Understanding Port Efficiency: A CPEC Perspective

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Abstract

This paper aims to provide an insight into the efficacious use and development of Pakistani ports located along the China-Pakistan Economic corridor. The main objective of this paper is to understand how the physical infrastructure, logistics suprastructure and value-added services contribute in the enhancing port efficiency in the wake of CPEC operationalization. A sample of 15 well-experienced respondents from the domains of supply chain management, logistics, trade and public sector were selected. The study concluded that physical infrastructure, logistics suprastructure and logistics services at a port play a vital role in improving port efficiency. The study further pointed out that adequate port structure and value-added services would significantly contribute to port efficiency and facilitate the smooth clearance of CPEC cargo.

***Keywords**:* CPEC, port efficiency, supply chain disruption, infrastructure, logistics, suprastructure, trade facilitation, customs clearance

1. Introduction

World trade has grown exponentially in recent years and has reached $16.482 trillion USD in 2015 ("Trade-World Bank Data," 2016). In recent years, China's role in the developing global economy has intensified and contributed in taking the world trade to unprecedented levels (Ali, Gang, & Raza, 2016). In 2015, China was the largest export economy of the world, reaching an export value of $2281.9 billion USD. However, as a result of a decrease in commodity and energy prices in recent years,

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China faces challenges in maintaining its existing growth rate. ("United Nations International Merchandise Trade Statistics," 2015).

China has therefore initiated a grandiose resurrection of the Silk Road based on land and maritime logistics; communication networks connecting Asia, Europe and Africa through "*One Belt One Road*" thereby creating new markets for the Chinese companies; tackling industrial overcapacity; and amassing enormous foreign reserves (Amir, 2016; Summers, 2016). This vision reflects China's desire to establish strong ties with its neighboring countries to access more strategic maneuvering space in Asia and Europe (Wang, 2016).

China has injected a remarkable level of investment to boost integrated economic growth in the Eurasian region through mega infrastructure projects across 6 corridors touted to provide a crucial connection between the economic nodes that are usually the centers in an urban landscape (Brunner, 2013).

The geographical location of Pakistan is a boon for global powers in pursuit of furthering their economic interests as well as strengthening their regional connectivity (Shaikh, Ji, & Fan, 2016). The China-Pakistan Economic Corridor offers both the countries an opportunity to consolidate their economic and financial strength in the emergent South-Asian region (Javaid & Javaid, 2016). It also offers Pakistan unique prospects of developing its industrial base whilst utilizing its human capital to reduce economic inequality (Amir, 2016).

The CPEC, therefore, carries great significance for both the countries. An estimated investment of $46 billion USD is projected to be poured into sectors such as; energy, transport, infrastructure, etc.(Stevens, 2015; Xia & Guowei, 2015). The CPEC stretches across 3000 kilometers, originating in Kashgar, far-western China to Pakistan's port city of Gawadar (Bader, 2015).This transportation corridor traverses extremely harsh landscape and weather conditions which consequently pose colossal infrastructure challenges (Derya, 2017).

The key components of a port production process are a transport route and logistics corridor comprised of ports featuring both physical infrastructure and logistics suprastructure (Rodrigue, 2012). From an economic perspective, a corridor promotes both internal and external trade by providing efficient connectivity in terms of transport and logistics services within a hinterland (Jaržemskis & Vasiliauskas, 2007;

Rodrigue, 2012). Port efficiency is based on performance by logistics service providers, Customs Department and terminal operators for cargo clearance and trans-shipment through port's physical infrastructure, cargo-handling logistics and associated value-added services for reducing dwell-time (Beresford, Pettit, Xu, & Williams, 2012; Tongzon, 2009).

The efficient operationalization of CPEC is largely dependent on the efficiency of dry ports and sea ports situated at various nodes on supply chain routes to facilitate imports, transit trade and export functions (Derya, 2017; Ding et al., 2016; Rafi, Khan, & Aslam, 2016).

November 2016 marks the passage of the first convoy of around 100 truckloads of imported consignments from China cleared at Sost Dry Port in Gilgit-Baltistan (Zahid, 2016). The Sost Port, designed for clearing a limited number of consignments i.e., 30-40 containers per day, faced a barrage of operational challenges at the Sost Terminal (Derya, 2016). The physical infrastructure at the Sost Port should be complemented with the cargo-handling logistics for providing related value-added services for mitigating the risk of upstream supply chain disruption on the Economic Corridor. However, the need for effective clearance through adequate infrastructure is vital at all ports situated on the CPEC's supply chain route for end-to-end speedy trade facilitation (Rafi et al., 2016). The stated port and logistics development is achieved through coordinated efforts by the stakeholders responsible for trade facilitation.

