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Optimizing Private and Public Mode of Operation in Major Ports of India for Better Customer Service

Deepankar Sinha
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Optimizing Private and Public Mode of Operation in Major Ports of India for Better Customer Service

Deepankar Sinha *
Shuvo Roy Chowdhury **

Abstract

Prior to 1991, in India, due to government dominance, port-customers did not get what they needed as they had to satisfy themselves with the port-offerings. This was so as for long time ports were inflexible to the changes in the need of port-customers. After, the liberalization process started, since 1991 in India, many of the major ports, administered by the Union Government of India have been shifting to privatization of its operation. Meanwhile globalization of world's economy, monumental development in transportation and logistics sector and magnum changes in information technology have led to the explosion of availability of port-customers' service-options and service-providers. In India, the number of ports increased manifold. There were around 10 ports prior to 1970s. At present there are 13 major ports administered by the Government of India while around 200 ports under the state governments. The bulk of the government expenditure is directed to the major ports of the country. But the returns are much less. The share of the major ports reduced from 90% (prior to 1991) to 70% in the year 2015. The span of choice for port-customers is increased which eventually led to the changes in the role of port. The major ports looked for private partnership to cope up with their dwindling share. At this stage, the major ports in the country has a hybrid state of governance aligned between a landlord port model (i.e., fully privatized management and operations) and a service port model (i.e., fully self-managed with no private participations). However, studies show that inspite of introduction of private participation these ports are yet to figure in the elite list globally. In this paper an attempt has been made to understand the cost-revenue dynamics of the hybrid state of governance of the major ports of the country and propose a computational framework to determine the optimum size of privatization by the major ports and opt for other measures to maximize the port efficiency, inter-alia customer satisfaction and revenue.

JEL Classification: R-4

Keywords: Cost-Revenue Dynamics, Port Efficiency, Privatization, Computational Framework.

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W.P. No: LD- 1 7 - 3 2

Optimizing Private and Public Mode of Operation in Major Ports of India for Better Customer Service

1. Introduction:

1.1. Background of Transformation of Indian Ports from Public to Private Sector:

Sea Ports are economic entity that provides facilities for ingress and egress of cargo to and from a country. The efficiency of port impacts the logistics cost that in turn affects the total landed cost of goods. The Indian port sector, like other trade sectors of India, was guided by the philosophy of self-reliance and public sector dominance till introduction of liberalization process in the 1991. India's share of world merchandise trade fell from 2.2 percentages in 1948 to almost one-fourth of its initial i.e. 0.5 percentage in 1983 (Srinivasan and Tendulkar, 2003). In the 1980s Indian major ports, owned and operated by the Government of India, were anemic due to obsolete technology, low loading rates, chronic congestion, delays, and poor connectivity with the hinterland (Peters, 1990).

Since liberalization policy announced in 1991, the major ports of India have been shifting towards privatization of its operations. Yet none of the ports figures in the top twenty ports in the world. A study on evaluation of efficiency levels of ports and terminals handling containers, in India, show that not all private terminals are operating under constant or increasing returns to scale (Dasgupta and Sinha, 2016).

At present a hybrid mode of governance, aligned between a landlord port model and a service port model, is being practiced by the major ports. Under this scheme of operation some of the terminals are being operated by the port authority while some of them are managed and operated by the private operators under the PPP (Public-Private Partnership) approach. The port earns a share of revenue from berths or terminals operated by the private operators and by providing certain services such as pilotage and other marine functions. The berths and terminals offered to private player resulted in redundancies of manpower and assets. The ports are not in a position to reduce the manpower through compulsory retirement policies or offer voluntary retirement compensations. As a result the revenue position of the ports are not encouraging while at the same time, keeping customer needs in mind, the efficiency and further capital investments are being aimed from private participation. This dilemma can be overcome if ports ensure a minimum level of efficiency for the portion of operations that can be sustained with its existing manpower while offering the other operations to private operators. In this paper an attempt has been made to understand the cost-revenue dynamics of the hybrid state of governance of the major ports of the country. It proposes a computational framework to determine the optimum size of privatization by the major ports and opt for other measures to maximize the port efficiency, inter-alia customer satisfaction and revenue.

1.2. Port Privatization – A review:

Ports reciprocate the nation's competitive advantages in international arena through efficiency and linkage with overall trading chain. Of late, one of the most obvious phenomena in worldwide port industry is privatization of ports. A number of studies and surveys had been conducted on the relationship between port ownership structure and its operation efficiency. According to the principal-agent theory, which attempts to address how to avoid an agent's shrinking behavior, private ownership is expected to be more efficient than the public ownership (Hartley and Parker 1991). Even without a change in the competition level, the transformation from public ownership to private ownership would be associated with improved efficiency (Hartley and Parker 1991). World Bank in its analysis of the divestment of the container operations at Kelang Port Authority (KPA), which is Malaysia's principal port, indicated that the weaker institutional incentive structure associated with publicly owned and operated ports results in lower control on costs, slower adoption of new technology and management practices, and thus, are generally less responsive to port users than private port operators (Yorke & Haarmeyer, 1993). Cullinane et al. (2002) employed stochastic frontier models, based on cross-sectional as well as panel data obtained through purely subjective appraisal, to assess the relative efficiency of selected Asian container ports. He supported that privatization should have some relation with the improvement in efficiency. Estache et al. (2002) used panel data of 44 observations from 11 independent Port Administrations of Mexico and found that the efficiency scores based on the statistical results illustrates that the reform of decentralization and privatization taken at Mexican ports generated huge short-term improvements in the average performance of the port industry. Although it was not emphatically proven that there exist a direct link between the degree of private sector involvement and economic efficiency, deregulation policies were generally used in many industries as well as in many countries (especially to the landside transportation sector), and privatization was perceived to be the most important policy for improving the efficiency of the ports sector (Cullinane et al., 2002).

However, contrary to these studies, some studies discard the opinion that port ownership had an effect on port efficiency. A number of eminent researchers (like Vickers and Yarrow, 1989; Estrin and Perontin, 1991) argued against the favour of private ownership and suggested that principal–agent problems might also emerge in the private sector as a result of capital market imperfections. Based on the observations of output and inputs for 28 ports in UK, Liu (1995), in his study to calculate technical efficiency and to compare the influence of public and private ownership on inter-port efficiency differences, failed to establish that port ownership type had a significant effect on port performance. Notteboom et al. (2000) used the Bayesian Stochastic Model, developed by Van Den Broeck et al. (1994), for comparing the efficiency level of a set of 36 European container terminals supplemented with four Asian container ports, and concluded that no relationship was found between the type of ownership, operations of a terminal and the efficiency level. In a study related to the economic efficiency of 27 Spanish ports a stochastic frontier cost function was used by Coto-Milla´n et al. (2000). He found that the type of organization had a significant effect on economic efficiency, but ports with autonomy were less efficient than the rest. Güner et al (2014) used Data Envelopment Analysis (DEA) and Malmquist Productivity Index for analysis of Turkish ports and concluded that during 14 years

period following the privatization, only one port performed beyond the efficiency frontier while others did not. Baird (2000) argued against the view that an outright sale of port land with a transfer of operational and regulatory functions to the private sector would definitely increase the operational efficiency or productivity. Tongzon (2005) examined that total dependence on the private sector to provide port infrastructure and superstructure would result in significantly delayed investments. He observed that this is primarily due to long payback period and high capital cost involved in port investment. As a result full port privatization would impede the improvement on port performance whereas some extent of private sector participation could increase the efficiency level. This indicates that the extent of privatization of port has a U-shaped effect on port efficiency. Thus, research results reveal that privatization may not result in an increase in efficiency in ports. Significant increase has been observed in trading volume of ports (in India) in terms of ship calls, cargo throughput, and total income during post privatization period, dramatic increases in total expenditures occurred simultaneously in that period which eventually resulted in operational ineffectiveness (as shown in Annexure 2 and 3).

