
COMPARING AND CONTRASTING COMPETITIVENESS OF MAJOR INDIAN AND SELECT INTERNATIONAL PORTS

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Abstract

Port competitiveness is the concept where ports internationally or nationally compete among themselves in terms of acquiring trade, where port operators and authorities engage and create opportunities in improving the same. It has been seen that various major international ports perform very well in the competitiveness of global ports as compared to the Indian major ports. So, a detailed study has been done to understand the factors that influence these major international ports in port competitiveness and contrasting them with the Indian ports.

Keywords: *Ports, Port competitiveness, factors, performance*

INTRODUCTION

Port competition is a complex concept which is influenced by changes in the market environment and rivalry between operators in the same port, between neighboring ports, between multi-port gateway regions and between entire port ranges[1]. Port choice decisions by shippers and forwarders also plays major impact on port competitions[2]. There is no well-defined concept for port competition because of its complex nature. However, port competitiveness is the concept where ports internationally or nationally compete among themselves in terms of acquiring trade, where port operators and authorities engage and create opportunities in improving the same[3]. This nature and characteristics of competition depend upon the type of port involved like; gateway port, local port, transshipment port, containers and liquid bulk. Other influential factors for the competitiveness of a port are summarized as efficiency, hinterland accessibility, productivity, quality, cargo generating effect, reputation, reliability, and sea and hinterland distances. Under such a competitive environment, port efficiency has become a vital component for a nation to achieve internationally competitive advantage[4;5;6;7].

In India there are 13 major sea ports, out of which 12 are run by governments and 1 is corporate.

These ports mainly handle export and import of textiles, chemicals, petroleum, iron, machinaries, automobiles, coals, minerals, coffee, timber logs and others. Here three major ports have been discussed namely, Jawaharlal Nehru Port, Mumbai, Ennore/Kamarajar Port, Chennai and Kandla Port, Gujarat. These ports have been discussed because they have been reported to handle the most traffic and have contributed towards major trade economy. Moreover, these ports have also planned to raise their traffic and capacity up to 10 million TEUs.

According to the list of busiest container ports made by AAPA World Port rankings, the top ten ports belong to Asia. Looking into the list, the busiest port of Europe is Port of Rotterdam, Netherlands and North America is Los Angeles Port, USA. However, as mentioned before in the review of literature the busiest ports of Asia and Europe have been accounted for to obtain the factors that make them the busiest ports and to determine their competitiveness. However, Port of Colombo, Sri Lanka has also been considered to attain the factors that have caused them to overrun the Indian ports in the long run. Shanghai port, which is the world's largest container port since 2010 has a net profit of RMB28.7bn for FY 2015-16 [25]. More than 2,000 container ships depart from the port every month to North America, Europe, the Mediterranean and other regions[26]. It is located at the middle of the 18,000km-long Chinese coastline of the Yangtse River and connects the inland waterways of Yangtse River Valley, express ways and state-level highways lead the port to the national highway network to all regions of the country[25]. These ports on contrasting have been found to have grown to greater extent due to better planning and implementation towards infrastructure, profits, capacity, performance and efficiency. Moreover, the Asian port's review implements that location and shipper's involvement are an influential factor along with better infrastructure and cargo load capacity. Reviewing the European ports it can be implied that these ports have grown to a greater extent and is planning on more competitiveness against other European ports by implementing better techniques and policies and also extending the port's capacity and infrastructure. The port of Colombo has been considered as the third fastest growing port in the world. This is mainly because of the location, infrastructure and shipper's involvement and these has caused them to outrun other South-Asian ports in the competition.

Factors affecting competitiveness of ports

There are various factors the influence the competitiveness of the ports. They make the ports economically efficient for the respective country. Moreover, various articles and researches describes the factors how they influence port's competitiveness.

Capacity of Ports: This is an important factor that drives the competitiveness of the ports. It has been seen that major leading ports have always targeted in developing the container and cargo traffic of the ports [42]. It has been seen that vessels should not wait for berths and it should be the other way round. Various ports have immensely beneficial geographical location but due to low capacity of storage and berths they do not get much traffic [10]. Thus, it can be implied that capacity of the ports are driven by the berth size, traffic maintenance of the ports, depth and basin

size of the ports and terminals [43].

