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Realising performance of Indian major ports and exploring their potential in efficient container handling and port development in the near future.

02 Port capabilities

Analysis of various factors responsible for integrated port development in India, through establishing correlation between these port functions.

03 Port-city Matrix

Assessment of degree to which port cities are dependent on ports by developing a matrix of port-city relationships and analyzing the position of major ports.

04 Smart port-city

Ministry of Shipping, Government of India, has taken up several policy initiatives for stimulating growth of smart port-cities along major ports in India.

05 Growth of JNPT

Assessing milestones achieved by JNPT in its path of becoming a Global Port Hub and identify operational challenges and possible interventions.



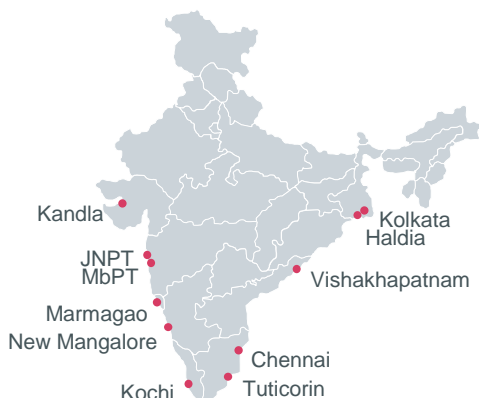
Port-city as an engine of port development - Case of Major ports in India

ASCELA, being involved in development of various ports in India, has been monitoring recent developments in maritime sector to analyze infrastructure growth opportunities to enhance cargo handling and capacity utilization of Indian ports.

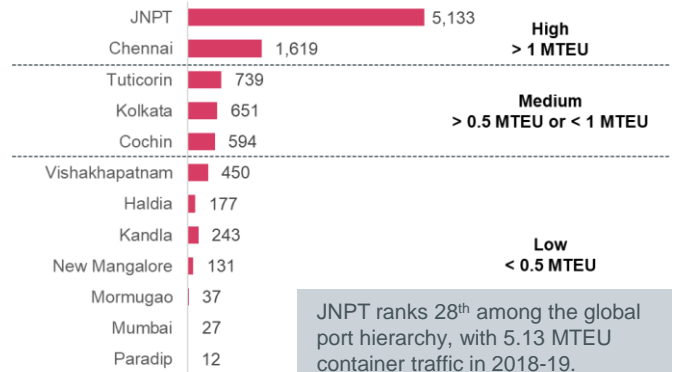
Outlook

India has a large coastline, stretching over 7,517 km, interspersed with more than 200 ports. In FY 2018-19, total throughput of Indian container terminals was registered as 17.02 MTEU, with average y-o-y growth of 8.5%. Total installed container handling capacity was at 28.65 MTEU, reflecting capacity utilization of around 59%. India's west coast ports, which collectively stand at 66% of overall Indian container handling capacity, contributed to around 72% of total volumes. This volume is majorly supported by terminal at JNPT (country's largest port; also a major port) and Mundra (a non-major port in state of Gujarat).

In the recent years, major ports in India have lost a significant share of container traffic to non-major ports. Market share of major ports declined from 92% in 2005 to 58% in 2019.



Indian major ports' container throughput (in 000' TEUs), 2018-19



Source: Indian Ports Association (IPA), 2018-19

As per the World Bank ranking 2019, India became world's fifth largest economy, leaving France and the UK behind. As global economy is largely affected by the US-China Trade War and by ongoing corona virus epidemic and has been experiencing a downturn in domestic demand, slowdown is also reflecting at Indian ports.

India's major ports witnessed combined throughput decline by 2%. Annual container traffic was at 801,000 TEU, at October 2019, compared to 817,000 TEU in 2018. JNPT and Chennai Port, the two busiest public container handlers, suffered sharp year-over-year decline by 5% and 13%, respectively.

Recent initiatives from Government of India under Sagarmala program and other related logistics reforms, including prioritizing port infrastructure improvement, are expected to turn the current slackening scenario of Indian ports.

Port's cargo handling capabilities

Growth in cargo handling at ports is dependent on numerous port functions, which includes number and size of berths, handling capacity, equipment, cargo handling depots, and storage facilities. These support functions attribute to cargo growth. Some of these can be interdependent and have multiplier impact on efficiency.