1.3. Factors and Measures of Port Efficiency:

The term 'Efficiency' implies benefit maximization and cost minimization in the long-run though the general mathematical representation of 'Efficiency' is total outputs divided by total inputs. Tongzon (2008) figured out that operational efficiency does not solely depend on a port's size and function. European container terminals with annual throughput of over 10,000 TEUs from 29 countries were included in the study by Wang and Cullinane (2006) where it was concluded that most of the terminals under study showed inefficiency and large scale production tended to be associated with higher efficiency. Choi (2011) used Data Envelop Analysis (DEA) models for his study on 13 major sea ports in North East Asia including the seven largest container ports where it was concluded that investment in infrastructure does not improve efficiency, rather self-created logistics demand and strategic allowances could improve the efficiency. Farrel (2009) illustrated how container terminal efficiency declined as the terminal became more congested. Yan and Liu (2010) revealed that number of berths and capital deployed are the most sensitive measures impacting performance of most container ports; and vessel turnaround time is highly correlated with crane allocation as well as the number of containers loaded and discharged. The benefits of such model provide port-operators opportunity to determine optimum crane allocation to achieve the desired turnaround time given the quantity of containers to be processed (Mokhtar & Shah, 2006).

The input and output variables for measuring the efficiency of container ports or terminals business tends to reveal a kind of variety in the literature as there is a lack of uniform evaluation criteria. Chang (1978) suggested that the inputs of a port should include the real monetary value of net assets in the port, the number of laborers per year as well as the average number of employees per month each year engaged in the port whereas Dowd and Leschine (1990) argued that the productivity of a container terminal depends on the efficient use of labor, land and equipment. Infante and Gutiérrez

(2013), pointed out that 'land' is an important input and can be represented as the total berth length of the terminals. As to the output side, container throughput is the most appropriate analytically tractable indicator of the effectiveness of the production of a port (Cullinane et al., 2005). Infante and Gutiérrez (2013), concluded that in their study that the reasons for low efficiency level, for the ports of America during 2009-2010, was on account of low container throughput and inadequate usage of terminal area. In general, they opined that gantry cranes, terminal area and container throughput were the variables that had a strong relationship to the efficient outcome. In addition, port authorities should seriously consider leasing fixed assets such as equipment, buildings and land to increase the cash flow and the fixed asset turnover ratio that in turn can improve operational efficiency of the port in the long run. On the other hand, due to drastic competitive environment in a containerization era, all terminal operators need to benchmark themselves to find out their strength as well as shortage for improving their competence (Liu, Liu & Cheng, 2007).

1.4. Customer's perspective of port services

To the extent that customers perceive services from different providers as fairly homogeneous, they care less about who is the provider than about what is the price (Kotler *et al.*, 2009). If it is possible to give the customers what they want at a price they can afford, it contributes to customer satisfaction and customer retention, which in turn drive customer revenue and, ultimately are key factors in determining profitability (Best 1997, as cited in Holt 2002). Market oriented companies are best informed about their customers' need and wants (Sandvik and Gronhaug 1998). Lack of strong market orientation in product/service innovation, an unwillingness to undertake proper need assessment and neglect of the customer spell disaster (Cooper 1998, as cited in Holt 2002).

By providing solutions to customers' wants and needs firms are able to create superior customer value [(Day 1994; Kohli and Jaworski 1990; Narver and Slater 1990) as cited in Herhausen 2011] which eventually leads to business success [(Belz and Bieger 2006; Day and Wensley 1998; Drucker 1993; Kotler and Keller 2008; Porter 1985; Rust, Moorman and Bhalla 2010; Woodruff 1997) as cited in Herhausen 2011]. Many businesses appear to have an incomplete understanding of what it means to be customer oriented because they concentrate on its responsive dimension towards customers' expressed needs and ignore its proactive dimension [(Kohli and Jaworski 1990; Slater and Narver 1998, 1999) as cited in Herhausen 2011]. Research exploring how firms learn about and act upon customers' needs has predominantly focused on responding effectively to customers' current and expressed needs (Herhausen 2011). Firms that do not excel at proactively anticipating customers' latent and future needs will find themselves at a competitive disadvantage [(Zeithaml et al. 2006) as cited in Herhausen 2011].

Ports have two distinct customers, one, the shipper and the other, the carrier. The shipper and the carrier expects the dwell time of their cargo and the turn round time (TRT) of the vessels, respectively, to be minimum. Any port whether government managed or private, needs to meet the customer's expectation. Else, the port is said to be less efficient.

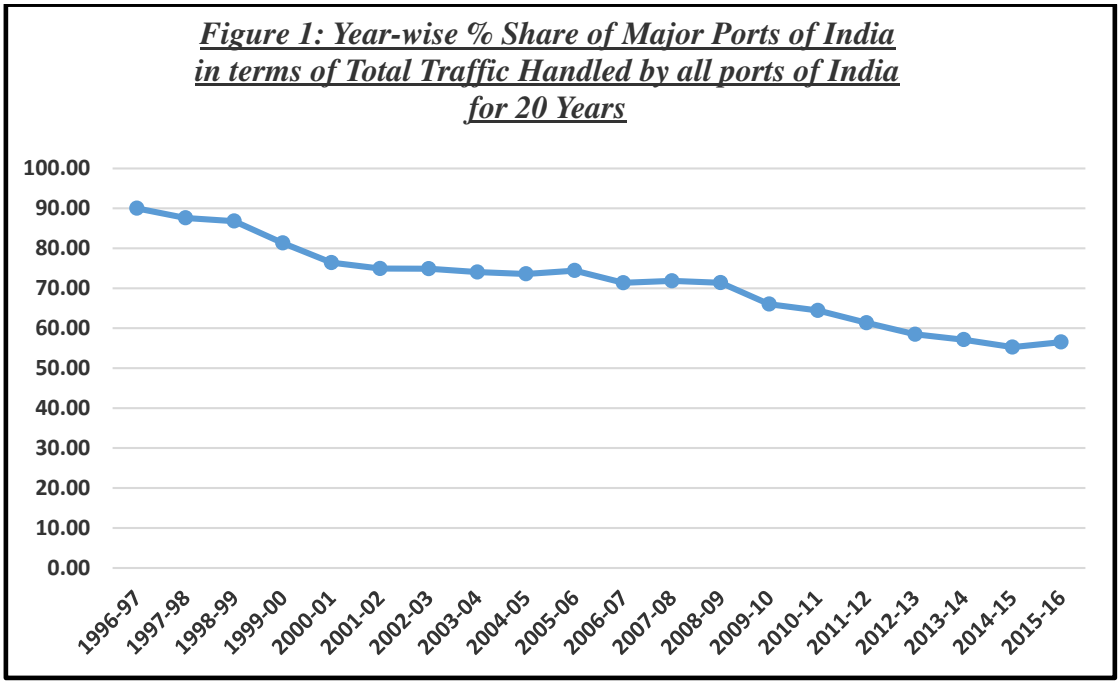
1.5. Study on Indian Perspective:

Chudasama (2009) pointed out the efficient and inefficient major ports of India and identified the sources of inefficiency for the inefficient ports on the basis of DEA. Shashikumar (1998) showed that despite the initiative for privatization at JNPT (Jawaharlal Nehru Port Trust), the then India's premier container port, it is unlikely that such initiative would propel JNP into the top tier of world-class container ports. Even current port planning in India still lacks the visionary to create an indigenous gateway port despite having a definite need for it; and as a result nation's container traffic would thus continue to transit through Colombo, Singapore, and Dubai or other Arabian Gulf ports. Bhatt and Gaur (2011) measured operational efficiency for the group of container terminals in JNPT- Mundra range of ports through appropriate indicators and used DEA to conclude that after privatization of the container terminals, the performance of the terminals was relatively closely matched; and the competition of securing the cargo had led to matching efficiencies on quay side where ships turnaround times and client satisfaction are closely related; but yard side efficiencies in evacuation of cargo were suffering major differences in terms of efficiency. Dasgupta and Sinha (2016) showed that out of 6 container terminals operated by private operators only 3 have been running efficiently in India and none of the terminal is able to feature in elite list globally. The availability of various mode of transportation (even the combination of modes also) as well as the availability of various service-providers, extended the span of choice for port-customers. This eventually led to the changes in the role of port (Kar & Sinha, 2012).