Connectivity and Location: Connectivity and location of ports on major sea routes plays a great impact on the competitiveness of the ports [44]. Various major ports like the Singapore, Busan and Shanghai has gained and leads in this factors due to their location and connectivity to the main land and the sea routes. Many ports are such built that they connect hinterlands well enough via road, rail, air and water too [45]. Again ports that open up gateways to the major long distance routes play a major role in attracting and competing well among other ports. Port of Rotterdam in Netherlands is considered to have the best geographical location as it contributes to majority of the Europe's trade [46]. Thus, it can be implied that hinterland connectivity and geographical location influences competitiveness among ports.

Port Infrastructure: The basic infrastructure requirements of any port are quay, terminals, berths, piers, breakwater infrastructure, size of depth and basin, and storage unit capacity [45]. A well-built port infrastructure is very important part in influencing port popularity. There are ships termed as 3-tier ships that can carry up to 18,000 MMT of containers or more and they need well-built berths for passaging [47]. Apart from these, all-weather technologies, hi-tech gadgets, advanced machines, cranes and accident and disaster proof infrastructure ensures the ships to halt in those ports [48]. Port infrastructures also include best navigational instruments and back-up lands for storage [4]. Thus, in short it can be implied that larger and better the infrastructure of port, greater influences the competitiveness among the ports.

Port performance and efficiency: Investments and its results determine the performance of the ports which future leads to their efficiency[49]. Major ports in the world keep on investing and thus they perform in various dimensions of improving the ports and in turn drive efficiency of the port. The effect of poor port performance reflects on its countries economic developments. Port efficiency varies widely from country to country and, specifically from region to region[50]. It is also well known that some of the Asian countries (Singapore, Hong Kong) are having the most efficient ports in the world, while some of the most inefficient ports are located in Africa (Ethiopia, Nigeria, Malawi) or South America (Colombia, Venezuela, Ecuador) [51;52]. When there are investments then there will be development and development will increase trade flow and traffic in the ports which in-turn improve the annual profits and traffic handling and thus, efficiency of the ports [53]. Thus, more the performance of the ports more they influence efficiency and in turn drive the competitiveness among ports.

Port cost: Pricing by ports and operators determines the cost of operations and other objectives of a port[54]. Port costs include items like: cargo handling, the time in port, port dues and charges. Further, the time spent in port is an opportunity cost that is dependent on time of stay. Port dues are charged by the port authority for use of a berth. The most important port cost, however, is of goods handling which is many times higher than other port costs [55]. Other factors of port costs like; different rates for peak and off-peak hours, different prices in the high and the low season etc. [56]. Another main factor that impacts the port cost is according to the standard of the port. Bigger

and world class ports will charge more than regular smaller ports [57]. Maintenance cost is another factor that also influences port costs [58]. Thus, looking into these factors it is implicated that port cost play a major role in influencing competitiveness of the ports.

Table 1: Factors reference table

Key Factors	References
Connectivity and Location	<i>Dappe, 2016</i> <i>Parola et al., 2016</i> <i>Campagna & Halatsis, 2013</i>
Port Infrastructure	<i>Parola et al., 2016</i> <i>Song & Geenhuizen, 2014</i> <i>Chang et al., 2008</i> <i>Fabling et al., 2013</i>
Port Cost	<i>Meersman et al., 2014</i> <i>Santos et al., 2016</i> <i>Acciaro, 2013</i> <i>Castillo-Manzano et al., 2009</i> <i>Borger et al., 2008</i>
Capacity	<i>Jeevan et al., 2015</i> <i>Gaur et al., 2011</i> <i>Hoshino, 2010</i>
Port performance and efficiency	<i>Rajasekar & Deo, 2014</i> <i>Bichou, 2013</i> <i>Khalid, 2012</i> <i>Liu et al., 2012</i> <i>Blonigen & Wilson, 2008</i>

Need for the Study

According to the Ministry of Shipping, around 95% and 70% of India's trading by volume and value respectively is done through maritime transport [8]. It was analyzed that ports in India together handled about 818.7 Million Metric Tons (MMT) of cargo in 2009 to 2010 while, Shanghai Port, the busiest port had handled 650 MMT of cargo alone on 2010 [9;10]. However, recently India's largest container handling port Jawaharlal Nehru Port Trust (JNPT), has signed an agreement to raise US\$ 400 million from State Bank of India and Development Bank of Singapore, to improve the infrastructure required for doubling its existing capacity to 9.85 million twenty foot equivalent units (TEUs) annually and is ranked 34th by World Shipping Council [11]. It was also expected that three major ports will have profits of approximately Rs. 6000 crores due to increased investments and collaborations internationally ("Ports Reports," 2017 and PTI, 2016). More investments are made to improve the condition of the Indian ports.

