

'Quality of Service' Based Pricing Framework for Major Ports of India

* Dr. Deepankar Sinha

**Ashutosh Kar

*** Dr. Ram Singh

ABSTRACT

The efficiency of ports contribute significantly to the total cost of goods. Most of the ports globally were traditionally under state control and acted in monopolistic way. With opening up of economy, technological advancement leading to different options for cargo transfer and creation of private ports the major ports of India supported by the Union Government are struggling to stay competitive. The port authority tried several reforms starting from partial privatisation to corporatisation of ports but ports are yet to meet the global standards. In this paper an attempt has been made to analyse the pricing system of the major ports of India. The objectives of setting port tariff are directed wholly towards the port and not to its customers. This paper suggests a pricing framework based on quality of service (QoS) that is customer centric. The paper suggests compensating the carriers for failing to provide the assured quality of service (QoS).

Keywords: Efficiency, port tariff, quality of service (QoS), port dues, berth hire charges pricing framework.

1. Introduction

Seaports act as an interface between land and sea or other waterways. It is an economic entity, and it is a part of transportation network through which cargoes are routed to different destinations. It provides facilities for loading and unloading of cargo, passenger terminal, repair of ships, breaking of ships, warehousing and acts as a point for multi-modal transport. It has location rigidity and has expansion limitations. A port may serve as multipurpose, special purpose, regional or trans-shipment hubs. Their planning must uniquely recognize their specific function (Frankel, 1990). The ports across the world were mostly Government controlled operating under protected (regulated) environment of the country. Hence, they enjoyed a natural monopoly for a long time. The obvious drawbacks of monopoly had crept into the port system over a period of time. The ports that were old, suffered from the limitations of being inflexible to the changes. They followed the "bureaucratic" model of business (Kent and Hochstein, 1998). Every approach was based on precedence and resource constraint. An activity could be taken up only if the existing resources were adequate and the requirement fitted into the rule and regulation framework. The requirement of ports' customers took the back seat. Customers did not get what they needed, but had to satisfy themselves with what ports provided them. Charges were based on method of 'absorption' costing and the port users had to pay for the port's inefficiency. No metric was defined for "quality of service" at ports. The planning process at port was based on forecast of cargo movement through ports and capacity computation (Sinha, 2005a). There were no attempts to integrate the

competitive, qualitative, technological, economic and financial dimensions into the planning process of the ports through analytical models based on an integrated information system. The factors such as globalisation of world economy and rapid change in transportation, information and related technology led to customer service explosion and time compression. Technological changes in ship building industry led to construction of ships of larger size. At the same time the industry witnessed scaling up of bulk cargoes. Thus, there was a need for the ships to achieve the required economies of scale. Larger options of modes of transportation (and their combination) and the choice of service provider were available to the port customers. The competition amongst the ports increased manifold. Ports were not able to sustain its growth. This led to the change in the role of the ports. This resulted in the evolution of various alternatives, such as the "landlord", "service" and "tool" ports (NCAER, India, 2001). The concepts of these roles are as follows:

- A **landlord port** is a port, where the port owns and manages the infrastructure. The private firms are able to own superstructure, and provide services as well as rent port assets by concessions and licenses.
- A **service port** is a port that owns the superstructure and provides all required services.
- A **tool port** owns the superstructure, while the management of the activities is the responsibility of other agencies.

Ports tried one or more combinations of these options to remain competitive. The maritime industry meanwhile witnessed several structural changes in business

* Associate Professor, Indian Institute of Foreign Trade, Kolkata

** Assistant Professor, NSHM College of Management and Technology, Kolkata

*** Professor, Indian Institute of Foreign Trade, New Delhi

operations including concentration, alliances and mergers (Ryoo and Thanopoulou, 1999; Graham, 1998; Zan, 1999). The shipping lines penetrated in terminal operations, and ports privatized their operations. Ports opted for the choice of co-operation as well as competition (Song, 2004). Besides, ports resorted to various quality measures such as ISO certification, quality circles and productivity based awards. In some cases the ports reduced the charges and controlled the productivity parameters to remain attractive (Suykens and Voorde, 1998). Thus, the shift from paradigm of operational efficiency to the paradigm of customer satisfaction made the port planners' job complex.