This paper aims at understanding port efficiency achieved through physical infrastructure, logistics suprastructure and related value-added services in the CPEC perspective. It also aims at providing an insight into the development of Pakistani ports located along the China-Pakistan Economic Corridor for enhancing their efficiency and their efficacious use for trade facilitation.

2. Literature Review

1.1.China- Pakistan Economic Corridor (CPEC)

The China- Pakistan Economic Corridor (CPEC) is the realization of China's vision of "One Belt, One Road", a means through which land-locked countries gain interconnectivity (Wang, 2016). An extensive

3000 km network of ports, terminals, roads, railways and oil & gas pipelines from Pakistan's coastal Gawadar snakes its way to China's historic city of Kashgar in northwestern Xingjiang (Bader, 2015). The CPEC envisions upgrading infrastructure, developing the energy sector and establishing industrial parks with an estimated cost of $46 billion USD by 2030 (Amir, 2016). This initiative is expected to ameliorate Pakistan's energy crisis whilst improving its macroeconomics indicators (Xie, Li, & Ma, 2015).

The construction of a $44 million USD fiber-optic cable network between the two countries aims to further strengthen the connectivity of the economic corridor (Chhetri, 2015). The first phase of CPEC, is expected to be accomplished by 2018 which includes infrastructure development, alleviation of Pakistan's energy crisis and operationalization of transit trade. The second phase would focus on the service sector and logistics to facilitate the transit trade route (Xie et al., 2015). Pakistan would become the first transit hub in the new Silk Road (Nilofar, Jiang, & Ishtiaque, 2014).

1.2.Port-Structures and Services

A port is a place of trans-shipment between maritime and hinterland transport, providing storage facilities and services[4] that attract industrial and trade companies (Janssens, Meersman, & Van de Voorde, 2003; Patra, 2015). Jaržemskis and Vasiliauskas (2007) affirm that a port or terminal is a common user facility with public authority status, equipped with fixed installations and offering value-added services for handling and temporarily providing storage facilities for any kind of goods. A dry port is an inland terminal where various cargo-handling and value-added activities are performed, and is ordinarily connected to a seaport with rail, road or barge services (Rodrigue, Debrie, Fremont, & Gouvernal, 2010; Roso, Woxenius, & Lumsden, 2009; Wiegmans, Masurel, & Nijkamp, 1999). Notably, activities at a port are placed under Customs control for clearing goods for home-consumption, warehousing, temporary storage for onward transit and exports (Notteboom, 2002; Slack, 1999; Van Klink & van den Berg, 1998).

[4]The services for this study include cargo handling and compliance of Customs clearance procedures at a terminal (Authors).

A border dry port, more specifically, refers to a dry port located in the border area of a region or city, its major function being a trans-shipment center or Customs clearance service (Beresford et al., 2012). A Port has micro-economic dimensions of spatial and technical structures for integrating into a logistics value system based on trans-shipment (Rodrigue et al., 2010).

1.3. Port Efficiency

Ports are a vital link in the trading chain. Researchers (Beresford et al., 2012; Bichou & Gray, 2004; Le-Griffin, Murphy, & F., 2006; Patra, 2015; Sutomo & Soemardjito, 2012) affirm that port efficiency is of utmost significance as it leads to speedy trade facilitation and competitiveness. Port efficiency relates to the performance[5] by logistics operators and Customs for cargo[6] clearance and trans-shipment through port services rendered by available infrastructure (Beresford et al., 2012; Bichou & Gray, 2004; Derya, 2017; Ki-Tae & Song, 2003; Kobina van Dyck & Ismael, 2015; Le-Griffin et al., 2006; Sánchez et al., 2003; Sutomo & Soemardjito, 2012; Tongzon, 2009). Moreover, Port efficiency is based on the total time taken to handle cargo, consistency of port performance and ability to provide alternative solutions (Kobina van Dyck & Ismael, 2015).

Consequently, port efficiency is a key contributor to a nation's international economic and trade competitiveness and development (Cullinane & Song, 2002). A port has micro-economic dimensions of spatial and technical structures for integrating into a logistics value system based on trans-shipment (Rodrigue et al., 2010). Spatial structures are referred to as physical or real-estate terminal infrastructures i.e., inland ports, airports, train stations and sea ports etc. constructed and erected as fixed locations and facilities (Cullinane & Song, 2002; Flor & Defilippi, 2003; Rodrigue, 2012; Tongzon, 2009; Wanke, 2013; Wilmsmeier & Hoffmann, 2008). Technical structures at a port are the cargo handling facilities, installed or movable, referred to as logistics suprastructure (Kobina van Dyck & Ismael, 2015; Ruiz-Garcia, Barreiro, Rodríguez-Bermejo, & Robla, 2007).