Thus, the statistics show the need to understand the factors that are lagging behind in the Indian ports towards competitiveness in the international standards. The Indian ports in the study have been considered because they are major ports and hold the most traffic and trade among all the

major ports of India, while the top ports of the world has been considered to contrast the factors that makes them the leading ports in the world and Europe. The Sri Lankan port has been accounted for to find what caused the positive shift of competitiveness against Indian ports.

Objectives of the study:

1. To understand the importance of port competitiveness
2. To find how the factors are influential in port competitiveness
3. To analyze and compare factors between Indian and other major international ports

Literature Review

Highly competitive environment of the port industry has forced to change strategic position and port businesses need a strategic tool for positioning their business. Port competitiveness has now become a persistent research area in the literature [14]. In this section, overview of three major Indian ports and five major international ports will be discussed based on capacity, locations, infrastructure, performance and costs and how these factors affect port competitiveness.

Research Methodology

The research methodology used in this journal was qualitative analysis. The major factors; capacity, location and connectivity, infrastructure, performance, efficiency and port cost was analyzed and studied to find out the objective of the journal, which is, comparing the competitiveness of 3 Indian ports and 5 major international ports. In the methodology, various prior researches done on the Indian ports and international ports were contrasted and an overview was studied on them. The basic point of research was to extract the five factors of competitiveness. Moreover, a detailed study was also done and studied on the factors that influence the competitiveness of ports. After which the factors were critically analyzed and ranked to the most influential factors contributing to port competitiveness and finally creating sub-sections of factors analyzed for the study ports into criteria wise ranks.

Findings and Discussions

Comparative analysis of port has been developed basically to show an overall data of the factors arranged in world ranking and comparing them against each other. Then the data collected from the literatures has been used to compare the study ports and create graphs to portray the objective of the research in sub-criteria. So, the main table has been sub-divided to compare the ports individually and its findings have been discussed.

Table 2: Comparative table on competitiveness of Indian and International Ports

Indian and International Ports	¹ World Ranking	Factors of Port (million TEU)	Connectivity	Location	Port Infrastructure (meters)	² Port Performance and efficiency (Traffic and Profit)	³ Port Cost (USD)
Shanghai Port, China [25]	1	36.54	North America, Europe, Mediterranean, Asia, Middle East, Southern Africa, Australia and Mainland China	Yangtse River Valley, China sea	Depth=12.5m Pier=4.6m Berths=125 Quay=738,000m	4.5% 27%	1100 - 2500 USD
Singapore Port (SPA) [28]	2	30.92	North America, Europe, Mediterranean, Asia, Middle East, Southern Africa, Australia	Strait of Malacca	Depth=12m Pier=5.5m Berths=67 Quay=1,188,000m	5.6% 23.5%	700- 1800 USD
Rotterdam Port, Netherlands [59]	11	12.23	North-South America, Europe, Mediterranean, South east Asia, Middle East, Africa, Australia	Rhine river and North Sea	Depth=24m Berths=23 Quay=74,000m	8% 5%	800- 1900 USD
Antwerp Port, Belgium [60]	14	9.65	North-South America, Europe, Mediterranean, South east Asia, Middle	Scheldt-Maas-Rhine-delta	Depth=13.1m Berths=30 Quay=129,000m	4.6% -1.5%	600- 1850 USD

			East, Africa, Australia						
Colombo Port, Sri Lanka [41]	28	5.19	South Asia, Kelani River and Indian Ocean	Depth=20m Pier=4.4m Berths=14 Quay=40,000m	10%	43.7%	400-1200 USD		
Jawaharlal Nehru Port, Mumbai [17]	34	4.49	India, South Asia, east Asia, Middle East, Africa, North South America, Australia, Europe	Thane creek by Arabian Sea Depth=14m Pier=4.6m Berths=4 Quay=2,322m	0.56%	9.96%	100-500 USD		
Ennore Port/Kamarajar Port, Chennai [61]	Below 50	1.4	India, South Asia, East Asia, Middle East, Africa, Australia	Coroman del Coast, Bay of Bengal Depth=16m Pier=3.5m Berths=5 Quay=1000m	3.1%	63.02%	100-500 USD		
Kandla Port, Kandla, Gujrat [62]	Below 50	1.2	India, India, South Asia, Middle East, Africa, Australia	Kandla Creek, Gulf of Kuutch Depth=12.5m Berths=12 Quay=2532m	13%	1.4%	100-600 USD		

(¹World Ranking as defined by World Shipping Council

²Port performance and efficiency is defined by the percentage rise of traffic and annual profit.