1.6. Current Indian Scenario:

India has a coastline traversing long 7516.6 kilometers which forms one of the biggest peninsulas in the world. While the Ministry of Shipping of Government of India administers the major ports of India (13 in number now), the non-major and intermediate ports (approximately 200 in number now) are administered by the Ministry of the respective States where they are located. Out of 13 major sea ports in India, 12 (twelve) are government/public concern and 1 (one) the Kamarajar Port of Chennai is the corporate/private one.

The share of major ports in terms of the total traffic handled by all the Indian ports has reduced from 90 per cent at 1996-97 to 56.52 per cent at 2015-16 with a CAGR of -2.4 per cent (as shown in Figure 1). It can be presumed that the prime reason attributed to this declining trend of share for major ports of India is imbalance in cost-revenue dynamics of port operation. As by virtue of being outside the purview of port regulator Tariff Authority for Major Ports (TAMP), minor ports do not have any tariff control and consequently enjoy the freedom to fix their service rates, allowing them to better compete with their rivals - the major ports in India (Ganguly-Scrase & Lahiri-Dutt, 2016).



The percentage of capacity utilization at major ports of India has reduced from 105.60 per cent at 1996-97 to 62.82 per cent at 2015-16 with a CAGR of -2.7 per cent (as shown in Annexure 2 and Figure 2).

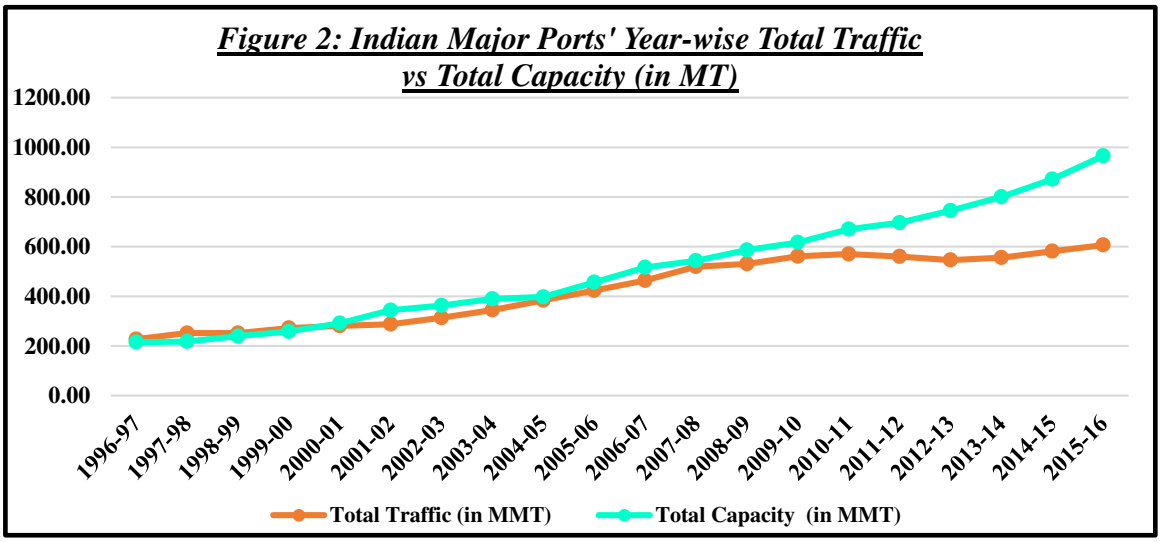


Figure 4 shows that, during the period 1996-97 to 2015-16, for major ports of India the CAGR of total operating income is 7.77 percent, while the same total operating expenditure is 7.96 per cent. These in turn reflects that there is an imbalance between revenue and cost (as shown in Figure 3).

Figure 3: Indian Major Ports' Year-wise Total Operating Income (in Rs. Crore) per Traffic MMT vs Total Operating Expenditure (in Rs. Crore) per Traffic MMT

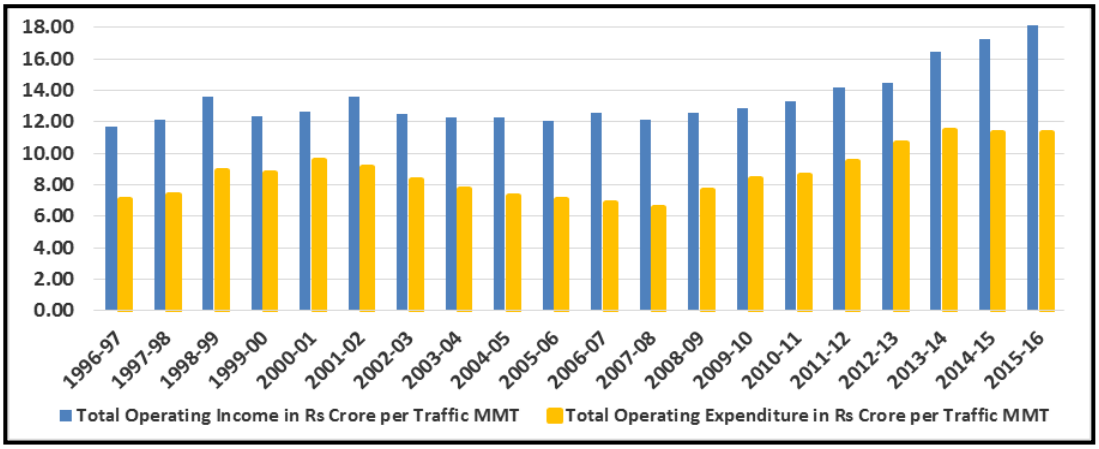


Figure 4: CAGR Percentage for 1997-2016 Time-Frame for Financial Parameters of Indian Major Ports

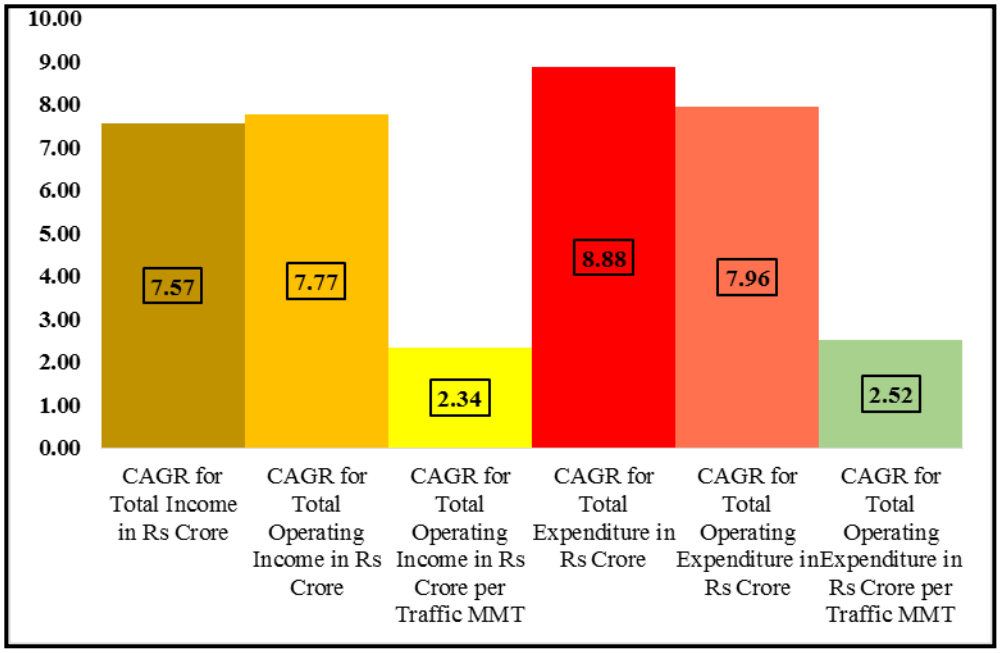
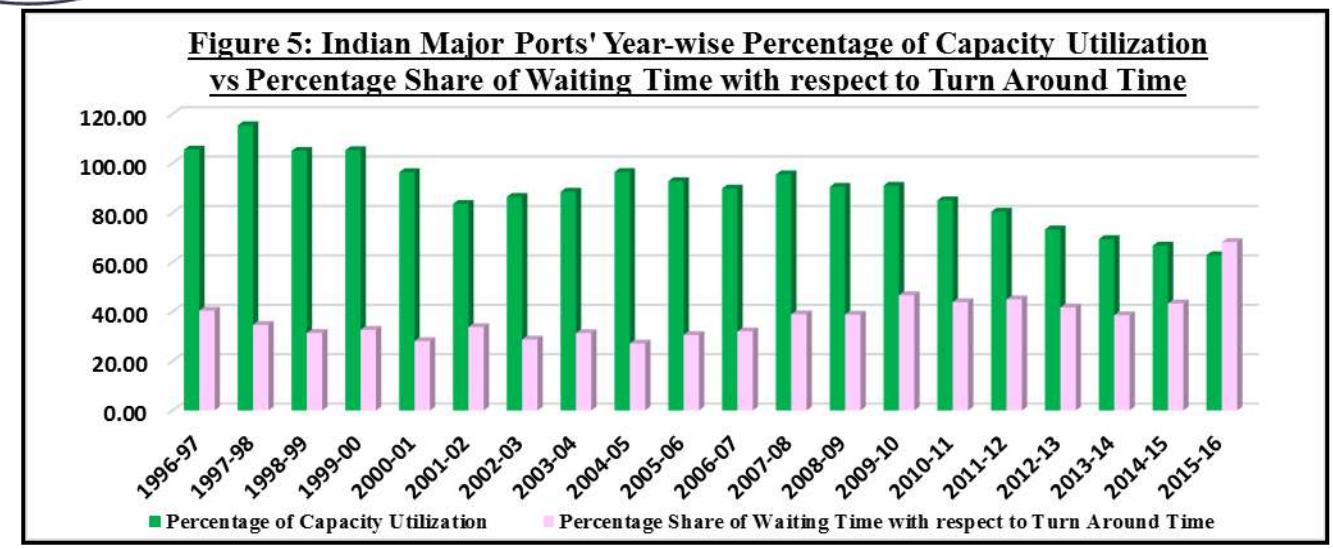