Traditionally, the ports across the world have set up their tariff primarily to recover the cost of operations and investments. UNCTAD (1975) studied the various pricing systems applied in 81 port authorities globally. This paper suggested that ports should have rational pricing policy. It prescribed that basically three elements, namely costs, utilization of installations, and what traffic can bear, must be taken into account in building up a realistic and adequate pricing system. UNCTAD set the objectives of port pricing as to ensure the most economical utilization of assets. In the process it suggested that pricing of certain services should be pegged at higher level in order to discourage the port users to use those assets unless they have greater returns from these services of the port. Another objective stated by UNCTAD was to build up financial reserves for cushioning the port against unexpected falls in revenue or rises in cost. However, it cautioned that higher reserves may hinder the achievement of other more important objectives. It finally recommends that benefits accrued against port activities stay in the country.

This approach, as suggested by UNCTAD is still prevalent in many ports in the world. In India, the Tariff Authority of Major Ports (TAMP) have laid down port-wise cost plus return on capital employed approach for fixing port charges. Though TAMP examines the reasonableness of the costs and investments to ensure that inefficiencies, uneconomic uses and practices or excesses are not passed on to users, no structured framework appears to be in place to ensure completeness of effecting such objectives. In order to encourage efficiency TAMP calls for revising its base price in cost plus approach to the order of 50% to determine the revised tariff (TAMP, 2012).

The department of Transport and Communication, Government of Australia reviewed its pricing system at ports in 1997 to enable changes to be effected in their pricing system (BTCE, 1997). The paper suggested lowering of cargo charges while enhancing the rental charges such as berth charges and lease rentals. The assumption behind such proposal was to increase the utilization of berths and land facilities by stevedores, giving

port authority the ability to meet growing demand with existing facilities. It proposed adoption of Ramsey pricing to ensure achievement of financial targets. At Ramsey price the profits are equal to zero and the output of each good is reduced by same proportion relative to the outputs that would be produced when prices are at marginal cost; and the amount by which price exceeds the marginal cost, expressed as a percentage of price, is greater for goods with less elastic demand.

The revised framework by the BTCE (1997) called for setting ship based charges in proportion to gross registered tonnage subject to any significant responsiveness of individual trades, or ship types to ship charges. The measurement of asset value has been suggested to be on the basis of market value or replacement cost rather than on historical cost. Haralambides (2002) showed how Marginal Cost Pricing of port infrastructure can be powerful 'pricing discipline' towards achieving cost recovery and fair competition among ports.

The different categories of port charges as surveyed by UNCTAD include the vessel, cargo and other services related charges. The common element of vessel related charges include port dues and berth hire charges. These charges are based primarily on gross registered tonnage though certain variations based on cargo handled per day or overall length of ship. The cargo related charges refer generally to the quantity of cargo handled in the port per vessel. The other service charges include lease rental, equipment hire, dry docking and other services.

2. Major ports of India

The major ports of India come under the purview of major port trust act (1961). There are 12 such ports at present along the 7000 km odd coastline in India. Some ports are century old while average is more than 50 years bearing one major port. The share of major Indian ports since independence has reduced from around 90 percent to less than 60 percent by 2013-2014.

Figure 1: Share of Major Ports in India vis-à-vis Minor Ports of India



The analysis for the cause of such decline reveal that productivity of these ports are yet to meet global standards, where majority of the best performers are the ports in Asian region. Literature study substantiates productivity measured in Turn Round Time (TRT) in general and ship day output in specific are nowhere near the global standards. This result is yet to make dent on to the performance of the port inspite of the fact that ports have resorted to implementation of all known policies to combat this problem. This includes liberalization of economy, privatization of operations, and globalization in approach and value addition enhancement of investments over the plan periods. The process started almost 20 years back but the results are yet to be realized. This paper aims at studying the two major dimensions of port performance i.e. productivity and financial dimensions.