³Port cost is defined by the average cost of docking entry fee, storage fee and container fee in US Dollars)

This comparative table demonstrates all the factors that defines and makes every port in the world to compete. This table shows only a compiled version of the findings from the literatures and arranged in world ranking base.

Port Capacity

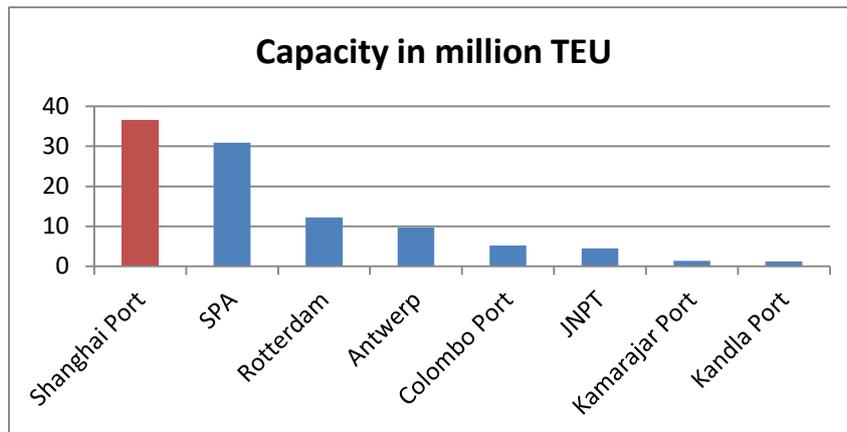


Figure 1: Diagrammatic representation of Capacity handled by the study ports

From the fig.1 it can be seen that that how the study ports vary in capacity handled. The competition between global seaports and between container terminals had increased by fast growth of container volume in major shipping routes [63]. It can also be seen that the overall capacity of Indian study ports of the research is still lower than the annual traffic by Shanghai port alone. Hence, strategies to improve seaport capacity or ignoring the requirement for additional capacity highly affect the competitiveness of seaports and may even lose to the severe competition with its other seaports. This is one condition that has been affecting Indian ports. Again, low investments in increasing the capacity and poor performance by the port authorities and government have also contributed towards low competitiveness of Indian ports. It has also been found that ports and terminals have been forced to make large and rapid investments in infrastructures to cope with new vessel sizes and preserve their competitiveness.

Thus, the ports can be ranked as per capacity as follows, 1. Shanghai Port, 2. SPA, Singapore, 3. Rotterdam Port, 4. Antwerp Port, 5. Colombo Port, 6. Jawaharlal Nehru Port (JNPT), 7. Kamarajar port/Ennore port, 8. Kandla Port.

Port's Infrastructure

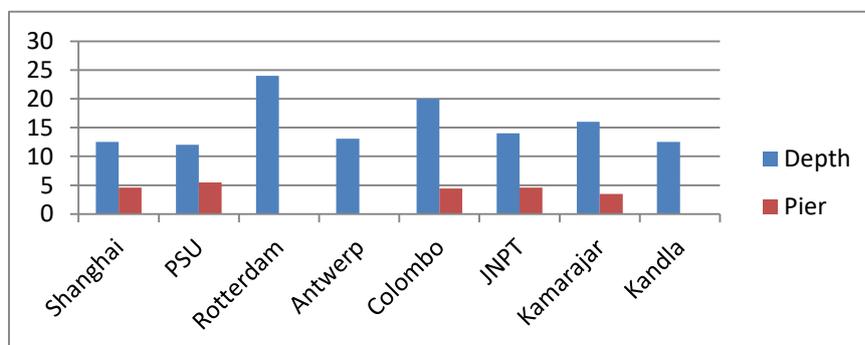


Figure 2: Graph of Port's depth and pier height

The infrastructure of the port is determined on the basis of, port's depth, pier height, port's berth

and port's quay length. The fig 2. represents the water depth and pier height of the port infrastructure and has been used to construct a rank based analysis on the port infrastructure. The pier heights of Rotterdam, Antwerp and Kandla ports have not been added due to lack of information and data. Rotterdam is seen to have the largest water depth while the lowest can be found in SPA. In pier height, SPA lead the graph while Kamarajar port lags in the graph.