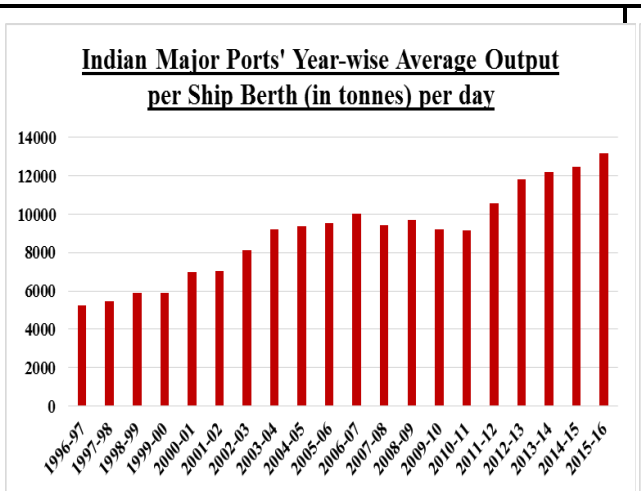
Figure 5 shows that, in case of major ports of India, during 1996-97 to 2015-16 the percentage share of waiting time with respect to turn around time had an increasing trend and the percentage capacity utilization had a decreasing trend. From these findings, as well, it can be concluded that the financial scenario of major ports of India has some inherent imbalance.

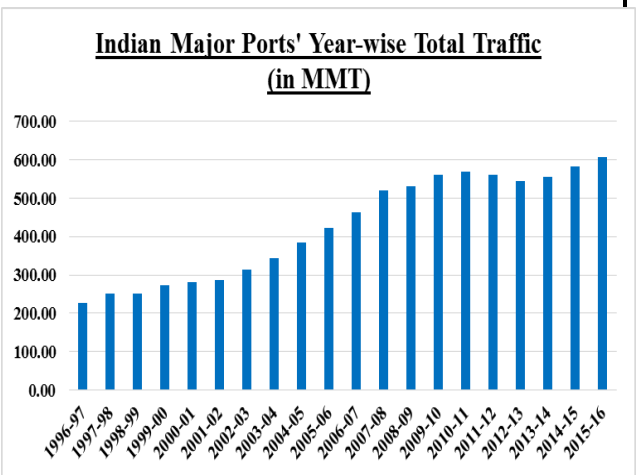
Figure 5: Indian Major Ports' Year-wise Percentage of Capacity Utilization vs Percentage Share of Waiting Time with respect to Turn Around Time



Annexure 2 depicts that the CAGR of total traffic (in MMT) at major ports of India during 1996-97 to 2015-16 has been 5.3 percent, whereas the CAGR of Total Capacity (in MMT) at major ports of India has been 8.2 per cent between 1996-97 and 2015-16 due to various PPP (public-private-partnership) endeavours at major ports initiated by government of India. In addition government of India plans to modernize the ports and has approved a project called 'Sagarmala' estimated at 10 billion USD. Figure 6 shows that the CAGR for the 'Average Output per Ship Berth (in tonnes) per day' (4.98%) increases at a slower rate than the CAGR for the 'Total traffic (in MMT)' (5.30%) in case of major ports of India during 1996-97 to 2015-16. This fact is likely to contribute to the financial imbalance as mentioned earlier.

Figure 6: Indian Major Ports' Year-wise Average Output per Ship Berth (in tonnes) per day vs Total traffic (in MMT)





After the Indian port sector was opened for private sector participation in 1998, the government of India decided to move towards the Landlord Port concept, where new ports were expected to be established as companies under the Companies Act 1956 and existing port trusts were expected to be corporatized. This plan has been implemented only in case of Kamarajar Port Limited, the only corporate port in India, throughout the country till now. The Government of India also initiated National Maritime Development Program (NMDP), an initiative to provide guidelines for capacity augmentation and hinterland connectivity improvements at major ports, which mandates that over 60 per cent of the required funds are be raised from private sector. The Ministry of Shipping also formulated a Perspective Plan for development of the Maritime Sector namely The Maritime Agenda (2010-2020) which set a target capacity of over 3130 MMT by 2020 driven by private sector participation. According to the government of India's present policy, no approval is required for foreign equity up to 51 per cent in projects providing supporting services to water transport; and various incentives has been declared, such as, ten year tax holiday for enterprises engaged in development of Port sector; also permission has been granted for formation of joint ventures between Major Ports and foreign ports, Major Ports and Non-Major Ports, and Major Ports and companies. The question is whether all these are likely to make Indian ports world class. So far as per CAG (Comptroller and Auditor General of India) report and the audit report on 'Public Private Partnership Projects in Major Ports' , PPP projects have contributed only 33 per cent to total capacity of major ports up to March 2014, thereby defeating the purpose of PPP model (PTI, 2015). Because even when the Private Sector Participation was implemented through Guidelines issued in 1998, PPP projects were expected to contribute to the extent of 49 percent to the total capacity of major ports. The port-charges in major ports are based on 'absorption' costing and port customers have to pay for port's inefficiency (Kar & Sinha, 2012).

2. The Problem:

With inclusion of private operators without exclusion of redundant resources such as manpower and physical assets major ports would continue to remain non-profitable. At the same time if the private operators operate below the desired efficiency level, port has no option but to bear the private operators till completion of their license term as they have invested in creating the infrastructure and the superstructure. Hence it would most profitable for the major ports to operate the existing berths at a given efficiency level and requiring no major capital expenditure while allocating the remaining operation to private operators requiring capital expenditure to create additional capacity. The other alternative for the major ports would be to outsource the cargo handling operations where the basic infrastructure is provided by the port while the private operators bring their own equipment and manpower. The port may choose to outsource those operations where it lacks human or equipment resources. The private operators own the resources so deployed by them. In this case the port pays for the charges it pays for the outsourced job while has pricing mechanism to levy from the end customer.

3. Research Gap:

The studies, so far, has aimed at identifying the impact of privatization on efficiency of ports. The authors have opined either in favour of privatization or otherwise. In the Indian context, the major ports have not been able to improve their operating income over operating expenditure even after introduction of privatization. Moreover, privatization has led to redundancy of port resources resulting in low returns. The major ports have adopted a hybrid state of governance with mixed results. Hence, it is felt that a computational framework leading to an optimum mix of public-private cooperative model of governance is the need of the hour.