The first aspect reveals that stay time at berth is the major component of Turn Round Time (TRT) i.e. dependent on quantum of cargo handled at the port and ship-day-output. The analysis of ship-day- output for dry bulk cargo such as coal or iron ore in major Indian port show that the same has increased from around 5000 MT per ship day in 1980s to around 20,000MT per ship-day in past few years i.e., four times increase during the last 20 years. However, this increase is yet to be closer to other Asian ports in Indonesia or Australia. In addition to the low performance of Indian ports, the ports during certain months in a year cannot provide the desired draft. As a result, the ships levy low water surcharge from the shippers. This is observed in river based ports such as Kolkata or Haldia. However, there could be situation when the ships do not get desired tonnage due to economic downturn or other reasons. In such cases, the shipping lines instead of levying surcharges may offer lower freight rates. In this case, the port has no action to take while in the former case the ports need to revisit their pricing policies that is based on gross tonnage of a vessel. This is especially so because the port dues, a component of vessel related charges, are proportional to the effort in piloting and tugging a ship. The vessel which is partially laden, the efforts are less and more so that the ship should not be penalized for ports' inability to conserve its channel or navigable fairway.

In case of containers, the moves per hour is in the range of 20 to 25 containers per hour with 1 to 2 cranes per vessel

in the major ports as against 25-30 moves per hour with 3-5 cranes per vessel in port of Singapore (Trace et al, 2009). At the same time it has been observed that in one of the privately managed container Terminals around 235 moves per hour has been achieved (http://en.wikipedia.org/wiki/Nhava_Sheva, 2012). The comparison above has been made with respect to container cargo. Singapore is a major transshipment port while none of the Indian ports are so. India is now working towards relaxation of its cabotage law (JoC, 2017) that will enable the container terminals in Cochin and Tuticorin to serve as hub, that is, also act as a transshipment port. However, the issue of moves per hour remains unchanged, or in other words, the ports and terminals in India needs to meet the global standards in productivity to get the status of hub port.

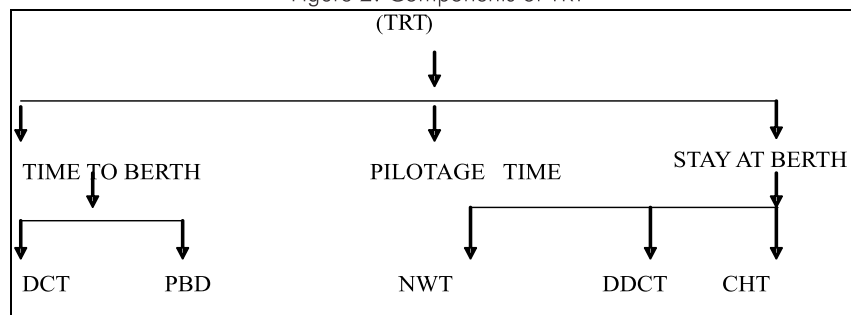
The government of India has laid down policy for private participation in Indian ports (Maritime Agenda -2020-Government of India – Ministry of Shipping). Several private terminals such as the container terminals managed by APM, DP World and PSA International has come up in JNPT, Cochin, Tuticorin and Ennore. However, a study on performance of container terminals, by Dasgupta and Sinha (2016), showed that all private terminals did not function with the desired scale efficiency.

The revenue patterns of these ports suggest that they are also in the growth phase, though not radical in its strength. This leads to, the conclusion that radical changes could only be brought in through structural changes. Thus, an attempt was made to analyze the revenue model of these ports.