[5]Port performance is measured in terms of the number of containers moved through a port (throughput) on the assumption that ports are throughput maximisers (Tongzon, 1995).

[6]There are generally four types of cargoes that are handled in ports: dry bulk, liquid bulk, containerized cargo and non-bulk non-containerized cargo (Tongzon, 1995).

1.4. Port efficiency in terms of Physical Infrastructure and Logistic Suprastructure

The past studies (like Bichou & Gray, 2004; Cullinane & Song, 2002; Jaržemskis & Vasiliauskas, 2007; Kia, Shayan, & Ghotb, 2002; Pfohl & Buse, 2000; Rodrigue, 2012; Tongzon, 2009; Wanke, 2013) have used indicators based on performance derived from spatial and technical structures for measuring port efficiency. A port may offer shippers adequate space in the form of Customs bonded warehouses for temporary storage to achieve efficiency in distribution management (Autry, Griffis, Goldsby, & Bobbitt, 2005; Epstein, 1982; Mason, Ribera, Farris, Kirk, & Part, 2003; Ndikom & Emeghara, 2012). The physical facets of transport e.g., roads, railroads, tunnels, waterways and pipelines etc. between ports are also a source of achieving time efficiency (Rondinelli & Berry, 2000).

Likewise, assessment halls, goods examination sheds, fumigation and quarantine sheds, forensic and sample testing laboratories at the port supports importers and exporters to efficiently and effectively meet regulatory requirements of Customs and other standard-setting agencies (Maglen, 2002; Notteboom & Winkelmans, 2001).

Port efficiency leads to rapid delivery of cargo that also requires a good logistics Suprastructure. These logistics include conveyors that may be used by freight forwarders and shippers for quick movement of cargo (Lodewijks, Schott, & Ottjes, 2007). The warehousing offered by port operators can benefit shippers by efficient inventorying of cargo and its distribution management to achieve Just-In-Time (JIT) deliveries. Moreover, port efficiency results in high quality transport services meeting delivery dates that would establish an efficient *logistics effect* (Ding et al., 2016; Gleissner & Femerling, 2014).

Rodrigue et al. (2010) affirm that cargo handling through cranes and weigh-bridges can increase port efficiency by clearing the port area for new arrivals. Cold chains i.e. refrigerated containers preserve perishable items and pharmaceuticals during a long-distance haul (Imai & Rivera IV, 2001; Ruiz-Garcia et al., 2007).

The ICT communication infrastructures installed at a port, based on telephone networks, fiber-optics networks, satellite networks and data centers give rise to an efficient supply chain network among various

nodes (Pfohl & Buse, 2000). (Notteboom & Winkelmans, 2001) assert that a robust ICT infrastructure is an important logistics component for strategic networking among transport nodes for efficient inland and cross-border traffic management.

1.5. Port Efficiency in terms of Value-Added services

The two main services offered at a port include cargo handling and Customs clearance that efficiently reduce cargo dwell time[7], and hence decrease the overall cost of the shipper (Beresford et al., 2012; Henriksen & Rukanova, 2011; Otsuki, Honda, & Wilson, 2013; Sánchez et al., 2003; Song & Panayides, 2008). A port's ability to offer extended hours of terminal operations to shippers also determines its operational efficiency (Bichou & Gray, 2004; Cullinane & Song, 2002; Imai & Rivera IV, 2001; Le-Griffin et al., 2006; Song & Panayides, 2008; Tongzon, 2001). Other essential port services are; loading and unloading by cranes and straddle carriers, collection of Customs duties, taxes and port charges and cargo handling and storage (Ding et al., 2016; Tongzon, 2009). Phyto-sanitary, forensic and chemical laboratory services for testing the consignments are also considered crucial port services (Henson & Loader, 2002; Maglen, 2002).

Notably, In-Gate and Out-Gate operations and electronic cargo clearance can lead to port efficiency in terms of real-time and speedy control of container flow (Giuliano & O'Brien, 2008). Additionally, Bichou (2011) asserts that to attain terminal efficiency, web-enabled surveillance of incoming and outgoing cargo through installation of various electronic reporting mechanisms is of utmost significance.

2. Research Method

The current study is the first chapter of a larger study, starting with qualitative (case study) research. The qualitative research approach was applied to understand and appreciate the views of the respondents. Care was taken that neither information nor opinions were shared with the respondents.