4. The Cost-Revenue Dynamics in Major Ports of India:

The crux of any PPP project lies in the impact of the net revenue position of the parent organization. The net revenue can be expressed in terms of following equation.

Net Revenue = Gross Revenue – Gross expenditure

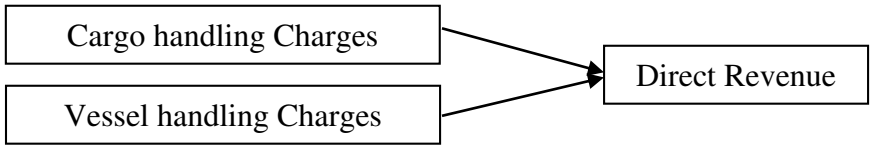
The gross revenue comprises income from traffic handled by port's own resources and that handled by private operators. If there are no private operators, the port is said to adopt a service model while if entire traffic is handle the private operators, the port is said to follow the landlord model. In most major ports in India, the total traffic is proportionately handled by port and private operators. The proportion varies from port to port. This has been termed as the hybrid approach for port governance. Table 1 shows the current practice in computing the earnings after tax for major ports in India.

Table 1: Port's Financial Model

	Port's Direct Revenue
Less	*Port's Direct Expenditure*
	Port's Net Direct Surplus / Deficit
Less	*Port's Dredging & Others Expenses* *Port's Depreciation* *Port's Management & General Administration Overheads*
	Port's Total Operating Surplus / Deficit
Less	*[Port's FMI – Port's FME (including Pension Payment)]*
	Surplus / Deficit
Add	*Port's Dredging Subsidy*
	Port's Total Taxable Surplus / Port's Total Deficit
Less	*Tax (if surplus is achieved)*
	Port's Income after Tax

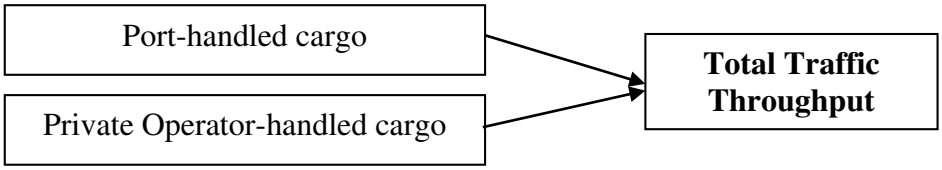
The above framework shows that variability in the components (added or subtracted) can lead to the change in the final position. "Direct Revenue" primarily depends on cargo and vessel traffic. Figure 7 depicts the causality of this component.

Figure 7: Causality of Direct Revenue with Cargo and Vessel Handling Charges



The cargo handling charges is based on traffic and the revenue per ton of traffic handled. The traffic may be handled by the port and/or the private operator. Figure 8 shows the means of total traffic handling in ports.

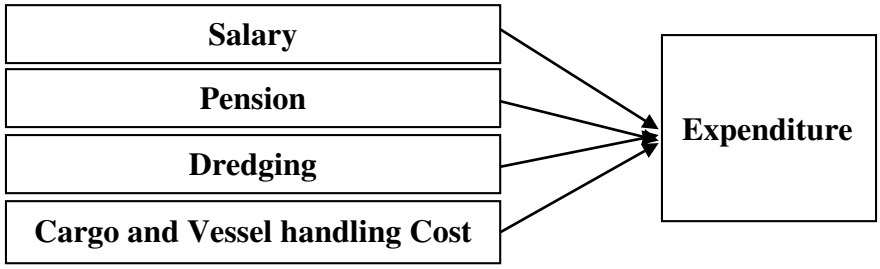
Figure 8: Causality of Total Traffic Throughput with Port Handled and Private Operator Handled Cargo



As per current trend observed from the implementation of privatization (under PPP mode) at various major ports in India, port earns 6% of the total revenue earned by the private operators. And for example, as per Mckinsey report (2015-16) KoPT (or Kolkata Port Trust) is expected to handle 110 MMT against its existing capacity of 60 MMT. It implied that the port may choose to handle 50 MMT of cargo while the balance amount may be handled by the private operators.

The vessel related charges are proportional to the size of the vessels, number of vessels and stay at berth per vessel. The port authority does not get the charges against stay-at-berth for vessels calling at private operated berths. Thus port stands to lose a part of vessel related revenue for vessels handled by private operators. Similarly the major component that would cause reduction in surplus for any major port includes the salary, pension and dredging expenditure (Major Ports of India, A Profile: 2015-2016). Figure 9 shows major components of port expenditure.

Figure 9: Major components of port expenditure



5. Mathematical computational framework to maximize the port efficiency:

Assumptions:

1. A port has the mandate of engaging its own services, or services of a BOT operator or an outsourced agency.
2. The efficiency level for all these three alternatives are same.
3. Capital expenditure is not a constraint for any of the three parties.
4. Ports are not in a position to retrench their manpower, if rendered redundant.
5. Number of vessels handled per berth per annum is fixed for a port.

Indices

i = Berth Operators

Say; i=1: Port operated berths

i=2: BOT operated berths

i=3: Outsourced agency operated berths

Parameters

R_i = Revenue earned per ton by port at berths operated by operator i

p_i = Net Earnings from cargo handling at berths operated by operator i

q_i = Net earnings from vessel handling at berths operated by operator i per annum

r_i = Revenue earned per berth operated by operator i

c_i = Cost per berth operated by operator i

C = total cargo handling capacity of port

N_b = Total number of berths in port

N_d = Number of days a port operates per annum

PL = Parcel Load per ship

VC = Port's Annual Vessel Capacity

PR_i = Productivity per day at berths operated by different berth operators

β = Desired Productivity

t = Traffic in tons per meter draft

D_r = Draft or Draught (Navigable depth)

VR_i = Earnings from each vessel by the port

Variables

n_i = Number of berths operated by different berth operators

This section presents the mathematical formulation for the aforementioned problem.

The mathematical model aims at maximizing earning through optimal allocation of berths i.e. the number of berth to be

assigned to private operators (BOT operator and outsourced agency) subject to total number of berths available. The total number of vessels (VC) is dependent on the parcel load per vessel and productivity per day per ship.

$$VC \leq (N_b * N_d) \div (PL \div PR_i) \quad \text{(i)}$$

Equation (i) represents that the capacity of a port to handle vessels is limited by total number of berths in a port (N_b), number of days a port (N_d) operates per annum, parcel load (PL) per ship and productivity (PR_i) in each berth. The value ($N_b * N_d$) indicates total berth-days available per annum while ($PL \div PR_i$) represents number of days a vessel stays in a port.

$$PR_i \geq \beta \quad \text{(ii)}$$

Equation (ii) represents that the productivity (PR_i) in each berth is not less than the desirable value β.

$$PL = t * D_r \quad \text{(iii)}$$

Equation (iii) represents that the parcel load (PL) per ship is equal to tons per meter draft and the draft available in the port.

$$p_i = (r_i - c_i) \quad \text{(iv)}$$

Equation (iv) represents that the net earnings per ton from cargo handling by different operators is the difference between the revenue and the respective costs. The major ports, being age old, has higher variable cost, overheads and fixed costs. While at the same time earning from BOT operated berths are low. The port therefore needs to tradeoff between high cost operation, if it operates the berth, and low earning from privatization.

$$r_i = \beta * R_i * N_d \quad \text{(v)}$$

Equation (v) represents "Total Revenue earned by an operator. It is product of 'Desired Productivity', 'Revenue earned per ton by port at berths operated by operator i' and 'Number of days a port operates per annum'.

$$q_i = (VC / N_b) * VR_i \quad \text{(vi)}$$

Equation (vi) represents "Earnings from vessels per berth by the port" where (VC / N_b) indicates the number of vessels handled per berth per annum and earning from each vessel (VR_i) by the port.

Objective Function

Maximize $\sum(n_i p_i) + \sum(q_i n_i)$ OR $\sum n_i * (p_i + q_i)$ (1)

Equation (1) represents the objective function which aims to maximize the revenue earned from cargo operations (p_i), and vessel handling (q_i).