Characteristics of major ports in India in 2019

Port	Port city	Coastline of state	# berths	# Container berths	Total berth length	Quay crane	Maximum depth	Designed capacity	Port storage facilities	Container throughput
		(in km.)	(in nos.)	(in nos.)	(in m.)	(in nos.)	(in m.)	(in MTEU)	(in sqm)	(in MTEU)
Case 'A': High throughput scenario (> 1.0 MTEU)										
JNPT	Maharashtra	720	15	11	3,322	43	16.2	10.8	3,004,527	5.13
Chennai	Tamil Nadu	1,076	24	7	1,717	14	15.5	1.2	262,998	1.62
Average			20	9	2,520	29	15.85	5.98	1,633,763	3.19
Case 'B': Medium throughput scenario (< 0.5 MTEU and > 1.0 MTEU)										
Tuticorin	Tamil Nadu	1,076	15	2	715	3	13	1.1	528,008	0.74
Kolkata	West Bengal	157	35	5	963	-	8.7	0.9	515,641	0.65
Cochin	Kerala	580	19	2	600	4	15.95	NA	219,565	0.59
Average			23	3	760	3	12.55	1.0	421,071	0.66
Case 'C': Low throughput scenario (< 0.5 MTEU)										
Vishakhapatnam	Andhra Pradesh	975	26	1	451	-	14.5	0.6	1,071,247	0.45
Haldia	West Bengal	157	21	2	440	-	6.7	0.3	921,840	0.18
Kandla	Gujarat	1,600	32	2	545	-	12.5	0.6	1,866,417	0.24
New Mangalore	Karnataka	360	16	0.5	198	-	10.5	NA	301,156	0.13
Mumbai	Maharashtra	720	29	1	244	-	10	0.6	808,704	0.04
Mormugao	Goa	160	7	0.5	210	-	14.1	NA	257,331	0.03
Paradip	Orissa	485	19	0.5	255	-	17.1	NA	1,980,211	0.01
Average			21	1	335	-	12.2	0.5	1,029,558	0.15

Source: Indian Ports Association (IPA), 2018-19

Note: 0.5 weightage is given to ports handling container traffic through multipurpose berths

For this assessment purpose, all major ports of India are divided into three categories on the basis of their container throughput. Figures below represent interdependence of port functions and suggest that container cargo traffic is highly correlated with number and length of container berths, container handling equipment, and port's draft. The assessment also suggests that adding storage area as a standalone measure would not be enough to increase port throughput, without improving other port functions.

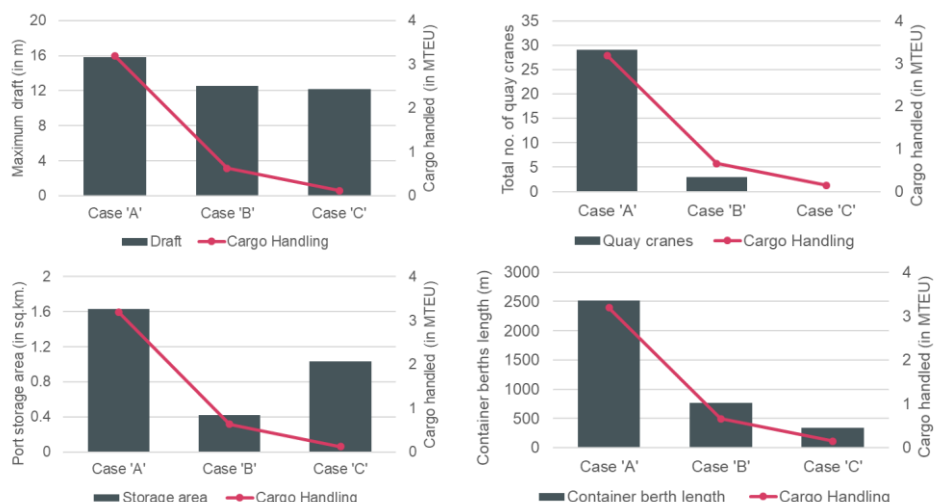
In order to understand the degree of dependency of various port functions, correlation between these assets have been determined. Major functions identified are- number and length of container and overall cargo berths, number of quay cranes, maximum draft, designed container capacity, and container throughput.

India falls along the main east-west trade route (Asia-Europe).

Average size of the vessels calling at Indian ports has increased over the years' in year 2011 average vessel size was 3,715 TEU. This increased to 6,239 TEU and 6,685 TEU in years 2018 and 2019, respectively.

This assessment is an attempt to theoretically analyse major ports of India and rendering likely dependence of port operation and cargo handling on various port functions. Conducting similar assessment on larger group of ports and including non-major ports of India may produce more refined results.

The study intends to highlights possible interventions which may impact port operations and cargo handling.



Correlation between various port functions of major ports in India

	# berths	# Container berths	Total berth length	Quay crane	Maximum draft	Designed capacity	Port storage facilities	Container throughput
# berths	1.0000	0.0931	-0.0735	-0.2468	-0.3786	-0.5364	0.0543	-0.1894
# Container berths		1.0000	0.9729	0.8897	0.2109	0.8383	0.4408	0.9167
Total berth length			1.0000	0.9663	0.3452	0.9216	0.5440	0.9807
Quay crane				1.0000	0.4212	0.9632	0.6029	0.9902
Maximum depth					1.0000	0.5307	0.3163	0.3746
Designed capacity						1.0000	0.8129	0.9713
Port storage facilities							1.0000	0.5890
Container throughput								1.0000

