessories; babies' (not knitted or crocheted)

6210	Garments made up of fabrics of heading no. 5602, 5603, 5903, 5906 or 5907 (not knitted or crocheted)
6211	Track suits, swimwear and other garments (not knitted or crocheted)
6212	Brassieres, girdles, corsets, braces, suspenders, garters and similar articles and parts thereof; whether or not knitted or crocheted
6213	Handkerchiefs (not knitted or crocheted)
6214	Shawls, scarves, mufflers, mantillas, veils and the like (not knitted or crocheted)
6215	Ties, bow ties and cravats (not knitted or crocheted)
6216	Gloves, mittens and mitts (not knitted or crocheted)
6217	Clothing accessories n.e.c.; parts of garments or accessories other than those of heading no. 6212 (not knitted or crocheted)

## Appendix 2. Survey Questionnaire for the Supply Chain of Apparel Industry in Sri Lanka through Colombo Port

Please describe the work your organization does, your position in the organization and your work related to the Apparel industry and the Colombo Port:

### Section 1 – History of Apparel Industry in Sri Lanka

1. When did it start to develop?
2. Can you think of any key factors that have been instrumental in the rise of Sri Lankan Apparel Industry?
  - a. Companies
  - b. Infrastructure
  - c. Government
  - d. Trade Associations
3. What is the geographic spread of the Apparel Industry?
  - a. Are there any clusters of Apparel Industry?
    - i. If so, is it in/or in proximity to Colombo?
    - ii. If they are scattered, are there any specific logistical reasons for the selection?
  - b. Where and how many production facilities are located in the region?
  - c. In your estimation, how much share of the workforce is working directly or indirectly for Apparel Industry in the region?
    - i. Directly
    - ii. Indirectly
  - d. How important is the Apparel Industry for the overall economic strength of the region?
    - i. Has this role changed over time?
4. What kinds of firms are running their business in the Apparel Industry of Sri Lanka (large corporation, suppliers, service providers, etc.)?
  - a. What stage are they in the supply chain?
  - b. How could you characterize the relationships between these firms?
    - i. Individual
    - ii. Parental-Subordinate
    - iii. Supplier-Client
5. What roles have local, state and federal policy makers played in the Apparel Industry in the past and what role are they playing today? When thinking about their roles, consider for example:
  - a. Taxes and financial incentives for firms
  - b. Organization and cluster development initiatives
  - c. Housing
  - d. Transportation
  - e. Education and training for local workforce

### Section 2 – Supply Chain of Apparel Industry in Sri Lanka

The nature of relationships among firms within the Apparel Industry and the overall supply chain:

1. What types of products in which level of production in the supply chain of Apparel Industry are usually produced in Sri Lanka?
  - a. Type of products
  - b. Stage in the supply chain
  - c. How much values are added in this process?
2. Sri Lanka has been mainly importing the raw materials from India and China for the Apparel Industry and manufactured some and the exported to the US and UK. When importing and exporting, if you could describe the logistical characteristics:
  - a. Import

- i. Shipping methods
    - ii. Where does it come to
    - iii. How much in volume
    - iv. In what types of cargos:
  - b. Export
    - i. Shipping methods
    - ii. Where does it come from
    - iii. How much in volume
    - iv. In what types of cargos:
- 3. Do firms in the region typically rely on outside firms at various stages in the production process or perform most tasks in-house?
  - a. What types of products or services are most commonly outsourced and why?
  - b. If they rely on outside firms, are these firms mostly located inside the metropolitan region or outside the region?
- 4. How would you characterize the firms who act as suppliers to the larger manufacturers in the region? When thinking about different firm characteristics, consider for example:
  - a. Firm size
  - b. Sector or industry
  - c. Degree of specialization
  - d. Ownership structure (i.e. family-owned)
  - e. Number of clients (i.e. single vs. many clients)
  - f. Market size and reach (i.e. global vs. local)
- 5. What role could the firms play in Sri Lanka in integrating the supply chain process?
  - a. Horizontal
  - b. Vertical
- 6. How have industry needs in sourcing, manufacturing, transport, distribution and compliance been changing over time?
- 7. Do you think the Sri Lanka's Apparel Industry can expand its market as a seller to the Southeast Asia market?
  - a. If yes: why, how?
    - i. See the section 3 question 11 for the Colombo Port role in this matter
  - b. If no: why?
- 8. In terms of the clients of the Sri Lankan Apparel industry, what would be the high value added products? (i.e. ZARA's brand designer: new fashion every season)
  - a. Type
  - b. Special material that is used?
  - c. Design?