Subject to

$\sum n_i (r_i + q_i) \geq TE$ (2)

Constraint (2) implies that the total revenue earned should meet the total expenditure (TE) incurred by the port. TE includes salary and pension that the port incurs irrespective of the fact whether it has privatized or outsourced its operation.

$\sum(n_i) \leq N_b$ (3)

Constraint (3) confines the sum total of berths under port and BOT operator's purview respectively to the total number of available berths in the port.

$n_i > 0$ (4)

Constraint (4) implies that berths cannot be negative.

Case I

Port proposes to operate berths partially while leases out remaining berths to private operators. The private operators are termed as BOT (built – operate – transfer) operators. These private operators are required to deploy their own resources such as cargo handling equipment and gears, manpower, materials and money required to run the operations.

This case takes the example of Netaji Subhas Dock (NSD), Kolkata Port in India. Kolkata Port is the oldest surviving major port (set up in 1870) in the country with NSD as its latest dock operating since 1960 (kolkataporttrust.gov.in, 2017). The value of parameters have been compiled from the different sources (BE, 2016-17) for Netaji Subhas Dock (NSD), Kolkata Port for the year 2016. The parameters relevant to NSD of Kolkata Port are given in table 2 below.

Table 2: The parameters relevant to NSD of Kolkata Port

Parameter	Type	Value
R_1= Revenue earned per ton by port from berth operated by port	Fixed value	5 USD
R_2= Revenue earned per ton by port from berth operated by BOT operators	Fixed value or Percentage of R_1	0.06 * 5 = 0.3 USD
β = Desired Productivity i.e., output in tons per ship per day per berth	Fixed value	10000
r_1 = Revenue earned by port from each berth operated by port per annum	β * R_1 * 300	15000000 USD or **150 lakh USD**
r_2 = Revenue earned by port from each berth operated by BOT operators per annum	β * R_2 * 300	900000 USD or **9 lakh USD**
N_b = Total number of berths in port	Fixed value	8
N_d = Number of days a port operates per annum	Fixed value	300
VC = Port's Annual Vessel Capacity	(N_b*N_d) ÷ (PL ÷ β)	2000
VR_1= Net earnings from each vessel handling by berths operated by port	Fixed value	13700 USD
VR_2 = Net earnings from each vessel handling by berths operated by BOT operators	Fixed value or Percentage of VR_1	0.85 * 13700 = 11645 USD
t = Traffic in tons per meter draft	Depends on type of cargo. Rule of thumb is 200 tons per 0.1 meter draft for general cargo	200
D_r = Draft or Draught (Navigable depth)	Fixed value	6 Meters
PL = Parcel Load per ship	t*D_r	12000
c_1 = Cost incurred by port per ton in port operated berths	Fixed value : average of past expenditure	7 USD
c_2 = Cost incurred by port in berths operated by BOT operators	Fixed value : average of past expenditure	Zero
C_1= Cost incurred by port per berth in port operated berths	β * c_1 * 300	21000000
C_2= Cost incurred by port per berth operated by BOT operated berths	β * c_2 * 300	Zero

p_1 = Net Earnings per berth operated by Ports	$[(r_1 - C_1)]$	= (-) 6000000 USD = **(-) 60 lakh USD**
p_2 = Net Earnings per berth operated by BOT operators	$[(r_2 - C_2)]$	= 900000 USD = **9 lakh USD**
q_1 = Earnings from vessels per berth per annum by the port from vessels calling at port operated berths	$(VC / N_b) * VR_1$	(2000/8)*13700 = 3425000 USD = **34 lakh USD**
q_2 = Earnings from vessels per berth per annum by the port from vessels calling at berths operated by BOT operators	$0.85 * [(VC / N_b) * VR_2]$ i.e., 85% of q_1	2911250 USD = **29 lakh USD**

For this case, the Objective Function

$$\text{Maximize} \quad \sum(n_i p_i) + \sum(q_i n_i) \text{ OR } \sum n_i * (p_i + q_i)$$

The problem now stands as:

$$\text{Maximize } Z = -60n_1 + 9n_2 + 34n_1 + 29n_2$$

OR

$$\text{Maximize } Z = -26n_1 + 38n_2 \quad (5)$$

Subject to

$$\sum n_i (r_i + q_i) \geq TE$$

i.e. Subject to

$$(150+34)n_1 + (9+29)n_2 \geq 984$$

[the value 984 is obtained from the KoPT Budget Estimates 2015-16 book]

$$184n_1 + 38n_2 \geq 984 \quad (6)$$

$$n_1 + n_2 \leq 8 \quad (7)$$

$$n_1, n_2 > 0 \quad (8)$$

The above formulation reflects the current scenario of Netaji Subhas Dock (NSD) under Kolkata Port Trust. It suggests that the port incurs an operational loss from its operation of berths under its control. That is, the operating expenditure is higher than the operating income of the port (NSD). In case of berth operated by BOT operators the port earns a revenue equivalent to six percent of total revenue earned by the agency without incurring any expenditure, hence has an operating surplus. The ideal situation would have been to set a constraint such that profit earned from a given mix of operator would enable to recover the fixed overhead of the port. With a negative profit from port operated berths and with a meager earning from BOT operated berths this constraint would lead to an infeasible solution. Hence, the

problem was modified to include a constraint such that the revenue earned from a given mix of operator would enable to recover the fixed overhead of the port. This leads to an optimal solution (with 2000 iterations in 20000 seconds) with a negative profit but the port will be able to meet its fixed overhead. This is so because the revenue earned by the port from berths under their control is around 5 times that of its earning from BOT operated berths.

The port has an approximate total expenditure of 100 million per annum which remains unchanged under any change in agency or operators of berths. Port is not in a position to retrench its manpower, and has a pension burden; and even if manpower is retrenched, pensions have to be paid to the retrenched employees. Under this scenario the apparent notion that privatization can enable port profitability does not stand valid. The results of the integer linear programming problem (integer LPP or ILPP) given by equation 5, 6, 7 and 8 indicate that NSD should have 5 berths self-operated by port authority and 3 berths to be handed over to the BOT operators by the port authority. Thus the common notion and practice of the port authorities in India to privatize all its berths does not stand valid. In order to generate a positive surplus the port needs to resort to the following decision:

1. Increase productivity (β).
2. Increase draft (D_r) to increase Parcel Load per ship
3. Enhance the royalty from the BOT operators. That is, present royalty of 6% would not enable port to generate profit.

Since, increase in drafts will lead to significant additional expenditure on account of dredging, while seeking more royalty from BOT operators will depend on the port-operators market. The best possible alternative would be to enhance productivity (β) plausibly through BPR (business process re-engineering), capacity building & similar measures. A β value of 12000 will result in positive profitability, as observed from solving the integer LPP. Under this scenario port may operate 3 of its berth while outsource the balance 5 berths to BOT operators. That is, the situation reverses and at the same time port earns a profit.

Case II

Port proposes to operate some of its berths, outsources the services in some of the berths while leases out remaining berths to private operators. The private operators are termed as BOT (built – operate – transfer) operators. These private operators are required to deploy their own resources such as cargo handling equipment and gears, manpower, materials and money required to run the operations.

This section presents the mathematical formulation for the aforementioned problem. The nature of income and expenditure definitely has an impact on the underlying model. The problem is solved for traffic handled by different berth operators, namely, the port, outsourced agency and the BOT operator.

The parameters are given in table 3 below.