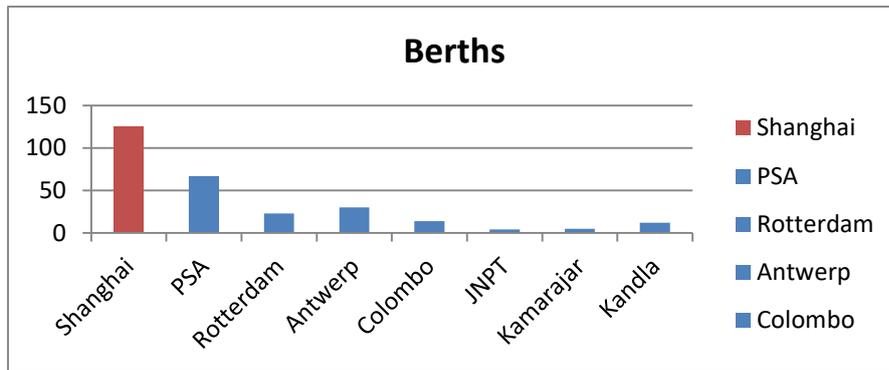


Figure 3: Graph of Port's no. of Berths

The fig.3 represents the no. of berths that the ports have for stationing incoming and outgoing ships. Berths are one of the most important components of a sea port. Shanghai leads the graph while JNPT is seen to have the least berths.

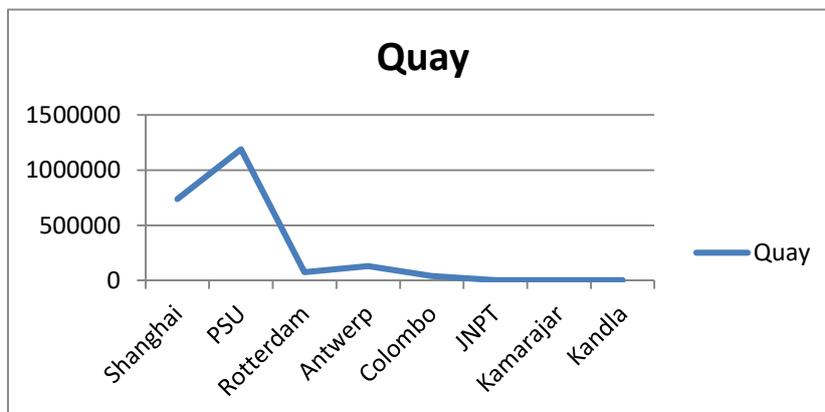


Figure 4: Graph of Port's Quay length

Fig.4 shows the quay length of the study ports and can be seen that SPA least the graph while the Indian ports lag in the graph.

Port infrastructure plays a major role in influencing productivity and competitiveness of ports (Akgul et al., 2015).Port infrastructure development should be pointed on all the terminals, all the equipment on the terminals, the area and its surroundings, along with all the physical parts of an infrastructure: roads, railway lines and others (Tovar et al., 2015). When compared to Indian ports they have a very poor infrastructure and low areas and services available. This is because either the authorities have not invested or they are not productive in results. Increase in port congestion leads to increase in maritime transport costs and is in turn related to quality of logistics services

in ports.

Thus, the ports can be ranked on the data analysis as in the following table.

Table 3: Ranking on the basis of Infrastructure

Ports	Ranks		
	Depth	Quay	Berths
Shanghai	6	2	1
SPA	7	1	2
Rotterdam	1	4	4
Antwerp	5	3	3
Colombo	2	5	5
JNPT	4	7	8
Ennore	3	8	7
Kandla	6	6	6

The pier height ranks cannot be made because of limitations of the availability of data, but the ranks on depth, quay and berths has been input.