### Section 3 – Port of Colombo

- 1. How would you evaluate the maturity of the Colombo Port?
  - a. In the scale of: Early stage, Developing, Mature, Very mature
  - b. And what makes you think so?
- 2. What main role/reason the Colombo Port do you think it serves in South Asia?
  - a. Logistical hub as a transshipment port
  - b. Biggest port (Throughput-wise)
  - c. Traditionally used the most
- 3. What is the SWOT analysis of the Colombo Port?
  - a. Strength
  - b. Weakness
  - c. Opportunities
  - d. Threat
- 4. Who are the competitor ports to the Colombo Port?
  - a. Would the answer change somehow if it is particularly in terms of the Apparel Industry?

The role of Port of Colombo plays in the Apparel Industry of Sri Lanka and how much it matters:

- 5. How many textile/apparel inflows and outflows are coming to/from Sri Lanka through the Colombo Port as they relate to inputs and finished product for domestic and export markets?
  - a. Inflows
  - b. Outflows
- 6. What stage of logistics does the Colombo Port provide in the Apparel Industry supply chain?
  - a. Warehouse for storage and inventory

- b. Any value-added activity from assembling
  - c. Delivery
  - d. Anything else
7. From the shipping carrier's company's point of view, how big is the role of Port of Colombo playing in the Apparel Industry of Sri Lanka logistics?
- a. Market share
  - b. Access: shipping links to other terminals
  - c. Capacity
    - i. Volume of vessel to hold
    - ii. Volume of cargo handling - Container throughput
  - d. Cost reduction
  - e. More clients links and other firms in the supply chain
8. What are the key functions of the terminals and facilities in the regional port that the firms prioritize?
- a. State-of-art Infrastructure (facility-wise)
  - b. Technology
  - c. Capacity
  - d. Port Management
  - e. Operation of the Port Authority
  - f. Access to the City
  - g. Other services
9. What is the turnaround time of Colombo Port to be handled in the terminal in the supply chain of the Apparel Industry? In comparison to:
- a. Cargo types (containers, bulks..)
  - b. Cargo size
10. What are the potential port expansion benefits to the Apparel supply chain?
- a. Transshipment
    - i. Volume
    - ii. Ease of transit
  - b. Value-added economic activity
    - i. Trading and warehousing
    - ii. higher-end or more specialized production lines
    - iii. IT
    - iv. financial or other services
11. Do you think the Colombo Port could play a crucial role in Sri Lanka's Apparel Industry's market expansion as a seller to the Southeast Asia?
- a. If yes: why, how?
  - b. If no: why?
12. Is there any transshipment benefit that the Colombo Port might provide for the value chain of apparel industry? For example, the Singapore port provides warehouses for defected electronics to be sorted out without going through the duties in the foreign trade zone. Is there something like that in the Colombo port?
13. What would you like to see from the Chinese investment on the Colombo Port development? What is your expectation?
14. Do you think it is going to be beneficial in expanding your market access and having better competitiveness in the region?

## References

- Acosta, M., Coronado, D., & Mar Cerban, M., 2007. Port competitiveness in container traffic from an internal point of view: the experience of the Port of Algeciras Bay. *Maritime Policy & Management*, 34(5), 501-520.
- ADB, U. a., 2014. Trade Process Analysis Report for Subregional Cooperation in South Asia.
- Baayen, R. H., Davidson, D. J., & Bates, D. M., 2008. Mixed-effects modeling with crossed random effects for subjects and items. *Journal of memory and language*, 59(4), 390-412.
- Brooks, M. R., & Pallis, A. A., 2008. Assessing port governance models: process and performance components. *Maritime Policy & Management*, 35(4), 411-432.
- Castillo-Manzano, J. I., González-Laxe, F., & López-Valpuesta, L., 2013. Intermodal connections at Spanish ports and their role in capturing hinterland traffic. *Ocean & coastal management*, 86, 1-12.