Table 3: Parameters for mathematical formulation to solve the research problem relevant to NSD of Kolkata Port

Parameter	Type	Value
R_1= Revenue earned per ton by port from berth operated by port	Fixed value	5 USD
R_2= Revenue earned per ton by port from berth operated by BOT operators	Fixed value or Percentage of R_1	0.06 * 5 = 0.3 USD
R_3= Revenue earned per ton by port from berth operated by outsourced agency	Fixed value or Percentage of R_1	0.50 * 5 = 2.5 USD
β = Desired Productivity i.e., output in tons per ship per day per berth	Fixed value	10000
r_1 = Revenue earned by port from each berth operated by port per annum	β * R1 * 300	15000000 USD or **150 lakh USD**
r_2 = Revenue earned by port from each berth operated by BOT operators per annum	β * R_2 * 300	900000 USD or **9 lakh USD**
r_3 = Revenue earned by port from each berth operated by outsourced agency per annum	β * R_3 * 300	7500000 USD or **75 lakh USD**
N_b = Total number of berths in port	Fixed value	8
N_d = Number of days a port operates per annum	Fixed value	300
VC = Port's Annual Vessel Capacity	$(N_b*N_d) \div (PL \div \beta)$	2000
VR_1= Net earnings from each vessel handling by berths operated by port	Fixed value	13700 USD
VR_2 = Net earnings from each vessel handling by berths operated by BOT operators	Fixed value or Percentage of VR_1	0.85 * 13700 = 11645 USD
VR_3= Net earnings from each vessel handling by berths operated by outsourced agency	Vessel calling at this berth will be handled by port authority	13700 USD
t = Traffic in tons per meter draft	Depends on type of cargo. Rule of thumb is 200 tons per 0.1 meter draft for general cargo	200
D_r = Draft or Draught (Navigable depth)	Fixed value	6 Meters
PL = Parcel Load per ship	$t*D_r$	12000
c_1 = Cost incurred by port per ton in port operated berths	Fixed value : average of past expenditure	7 USD

c_2 = Cost incurred by port in berths operated by BOT operators	Fixed value : average of past expenditure	Zero
c_3 = Cost incurred by port in berths operated by outsourced agency	Fixed value : average of past expenditure	Zero
C_1= Cost incurred by port per berth in port operated berths	$\beta * c_1 * 300$	21000000
C_2= Cost incurred by port per berth operated by BOT operators	$\beta * c_2 * 300$	Zero
C_3= Cost incurred by port per berth operated by outsourced agency	$\beta * c_3 * 300$	Zero
p_1 = Net Earnings per berth operated by Ports	$[(r_1 - C_1)]$	= (-) 6000000 USD = **(-) 60 lakh USD**
p_2 = Net Earnings per berth operated by BOT operators	$[(r_2 - C_2)]$	900000 USD = **9 lakh USD**
p_3 = Net Earnings per berth operated by outsourced agency	$[(r_3 - C_3)]$	7500000 USD = **75 lakh USD**
q_1 = Earnings from vessels per berth per annum by the port from vessels calling at port operated berths	$(VC / N_b) * VR_1$	(2000/8)*13700 = 3425000 USD = **34 lakh USD**
q_2 = Earnings from vessels per berth per annum by the port from vessels calling at berths operated by BOT operators	0.85 * $[(VC / N_b) * VR_2]$ i.e., 85% of q_1	2911250 USD = **29 lakh USD**
q_3 = Earnings from vessels per berth per annum by the port from vessels calling at berths operated by outsourced agency	$(VC / N_b) * VR_1$	(2000/8)*13700 = 3425000 USD = **34 lakh USD**

For this case, the Objective Function

$$\text{Maximize} \quad \sum(n_i p_i) + \sum(q_i n_i) \text{ OR } \sum n_i * (p_i + q_i)$$

The problem now stands as:

$$\text{Maximize } Z = -60n_1 + 9n_2 + 75n_3 + 34n_1 + 29n_2 + 34n_3$$

OR

$$\text{Maximize } Z = -26n_1 + 38n_2 + 109n_3 \quad (9)$$

Subject to

$$\sum n_i (r_i + q_i) \geq TE$$

i.e. Subject to

$(150+34)n_1 + (9+29)n_2 + (75+34)n_3 \geq 984$

[the value 984 is obtained from the KoPT Budget Estimates 2015-16 book]

$184n_1 + 38n_2 + 109n_3 \geq 984$ (10)

$n_1 + n_2 + n_3 \leq 8$ (11)

$n_1, n_2, n_3 > 0$ (12)

The above formulation reflects the proposed scenario of Netaji Subhas Dock (NSD) under Kolkata Port Trust. The results of the integer linear programming problem (integer LPP or ILPP) given by equation 9, 10, 11 and 12 indicate that NSD should have 2 berths self-operated by port authority; no berths to be handed over to the BOT operators by the port authority; and 6 berths to be handed over to the outsourced agency operators by the port authority.

6. Conclusion:

In the context of increased span of choice for port-customers and changes in the role of major ports of India in a hybrid state through shifting to privatization of its operation since introduction of LPG (liberalization-privatization and globalization) policy, in order to prevent the declining trend of share for major ports of India as well as to be figured in the elite list globally an attempt has been made to understand the Cost-Revenue Dynamics of port operation as well as to figure out a mathematical computational framework to optimize the port efficiency and profitability of major ports depending on some common factors which not only lead to a 'pro-active' decision making for port management but also ensure customers' satisfaction through levy of optimum charges and time in the business. Though, the ports and shipping industry in India plays a vital role in sustaining growth in the country's trade and commerce, yet, it has been revealed that that the prime reason attributed to this declining trend of share for major ports of India is imbalance in cost-revenue dynamics of port operation. The most striking feature revealed through this study is that, in case of major ports of India during 1996-97 to 2015-16, the 'Percentage Share of Waiting Time' with respect to 'Turn Around Time' has increasing trend as well as the 'Percentage of Capacity Utilization' has decreasing trend. Both the above trends should be treated as affecting adversely the cost-revenue dynamics of the major ports of India. Another striking feature is that the CAGR for the 'Average Output per Ship Berth (in tonnes) per day' increases at a slower rate than the CAGR for the 'Total traffic (in MMT – million metric ton)' in case of major ports of India during 1996-97 to 2015-16 which is likely to contribute to the financial imbalance as mentioned earlier. It is also clear from this study that the rate of growth of operating expenditure is higher than that of operating income which trend definitely affects adversely the cost-revenue dynamics of the major port's operation. This scenario remains the same if the analysis is done based on the CAGR for 'Total Operating Income in Rs. Crore per Traffic in MMT' and CAGR for' Total Operating Expenditure in

Rs. Crore per Traffic in MMT'. The above findings clearly establish inherent financial imbalance affecting the cost-revenue dynamics of major port's operation.

The tariff structure for any major ports of India has four determinants named –

1) Charges on cargo (per ton or ad valorem);

2) Charges on vessel (per gross registered tonnage or GRT) including berth hire charges that the ship pays for the duration it stays at port;

3) Port Dues (under India Port Act, 1908); and

4) Other miscellaneous charges.

Port's Direct Revenue primarily depends on cargo and vessel traffic. The cargo handling charges is based on the traffic forecast, the targeted revenue per ton, and the PPP-versus-Non-PPP cargo composition which directly impact the revenue computation of the port. PPP and Non-PPP (i.e. Port) Cargo Composition should be rightly apportioned to achieve targeted revenue to survive in the competitive market and so as to fix right charge for port-customers. Whereas, the vessel related charges are proportional to the size of the vessels, number of vessels and stay at berth per vessel. After entering into the port area, ships may have to wait for operation (loading or unloading) to begin, due to non-availability of berth, and/or delay in document processing and/or non-availability of other resources which will lead to increase in operational cost per ship. With the increase in draft, the parcel load per vessel is likely to increase resulting in reduction in number of vessel but increase in size of the vessel i.e. from Supramax to Panamax vessel which will in turn increase the revenue of the port for long run. Again, the reduction in stay-time at port is likely to reduce the port's revenue in short term but may prove beneficial in long run by being more attractive to trade for the port-customers. But, the revenue against stay-at-berth, in the form of berth hire charges, for PPP cargo is not attributable to port's revenue. Additionally, ports have earning from its estates. On the other hand, the major component that would cause reduction in surplus for any major port includes the cargo & vessel handling cost, salary & pension of port employees, and dredging expenditure. However, port needs to continuously endeavour in reducing expenditure as well as in increasing revenue through innovative ways and means to improve efficiency and productivity for long run so as to fix right charge for port-customers. It will enhance the competitiveness and the brand-image of the port resulting increase in number of ship calls in the long run. It should be kept in mind that the increase in total cost to ship will in turn increase the relative cost of the ship (i.e. her cost compared to cost incurred at other ports) which is likely to affect the ship's arrival at port because then the port is going to experience reduction in number of ship calls. Eventually, as the significant part of the port revenue is earned on number of ships as well as size of ships, the total revenue is likely to decrease in long run. Capacity maximization at port is another issue which should be emphasized as waiting time of a ship is dependent on port's capacity where less capacity would mean increase in waiting time of the ship, which in turn would increase the ship's operational cost and eventually the relative cost.