A semi-structured interviewing technique was adopted and the respondents were prompted to express their own views and opinions on

[7]Dwell time is the number of days a container can remain at a container terminal once it has been unloaded from a ship/vehicle before incurring storage charges (Yeo, Roe, & Dinwoodie, 2008).

each question posed. According to Berg and Lune (2004) and Bhatti, Aslam, Hassan, and Sulaiman (2016), standardized interviews are based on questions that are formally structured. This helps the collection of responses that are comparable (Bhatti et al., 2016).

Moreover, the researchers used essential questions, probing questions and throw-away questions for effective and efficient data collection. The key questions were focused on the primary themes of the study – China-Pakistan Economic Corridor and its significance, Importance of Port-Structures and Services, CPEC and Port Efficiency based on Physical & Logistics Infrastructures, and CPEC and Port efficiency based on Value-added Services. During all the interviews, probing questions were asked to obtain additional information from respondents and to provide them with leads during the interviews. It is usual to use throw-away questions to build a rapport with the participants (Table I). Data were analysed on the basis of information achieved through survey questions and consolidated into propositions.

2.1. Research Participants

A sample of fifteen experienced professionals were selected for the study. Selection of the respondents was made through a purposive sampling, as the researcher's objective was to develop an understanding of efficiency at Pakistani ports, specifically those located on the China-Pakistan Economic Corridor. The researchers selected knowledgeable and experienced professionals from the government, port authority, logistics and transport by utilizing their personal and professional networks. The respondents were senior government officials, CEO's, business consultants and permanent employees in senior managerial positions with no less than 10 years of working experience.

2.2. Data Collection and Analysis

The researchers conducted in-depth face-to-face interviews with the respondents. These targeted respondents were the primary stakeholders in CPEC trade facilitation and operationalization like Pakistan Customs, and included officials ranging from senior officials at policy making headquarters to executive and operational officials at Customs dry ports. Other respondents included officials from ministries of Communications, Commerce, Planning and public sector infrastructure development entities like NLC and FWO.

Interview were also conducted from prominent clearing houses, logistics operators and freight-forwarders. Interviews approximately lasted between 45 and 60 minutes. The respondents were asked key questions and probing questions, as well as throw-away questions. All interviews, with the consent of the respondents, were audio taped and later transcribed.

The transcribed data were coded and scaled down to meaningful themes as stressed by Miles, Huberman, and Saldaña (1994) and Bhatti et al. (2016). In addition, the researchers encouraged the respondents to freely express their opinion on the issue. Twelve males and three females were interviewed as shown in Table 1.

3. Findings and Discussions

The current section presents the results reported in view of the research objective in the exploratory study. The following themes were extracted from the interviews:

3.1. China-Pakistan Economic Corridor and its significance

In giving their viewpoint about the China-Pakistan Economic Corridor, *Respondents 1, 2, 5, 6* and *7* affirmed that CPEC is not a new vision of the Chinese government. China wishes to link its landlocked western region/provinces to the sea as well as to ensure that trade links with Middle East and Africa are established. *Respondents 8, 9* and *10* avowed that the CPEC was more than just a $47 billion USD investment, but in fact it was likely to revolutionize Pakistan's overall economic condition and improve the lives of millions of people across the region. *Respondents 3, 4, 14* and *15* were of the view that CPEC would further cement the friendship between the two countries through an effective trade corridor. This corridor would act as a bridge between South Asia, Central Asia, Europe, Middle East and Africa, hence, rendering Pakistan a strong player on the global trade scene. In addition, the imminent energy projects announced as part of the CPEC agreement would overcome Pakistan's energy crisis permanently.

It is apparent from the reasoning of the respondents that China-Pakistan Economic Corridor is akin to a ray of hope for many Pakistanis and could well be the impetus to change the economic situation of Pakistan.

Proposition 1: China-Pakistan Economic Corridor leads to change in the economic condition of Pakistan.

3.2. Importance of Port - Structures and Services and Port efficiency

All respondents were of the view that adequate port infrastructure and cargo-handling equipment helps in improving services that lead to operational efficiency for increasing the overall trade flow.

Ample storage space for cargo helps in clearing the congestion at ports and leads to efficient distribution, management and transshipment to the hinterland. Additionally, round-the-clock value-added services could be made available at ports to further reduce transit time to seaports. This would prove to be even more valuable in meeting the export and customer deadlines.

Proposition 2: Port structures and port efficiency lead to enhanced trade facilitation.