3. Quality of Services (QoS) at major ports of India

The single efficiency parameter that judges the performance of the port is the turn round time (TRT) or also referred as turnaround time (TAT). This is defined as the time a ship spends in the port's territory. The basic reason for increase in TRT is increase in cargo load per vessel. But in many of the major ports TRT is much higher compared to the best performers such as port of Singapore for equivalent quantity of cargo. The components of TRT are shown in the chart below:

Figure 2: Components of TRT



DCT stands for DOCUMENT CLEARANCE TIME BY Customs, Port and other agencies PBD stands for Pre Berthing Detention i.e., waiting time of ship prior to start of work DDCT stands for DEPARTURE DOCUMENT CLEARANCE TIME i.e., clearance of document after completion of work NWT stands for Non-Working Time i.e., time during which ship is idle at berth CHT stands for Cargo Handling Time

The turn round time primarily comprises pilotage time, time to berth and stay time at berth. Pilotage time is time taken for the ship to reach the berth from the reporting point of the port. Though this time is not significant for majority of sea ports, it is quite significant for riverine ports such Kolkata or Haldia. Time to berth comprises the time required to obtain clearances from different statutory agencies and the pre-berthing or the time during which a ship awaits due to non-availability of berth. The stay time of berth comprises actual time during which the ship handles cargo, its idle time at berth and the time taken by the ship to get clearance or permission to sail.

The impact of efficiency of a port is manifested in the quantity of cargo per ship that flows into the port. It is termed as parcel-load. Thus, a lower parcel load implies that either the port is unable to provide the right draft or infrastructure or that its inefficiency is discouraging the ships to bring in right parcel load.

In a report by Comptroller and Auditor General of India, for the year 2009-10, it was reported that at the Kolkata Dock System, the liquid bulk vessels were constrained by the low drafts and faced inadequate handling infrastructure. As a result, 72 per cent of the handling was occurring at the anchorage and particular locations on the access channel, resulting in high TRT (4.1 days compared to 1.76 days at Jawaharlal Nehru Port Trust (JNPT) of liquid bulk vessels. It stated that the Ministry (Government of India) replied (August 2009) that the number of vessels calling at some ports was low and there was not much waiting time for such vessels. As the revamping of the Marine loading arms (MLA) was capital intensive in nature, ports were revamping them according to their requirements. While the Ministry's argument is valid to some extent, it, however, needs to be stressed that in ports like Mumbai where large volume of liquid cargo was handled, investment in revamping of MLAs at berths with low capacity would result in efficiency gains in operation. Further, in ports where the volumes handled are presently low, improvements in handling efficiency are necessary for them to remain competitive. It was found in Cochin that liquid cargo was being back-loaded followed by diversion to other ports. At the Haldia Dock Systems at Kolkata, which ranked fifth among the major ports in terms of

volume (19.66 MT) of liquid bulk handled in 2007-08, draft restrictions above eight metres at the two oil jetties together with inefficient handling had become serious limitations to smooth operations. The principal user, Indian Oil Corporation Limited (IOCL), shifted (November 2008) its handling operation to Paradip port in Orissa even though the cargo would eventually come to IOCL's storage facilities at Haldia through underground pipelines. The port had failed to take any proactive action to minimise the significant business loss. Even at Cochin, the single largest customer, Kochi Refinery Limited (KRL), shifted (December 2007) the handling point from the liquid berths dedicated to them since 1986 to the single buoy mooring (SBM). The shift resulted in reduction of revenue along with idling of the berths. Even the business plan of Cochin port had identified that the port's revenues were linked to the capacity of KRL refinery (CAG, 2010)

4. Revenue model

The ports earn the revenue primarily through charges on ship, cargo and services. The ship charges are based on its size. It is termed as ship dues, the idea behind levying this charge as revealed in the literature survey above is to recover the cost of providing services to the ship i.e. proportional to its size or in other words larger the cargo carrying capacity bigger the vessel and hence utilization of the ship. But the analysis of parcel load suggests that the ship does not carry to its full capacity while calling a port either due to lack of demand or inadequate draft. But the port continues to charge the vessel in the same format as applicable to fully laden ship. In some cases the importer had to even pay additional cost for calling partially loaded ship. In recent past due to the lower draft into Kolkata / Haldia ports, thus limiting the load factor of vessels plying this trade, a surcharge called "Low Water Surcharge" has surfaced. This is to be applicable for shipments ex-Port Klang and Singapore into Kolkata / Haldia ports. Quantum of usd120 per TEU on all SOC shipments (laden boxes only) will be applicable both ways – Port Klang / Singapore into Kolkata / Haldia and back (<http://malaysiashipping.info/2011/10/low-water-surcharge>, 2012).