Port Performance

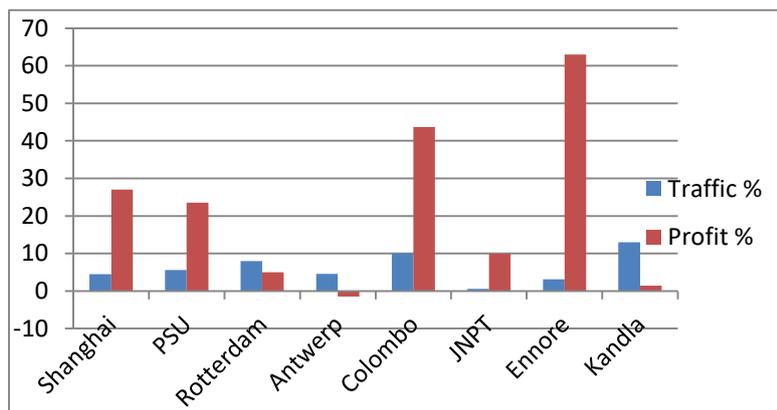


Figure 5: Graph of Port's performance

The fig.5 shows the port performance of the study ports. Most ports constitute an important economic activity in the country's development. In traffic increase percentage Kandla port has been seen to lead the graph followed by Colombo port. The least traffic increase has been seen for JNPT. While for the profit rise, Ennore port has been seen to lead the graph and achieve the most profit and Antwerp has seen a negative and downfall in the profits percentage. Ports also to the support of economic activities in the hinterland since they act as a crucial connection between sea and land transport [65]. It has also been seen that seaports contribute to most of the economic development of a country [66]. Port traffic is dependent on the management, location and the port infrastructure[67], [68]. The total tonnage handled by ports, loaded, unloaded and the vessel stand by is affected by traffic. The volumes of containers if grown and will outpace the current capacity possessed by seaports. Seaport that is unable to level up their seaport capacity will cause disadvantages like congestion, long turn-around time for vessels and containers and also affect

the efficiency in the supply chain[48].

The ports have been ranked on the basis of the data and graph.

Table 4: Ranking on the basis of port performance

Ports	Ranks	Traffic %	Profit %
Shanghai	6		3
SPA	4		4
Rotterdam	3		5
Antwerp	5		8
Colombo	2		2
JNPT	8		6
Ennore	7		1
Kandla	1		7

Port Cost

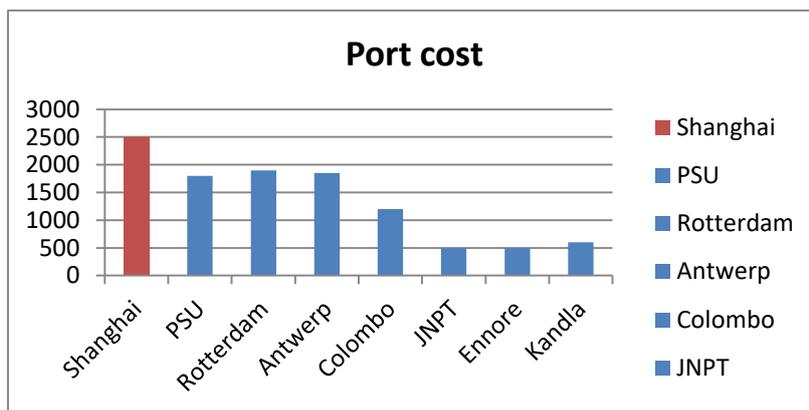


Figure 6: Graph of Port's costs

The graph shows the contrastness of port costs among the study ports. It has been seen that shanghai port prices are the highest and Indian port prices are the lowest.

Logistics costs influence shipping costs[65], [69], [70]. Port costs are increased to benefit in profits, when there is profit there will be services and if services there will be more traffic and again more traffic will influence more profits. It is cyclic process of costs to profits. Most of the international ports charge higher than Indian ports[50]. So, this is a reason of comparativeness in the competitiveness of ports in the international levels. Value added creation is another prospect by ports and port-related industries. The larger the port, the more value added is created and tend to attract a variety of industries. Value added of industrial development within ports can be at a par or even higher than those of direct port value added[69]. This can also be linked with the objective that, in India there is a low link between port-industries and ports and so the value is low. This is causing a low attraction of international market and low developments.

However, the ports can be ranked as follows.

Table 5: Ranks on the basis of costs of ports

Ports	Ranks
Shanghai	1
SPA	4
Rotterdam	2
Antwerp	3
Colombo	5
JNPT	7
Ennore	7
Kandla	6

Comparative Analysis

Although the above factors could be ranked on the basis of the data collected and analysed from the literature. The underneath are other factors that has been analysed and interpreted from the main ranks comparative table.