3.3. CPEC and Port Efficiency based on Physical & Logistics Infrastructures

Respondents 4, 5, 6, 7 and *8* stressed that necessary physical infrastructure and cargo-handling logistics at the port were necessary to manage CPEC requirements in the near future. Importantly, the existing port-related facilities are not equipped for the impending strain they are likely to come under. A lack of infrastructure at border ports (e.g, Sost Dry Port) would decrease the Port's efficiency in terms of speedy clearance of CPEC consignments and might result in upstream supply chain disruption. *Respondents 10, 11, 12* and *13* asserted that separate, dedicated incoming and outgoing routes should be assigned to border ports. This would allay containerized congestion created by CPEC cargo, thus improving overall port efficiency.

Respondents 3 and *15* stressed that CPEC would become a permanent part of the landscape and in order to meet the demands of the project, Pakistan would have to enhance facilities and infrastructure across all its ports. These facilities would have to include offices and residences for Customs and terminal operators that are functional throughout the year without interruptions, such as extreme weather conditions in the case of Sost Dry Port in Gilgit-Baltistan.

Table 1
Respondents Profile

Respondents	Gender	Title	Age	Experience
Respondent 1	Female	Senior Policy-making Government Official	56	27 years
Respondent 2	Male	Senior Government Official	44	15 years
Respondent 3	Male	Senior Government Official	35	10 years
Respondent 4	Male	Entrepreneur (Multi-national Firm)	40	13 years
Respondent 5	Male	Senior Official (Port Authority)	51	24 years
Respondent 6	Male	Import Manager (Industrial Manufacturing)	52	18 years
Respondent 7	Male	Senior Operations Manager (Freight Forwarding)	51	35 years
Respondent 8	Male	Technical Manager (IT)	52	23 years
Respondent 9	Male	Marketing Manager (Trading)	36	10 years
Respondent 10	Male	Senior Executive (Construction firm)	47	22 years
Respondent 11	Female	Senior Government Official	49	27 years
Respondent 12	Male	Chief Executive (Clearing house)	43	18 years
Respondent 13	Male	Senior Executive (Chamber of Commerce)	53	36 years
Respondent 14	Male	Senior Executive (Chamber of Commerce)	61	39 years
Respondent 15	Female	Professor (Higher Education)	60	32 years

Respondent 1 opined that in view of the colossal increase in containerized flow of import, export and transit cargo in the future, there seemed to be an immediate requirement of more operational collectorates and directorates. Also, sufficient space such as Customs bonded warehouses for temporary storage, assessment halls, goods examination sheds, fumigation and quarantine sheds, forensic and sample testing laboratories, cranes and weigh-bridges, cold chains, and ICT communication infrastructures in the form of e-facilitation centers are required for improving Port Efficiency based on Physical & Logistics Infrastructures.

In general, all respondents affirmed that there is a dire need for greater port efficiency, contingent upon physical & logistics infrastructures for the CPEC to be successful.

Proposition 3: Physical infrastructure and. logistics suprastructure lead to port efficiency that enhances trade facilitation under CPEC.

3.4. CPEC and Port Efficiency based on Value-added Services

The respondents had mixed views about port services in terms of port efficiency once the CPEC is operational. *Respondents 2, 3, 5, 7* and *11* asserted that simplification of Customs clearance procedures through bilateral arrangements and expertise in Customs brokerage would be the determining factors in enhancing the efficiency of port services. *Respondents 3* and *8* emphasized that the availability of electronic cargo clearance through customized e-portal systems is the most significant factor in enhancing port efficiency. *Respondents 1, 10, 12* and *15* acknowledged that provision of port services in extreme weather at border ports as well as the availability of bonded carriers would result in increased port efficiency. Therefore, it can be established that port efficiency based on value-added services can be instrumental in making the CPEC more operationally sustainable in the long term.

Proposition 4: Value-added services lead to port efficiency that enhances trade facilitation under CPEC.

4. Conclusion

The results of the study are crucial in understanding that port efficiency plays a vital role in trade facilitation in the international business arena. The dynamic nature of trade flow requires that suitable measures are to be taken to create and sustain port efficiency so that the supply chain operations associated with port clearances remain

competitive and cost-effective. It is imperative for the top management to have a comprehensive knowledge of the factors that optimize port efficiency and productivity.

The study highlights that port efficiency is achieved through the right mix of port infrastructure, logistics suprastructure and related value-added services. Port efficiency also leads to effective cargo-handling and reduced dwell time. Enhancement in port efficiency gains even more significance against the CPEC backdrop as Pakistani ports will see a tremendous increase in containerized traffic in the near future. A deeper insight into, and better planning for port efficiency would be vastly beneficial to Pakistan as China's trade partner in the CPEC.

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