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Annexure 1:

Year-wise % Share of Major Ports of India in terms of Total Traffic Handled for 20 years

Financial Year	Traffic Handled at Major Ports of India (in MMT)	CAGR for Total Traffic Handled at Major Ports of India (in MMT)	Traffic Handled at All Ports of India (in MMT)	CAGR for Traffic Handled at All Ports of India (in MMT)	% Share of Major Ports of India in terms of Total Traffic Handled	CAGR for % Share of Major Ports of India in terms of Total Traffic Handled
1996-97	227.26		252.51		90.00	
1997-98	251.66		287.28		87.60	
1998-99	251.66		289.93		86.80	
1999-00	271.92		334.46		81.30	
2000-01	281.10		367.93		76.40	
2001-02	287.58		383.85		74.92	
2002-03	313.55		418.72		74.88	
2003-04	344.79		465.63		74.05	
2004-05	383.75		521.58		73.57	
2005-06	423.57	**0.053**	569.09	**0.079**	74.43	**-0.024**
2006-07	463.80		649.90		71.36	
2007-08	519.31		722.93		71.83	
2008-09	530.80		743.73		71.37	
2009-10	561.09		849.95		66.01	
2010-11	570.09		884.88		64.43	
2011-12	560.19		913.15		61.35	
2012-13	545.83		933.66		58.46	
2013-14	555.49		972.63		57.11	
2014-15	581.34		1052.01		55.26	
2015-16	606.47		1073.00		56.52	

Annexure 2: Year-wise Data with Analysis regarding some Important Parameters of All Major Ports of India for 20 years

Financial Year	Total Traffic (in MMT)	CAGR for Total Traffic (in MMT)	Total Capacity (in MMT)	CAGR for Total Capacity (in MMT)	Percentage of Capacity Utilization	CAGR for Percentage of Capacity Utilization	Average Turn Around Time in days	CAGR for Average Turn Around Time in days	Average Pre-Berthing Detention in days	CAGR for Average Pre-Berthing Detention in days	Percentage Share of Waiting Time with respect to Turn Around Time	CAGR for % Share of Waiting Time with respect to Turn Around Time
1996-97	227.26	0.053	215.21	0.082	105.60	-0.027	6.24	-0.058	2.52	-0.032	40.38	0.028
1997-98	251.66		217.96		115.46		6.03		2.09		34.66	
1998-99	251.66		239.50		105.08		5.23		1.64		31.36	
1999-00	271.92		258.05		105.37		4.84		1.58		32.64	
2000-01	281.10		291.45		96.45		4.24		1.19		28.07	
2001-02	287.58		343.95		83.61		4.06		1.37		33.77	
2002-03	313.55		362.75		86.44		3.69		1.06		28.73	
2003-04	344.79		389.50		88.52		3.45		1.08		31.30	
2004-05	383.75		397.50		96.54		3.54		0.96		27.12	
2005-06	423.57		456.30		92.83		3.63		1.11		30.58	
2006-07	463.78		516.15		89.85		3.81		1.22		32.02	
2007-08	519.31		543.47		95.55		3.98		1.55		38.94	
2008-09	530.53		586.07		90.52		4.20		1.63		38.81	
2009-10	561.09		616.73		90.98		4.63		2.16		46.65	
2010-11	570.03		670.13		85.06		5.29		2.32		43.86	
2011-12	560.14		696.53		80.42		4.56		2.05		44.96	
2012-13	545.79		744.91		73.27		4.29		1.79		41.72	
2013-14	555.49		800.52		69.39		3.84		1.48		38.54	
2014-15	581.34		871.52		66.70		3.89		1.68		43.29	
2015-16	606.47		965.36		62.82		2.00		1.36		68.16	

Annexure 3: Year-wise Data with Analysis regarding some Financial Parameters of All Major Ports of India for 20 years

Financial Year	Total Revenue/Income in Rs Crore	CAGR for Total Revenue/Income in Rs Crore	Total Operating Income in Rs Crore	CAGR for Total Operating Income in Rs Crore	Total Operating Income in Rs Crore per Traffic MMT	CAGR for Total Operating Income in Rs Crore per Traffic MMT	Total Expenditure in Rs Crore	CAGR for Total Expenditure in Rs Crore	Total Operating Expenditure in Rs Crore	CAGR for Total Operating Expenditure in Rs Crore	Total Operating Expenditure in Rs Crore per Traffic MMT	CAGR for Total Operating Expenditure in Rs Crore per Traffic MMT
1996-97	3171.63		2654.44		11.68		2123.90		1604.96		7.06	
1997-98	3607.31		3051.33		12.12		2390.72		1849.80		7.35	
1998-99	4009.52		3412.35		13.56		2942.02		2240.86		8.90	
1999-00	4050.28		3356.71		12.34		3235.54		2385.48		8.77	
2000-01	4261.80		3545.30		12.61		4166.17		2695.05		9.59	
2001-02	4805.71		3900.13		13.56		4223.31		2622.13		9.12	
2002-03	4911.09		3916.79		12.49		3756.31		2602.53		8.30	
2003-04	4740.01		4228.89		12.27		4075.42		2679.17		7.77	
2004-05	5452.93		4717.57		12.29		4355.46		2811.30		7.33	
2005-06	5981.30	**0.076**	5102.79	**0.078**	12.05	**0.023**	3936.91	**0.089**	3002.54	**0.080**	7.09	**0.025**
2006-07	6866.41		5839.44		12.59		4416.89		3195.93		6.89	
2007-08	7176.62		6312.31		12.16		4680.29		3431.52		6.61	
2008-09	7487.85		6675.03		12.58		5736.15		4060.39		7.65	
2009-10	7976.68		7199.03		12.83		6517.31		4721.43		8.41	
2010-11	8008.44		7576.84		13.29		7043.12		4904.03		8.60	
2011-12	9267.19		7950.36		14.19		8329.93		5331.96		9.52	
2012-13	9956.00		7897.48		14.47		9444.63		5833.88		10.69	
2013-14	10085.38		9121.81		16.42		9856.55		6366.42		11.46	
2014-15	11069.60		10032.30		17.26		9458.76		6580.55		11.32	
2015-16	12680.69		10998.70		18.14		10703.53		6876.95		11.34	

Data Source for Annexure 1, 2 and 3:

- www.indiastat.com
- www.ipa.nic.in
- httpsdata.gov.in

Annexure 4: Net Surplus Calculation Model after Merger of CDLB with KOPT

		KDS SURPLUS
		HDC SURPLUS
		KoPT(KDS+HDC) SURPLUS
ADD		CDLB SURPLUS
		MERGED SURPLUS
ADD		DREDGING SUBSIDY
		TOTAL KoPT SURPLUS
	PENSION LIABILITY :	
	CDLB ARREAR	
	CDLB INTEREST	
	CDLB ACTURIAL	
	KoPT PENSION	
	TOTAL LIABILITY	
ADD	IF KoPT RECEIVES LOAN ASSISTANCE EQUVALENT TO TOTAL LIABILITY THEN THE EXPENDITURE ON THE RHS NEED NOT BE APORTIONED, HENCE ADDED BACK	KoPT PENSION NOT REQUIRED
ADD		CONTRIBUTION OF PENSION NOT REQUIRED
ADD		CDLB PENSION NOT REQUIRED
ADD	PROPORTIONATE DREDGING SUBSIDY ADDED BACK TO MAINTAIN CUMULATIVE SURPLUS ≈ 0	DREDGING SUBSIDY NOT REQUIRED
		SUM TOTAL KoPT SURPLUS
LESS		INTEREST ON LOAN AGAINST TOTAL LIABILITY
		PROFIT BEFORE TAX (PBT)
LESS		TAX
		PROFIT AFTER TAX (PAT)
ADD		LOAN ANNUAL - PRINCIPAL REPAYMENT
		NET SURPLUS
		CUMULATIVE NET SURPLUS

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