Strategic geographic location plays a major role in influencing the competitiveness of the ports [71]. Shipping companies attract traffic and activity to ports and they in turn are attracted by industrial and other activity of a country. With large investments there has been a substantial increase on the traffic in recent times. Geographical advantage allow big vessels to access and easily stretching to hinterland areas, while for some ports in the open sea cannot berth large vessels[72]. However it can also be interpreted that, containers discharged from the same port have different destinations, thus, a port which has geographical advantage to a region is usually recouped by its disadvantage to another region. Again, inland distance, hinterland and connectivity to major shippers together with the presence of efficient inland transport networks constitute the prime factor to improve competitiveness of gateway ports[73;74]. Shipping routes centrality is crucial for gateway ports and transshipment hubs[75]. In Indian ports it has been seen that there is a lack of such connectivity or strategic geographical influence. The only port that is well connected and suits the location is Jawaharlal Nehru port in Mumbai[17]. Shipping routes for the Kandla port and Ennore port might also be a reason for the low competitiveness of ports in the international level.

Apart from these main factors, some other issues has also been discovered from the literature that the significant growth of vessel size has forced ports to achieve higher degree of infrastructure and management with their hinterlands[44]. Again, another factor that has caused inadequate competitiveness of Indian ports is governance mechanisms in Port Authorities thus, hindering fast decisions, consistency and the speed. In addition, the establishment of chains of authorities among the port with local and central government strengthens port competitiveness. Strengthening ties among private firms has the power to improve competitiveness of ports [76;77]. Development of

corporation and global alliances in shipping impose anew pressure on ports and it becomes critical to deal with large constellations of ship-owners sharing vessel capacity and investments [78]. Thus, shows growth in operational needs on port costs, infrastructures, service quality and operational efficiency. Other inefficiencies in contrast to international ports is that most major ports were originally designed to handle specific categories of cargo and the ports have not been able to adjust to the categories of cargo which grew the most [62]. Over staffing at Indian ports also remains a consistent reason for unproductive port [13]. Equipment utilization and modernization is again very poor and provides to low competitiveness between international and Indian ports [14].

Finally from the analyzed data and the literature the ports studied in this research can be compiled and ranked in final to show the competitiveness among them and where they belong.

Table 6: Final rank of the study ports after the finding and analysis

Ports	Final Ranking
Shanghai	1
SPA	2
Rotterdam	3
Antwerp	4
Colombo	5
JNPT	8
Ennore	7
Kandla	6

The table shows the final ranking on the basis of the findings from the literature and not on the basis of the intentional ranks. The factor has been analyzed and the ports with the most competitiveness have been ranked accordingly. Shanghai and SPA however retains their spot in the table. Antwerp port and Rotterdam also retains the same position, however Antwerp port surpassed in Rotterdam in one factor of competitiveness. Similarly, SPA too surpassed Shanghai port in a few factors but in overall Shanghai still holds the top post. In, Indian ports, JNPT however dropped to the bottom in comparison to Kandla and Kamarajar port. Kandla and Kamarajar port surpassed JNPT in all aspects except for capacity and hence JNPT was ranked the lowest.

Discussions and Conclusions

The main aim of the journal was to compare and contrast the factors that influence competitiveness between Indian major ports and international major ports. Port competition attracts attention from an economic, social political and business perspective. This is due not only to the substantial social and economic significance of seaports within a regional and national context. From the studies it has been found that not only locations, capacity, performance, cost or infrastructure influence competitiveness, but also economies in shipping, governance, competition, inter-firm networks and modernization also contributes largely towards effective competitiveness among ports. However, port locations and port infrastructure are the most

influential factors of port competitiveness because locations are selected by shippers and infrastructures attract large shippers. Indian ports in contrast to the international ports have been seen that; poor infrastructures, poor investments, poor governance, geographic locations, capacities and distance from the major sea routes have contributed largely towards ineffective competitiveness of Indian ports.

It is recommended that Indian ports authorities should focus on developing service ports, tool ports and landlord ports. They can also improve their policies with the help of Government of India and inviting private participation and the port authorities can raise the issue to increase financial powers. Intra-port and inter-port competitiveness will also enhance the competitiveness of the Indian ports. It is strictly recommended that the Indian ports though now cannot change the locations of the existing major ports but can improve infrastructures, ports costs and increase capacity in the future by investing more on them for better performance and efficiency. In future for the planned ports the authorities and operators can engage more on implementing these factors.

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