4.1 The port pricing system at major ports of India – case of Kolkata Dock System

The major ports in India, such as Kolkata Dock System, levy broadly two different types of charges from the ships calling at port. These are the vessel related charges and cargo related charges. One of the component of vessel related charges include berth hire charges i.e., the charges that a ship pays for duration of time it stays at port. The current charges are as follows.

Table 1: Vessel Related Charges for Vessel Engaged in Foreign Trade and Vessel Engaged in Costal Trade: Berth Hire Charges

S.21 Berth Hire (This clause is related to the tariff hosted in website of Kolkata Port Trust (www.kolkataporttrust.gov.in))
 S.21.1 Berth Hire on vessel at Dock berth/ River side jetty shall be levied at the following rates:

Serial No.	Description of vessel rate per hour per GRT	Charges
1.	Vessel engaged in foreign trade and except as specified at serial number 4	0.2875 cents subject to a minimum of \$6.90 per hour
2.	Vessel engaged in costal trade other than those plying between Andaman and KOPT	Re. 0.0437 subject to a minimum of Rs.103.5 per hour.
3.	Vessel engaged in costal trade between Andaman and KOPT	Re. 0.031 subject to a minimum of Rs. 31.05 per hour
4.	In case of Exhibition Vessel 50% of the rates specified at serial number 1 & 2 above, as the case may be, shall be levied.	
<p>Note to above schedule of charges:</p> <ul style="list-style-type: none"> (i) If any vessel does not work against its booking for work on holiday due to reason attributable to port, the Berth Hire for the shifts in which it does not work against booking shall be levied at twice the rates specified at S.21.1 (ii) Whenever, a vessel is double/triple banked with another Sea going vessel occur berth, the vessel so double/triple banked will be charged at the rate of 50% of the Berth Hire charges specified above provided the vessel is in nonworking condition. (iii) For fishing trawler occupying barge jetty/anchorage jetty at HDC or any other jetty or landing stage or moorings RS. 14.375 per hour shall be levied. (iv) In case a vessel idles due to non-availability or breakdown of the port equipment power failure at KOPT or any other reason attributable to the KOPT, rebate equivalent to berth hire charges accrued during the period of idling of vessel shall be allowed. 		

Source: Port Tariff, www.kolkataporttrust.gov.in, 2012

Table 2: Vessel Related Charges for Vessel Engaged in Foreign Trade and Vessel Engaged in Costal Trade: Port Dues

S.25 Port Dues

S.25.1 Port dues shall be levied on Sea going vessels entering the Port of Kolkata at the following rates.
 The dues are payable on each entry of the same vessel into the port.

Sl. No.	Description of vessel	Rate per GRT
i)	Vessel engaged in Foreign trade	34.50 Cents
ii)	Vessels engaged in Coastal trade other than those plying between Andaman and KOPT .	Rs.9.2345
iii)	Vessel engaged in Coastal trade between Andaman and KOPT (in Indian Currency)	Rs.5.336
iv)	Vessel entering in ballast and not carrying Passengers.	75% of the respective rates specified at Sl. No. (i), (ii) & (iii) above.
v)	Vessel entering for but not discharging or taking any cargo or Passenger therein (with the exception of such shipment and /or re-shipment as may be necessary for repair	50% of the respective rates specified at Sl. No. (i), (ii) & (iii) above.
vi)	Vessels attending at Sand heads for lighter age operation.	25% of the respective rates specified at Sl. No. (i), (ii) & (iii) above
<p>Note to above schedule of charges:</p> <ul style="list-style-type: none"> i) For 'Oil tankers' with segregated ballast, the reduced gross tonnage that is indicated in the "Remarks" column of its international Tonnage Certificate will be taken to be its gross tonnage for the purpose of levy of Port dues. ii) LASH Vessel making a "Second Call" to pick up empty LASH barges shall not be charged any Port dues. iii) In case of vessel visiting both KDS and HDC 50% of the applicable port dues shall be payable 		