- Dassanayake, I., 2017: Interviewed on 01.12. 2017.
- De Langen, P. W., 2007. Port competition and selection in contestable hinterlands; the case of Austria. *European Journal of Transport and Infrastructure Research*, 7(1), 1-14.
- EI Unit, T. E., 2016. "One Belt, One Road": An Economic Roadmap. 189-190.
- Erich, N., 2017: Interviewed on 12.02. 2017.
- Frederick, S. E., 2010. Development and application of a value chain research approach to understand and evaluate internal and external factors and relationships affecting economic competitiveness in the textile value chain: NORTH CAROLINA STATE UNIVERSITY.
- Fugazza, M., 2015. Maritime connectivity and trade: UN.
- Fugazza, M., Hoffmann, J., & Razafinombana, R., 2013. Building a dataset for bilateral maritime connectivity: UN.
- Horwitch, R., 2017: Interviewed on 03.15.2017.
- Kirwel, N., 2017: Interviewed on 03.16.2017.
- Krulich, A., 2017: Interviewed on 03.16. 2017.
- Lirn, T.-C., Thanopoulou, H. A., & Beresford, A. K., 2003. Transshipment port selection and decision-making behaviour: analysing the Taiwanese case. *International Journal of Logistics: Research and Applications*, 6(4), 229-244.
- Lopez-Acevedo, G., & Robertson, R., 2016. *Stitches to Riches?* World Bank Publications.
- Mann, C. L., Eckert, S. E., & Knight, S. C., 2000. *Global electronic commerce: A policy primer*: Peterson Institute.
- Martínez Moya, J., & Feo Valero, M., 2016. Port choice in container market: a literature review. *Transport Reviews*, 1-22.
- McBride, J., 2015. *Building the New Silk Road*. Council on Foreign Relations. Retrieved November 2016, from: <https://www.cfr.org/background/buiding-new-silk-road>
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G., 2001. Defining supply chain management. *Journal of Business logistics*, 22(2), 1-25.
- Nelmes, G., 2006. Container port automation. Paper presented at the Field and Service Robotics.
- OECD., 2004. *A New World Map in Textiles and Clothing: Adjusting to Change*.
- Onut, S., Tuzkaya, U. R., & Torun, E., 2011. Selecting container port via a fuzzy ANP-based approach: A case study in the Marmara Region, Turkey. *Transport Policy*, 18(1), 182-193.
- Steven, A. B., & Corsi, T. M., 2012. Choosing a port: An analysis of containerized imports into the US. *Transportation Research Part E: Logistics and Transportation Review*, 48(4), 881-895.
- Sturgeon, T., & Memedovic, O., 2010. *Mapping Global Value Chains: Intermediate Goods Trade and Structural Change in the World Economy*. UNIDO Working Paper 05/2010. United National Industrial Development Organization, Vienna, Austria.
- Suárez-Alemán, M. H. D. a. A., 2016. *Competitiveness of South Asia's Container Ports* (Publication no. 10.1596/978-1-4648-0892-0).
- Tai, H.-h., & Hwang, C.-c., 2005. Analysis of hub port choice for container trunk lines in East Asia. *Journal of the Eastern Asia Society for Transportation Studies*, 6, 907-919.
- Tiwari, P., Itoh, H., & Doi, M., 2003. Shippers' port and carrier selection behaviour in China: a discrete choice analysis. *Maritime Economics & Logistics*, 5(1), 23-39.
- Tongzon, J., Chang, Y.-T., & Lee, S.-Y., 2009. How supply chain oriented is the port sector? *International journal of production economics*, 122(1), 21-34.
- Torres-Reyna, O., 2007. *Multilevel Analysis*.
- Ugboma, C., Ugboma, O., & Ogwude, I. C., 2006. An analytic hierarchy process (AHP) approach to port selection decisions—empirical evidence from Nigerian ports. *Maritime Economics & Logistics*, 8(3), 251-266.
- Wiegmans, B. W., Hoest, A. V. D., & Notteboom, T. E., 2008. Port and terminal selection by deep-sea container operators. *Maritime Policy & Management*, 35(6), 517-534.
- Yeo, G.-T., Roe, M., & Dinwoodie, J., 2008. Evaluating the competitiveness of container ports in Korea and China. *Transportation Research Part A: Policy and Practice*, 42(6), 910-921.
- Yuen, C.-l. A., Zhang, A., & Cheung, W., 2012. Port competitiveness from the users' perspective: An analysis of major container ports in China and its neighboring countries. *Research in Transportation Economics*, 35(1), 34-40.