Source: Port Tariff, www.kolkataporttrust.gov.in, 2012

The above schedule of charges show that if ship stays in the berth for longer duration, even due to lower productivity it has to pay the charges (except in case of idling due to complete stoppage of work) meaning that the port earns on account of even being inefficient. The port dues per GRT suggests that the vessel has to pay for its size though the port does not permit the right parcel load due to draft restriction or that the shipper is not eager to handle its cargo in the port, being inefficient.

4.2 Basis of levying vessel related charges by other ports in the World

The basis of levying vessel related charges world wide include charge per GRT (gross registered tonnage), or charge per NRT (net registered tonnage), or charge per length of ship, or charge per length of quay occupied by the ship, or charge per cargo handled per day per ship, or charge per dead weight tonnage (DWT) and draft, charge per cargo tonnage moved (parcel load) or similar basis (UNCTAD, 1975, BCTE, 1997). Thus it implies that the many of the ports have tried to incorporate efficiency based pricing that is, either on basis of tonnage moved and not on the size of the vessel and draft, or on the basis of actual tonnage handled per day per ship.

6. Conclusion

In India, the major ports under the purview of the Union Government are loosing their share to the minor ports in the country. The share dipped from ninety percent in 1990s to less than sixty percent in past few years. The port authority tried several reforms starting from long term leasing to corporatisation of ports but are yet to meet the global standards.

This study is an attempt to analyse the reasons for slow response of the major ports in India to the demanding global standards. The study revealed that one of the reasons is attributed to the pricing system of port services. The objectives of setting port tariff are directed wholly

Table 3: Pricing framework based on Quality of Service (QoS)

Port Charges	Pricing Structure	Assured Quality of Service	Compensation
Port Dues	Per DWT	'x' meters draft	w% reduction per meter fall in draft
Berth hire charges	Per day cargo handled	'y' MT per day per ship	z% reduction in charges per metric ton (MT) fall in productivity

The notions x, y, w and z refers to the values the individual ports may project to the shipping community with regard to the draft, ship-day-output or productivity it assures, compensation for not providing the assured draft or productivity respectively.

5. Proposed pricing framework

In view of the above analysis it is proposed to develop a pricing framework based on quality of service (QoS) in order to enable the major ports of India meet the global standards. The proposed framework not only suggests choosing the right basis for levying charges to the vessel but also associating the same with assured level of service the port promises to provide, failing which the carriers would be accordingly compensated. It is proposed to levy the vessel related charges based on the DWT that directly conveys the load bearing capacity of the vessel and can be related to the draft (i.e., navigable water level). This can be illustrated by the different ships categorized as Panamax, Suezmax or so requiring draft of 10-12 meters or 17-20 meters respectively. The framework suggests determining the rate of compensation based on the actual loss or the opportunity cost to the carrier and the price sensitivity of the carrier. The framework is illustrated in the table 3 below.

towards the port and not to its customers. The primary objectives include recovery of cost and return on capital employed. The findings show that the port levies dues on the size of the ship that calls to the port while the port is unable to provide the requisite draft to facilitate full ship load or remains un-attractive for the carriers and the shippers because of its in-efficiency. The ship pays for stay at berth even if the duration of such stay is attributable to port's inefficiency. This paper suggests a pricing framework based on quality of service (QoS) that is customer centric and proactive in nature. The proposed framework not only suggests choosing the right basis for levying charges from the vessel but also associating the same with assured level of service the port promises to provide, failing which the carriers would be accordingly compensated.

The study can be extended further to incorporate the framework to determine the values of x, y, w and z for different carriers, type of cargo and parcel load for different major ports.

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