Source: ASCELA analysis

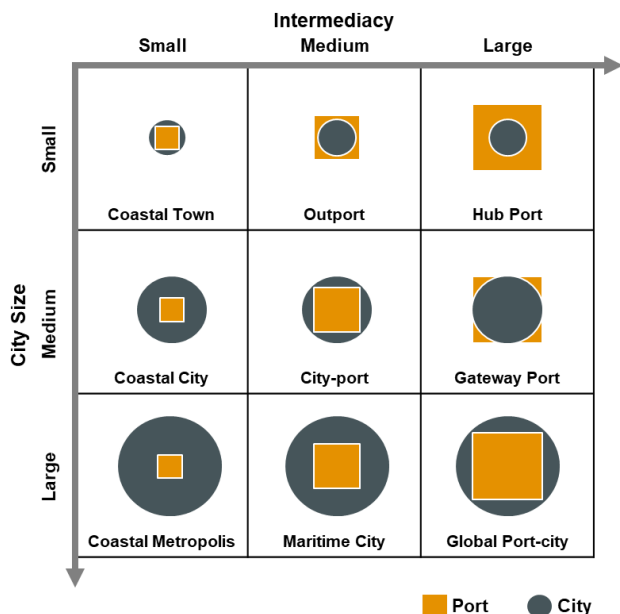
Above table highlights correlation between various port functions, as assessed using Pearson Correlation method. It is observed that container traffic has strong correlation with number and length of container terminal. In order to strengthen these functions, functions showing high correlation with them, need to be developed in an integrated manner.

In addition to port's internal cargo handling infrastructure and equipment, port's immediate hinterland or its land-side also provide several key functions that may support ports. Empirical evidence suggests that availability of efficient port and city linkage can substantially influence growth of the port.

Role of Port's hinterland – Port City

Hoyle, in his Port city theory, pointed possibilities of high synergies between port and city. Cities provide several key functions that support ports and help develop and sustain a number of services required by the port, including shipping agents and liner services, logistics and transport services, warehousing, ship building and ship repair, and provision of infrastructure such as rail, roads, and power. Similarly, ports provide employment, revenue and growth to city.

Matrix of port-city relationships is based on concepts of centrality and intermediacy, considering that centrality is an urban functional measure, while intermediacy is an essentially maritime-based measure. Based on city size and port traffic, port cities are classified from coastal port towns to global port cities.



Port-city matrix showing interdependence of ports and cities

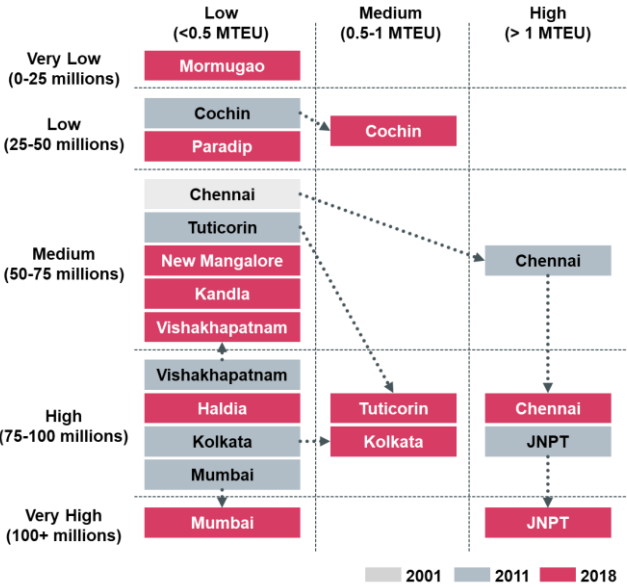
Empirical evidence suggests that availability of infrastructure services is a crucial function of a port city that can influence the growth of port, substantially. Over the last 20 years port areas have expanded, contributing to large urban trends.

- › **Global port cities** are large cities with large ports, like New York, Hong Kong and Singapore which act as both, business centers and major ports.
- › **Gateway ports** have unbalanced profiles, subdued to their hinterland and develop few activities apart from heavy industry and logistics, like Le Havre, Genoa, Rotterdam.
- › **Maritime city** have efficient port functions in spite of an important urban environment, like Barcelona, Marseilles, Capetown, Buenos Aires.
- › **Hub ports** have limited centrality, like ports of Freeport, Gioia Tauro, Laem Chabang, and Salalah
- › **Coastal metropolis** have limited intermediacies, like ports of Stockholm, Tunis, Baltimore, and Mumbai port.
- › **City-ports** manage to keep a balanced combination of centrality and intermediacy
- › **Coastal cities** have some importance in the urban system but limited port activities, like Incheon and Bordeaux ports.
- › **Outports** depend on nearby cities and their port functions do not act as a mechanism for developing their own urban economy, like Fos, Felixstowe, and Apapa ports.

Assessment of degree to which port cities are dependent on ports would help in obtaining global snapshot of their positioning.

Historical port throughput data suggest that there have been significant changes in last 20 years in relative interdependence of ports and cities. This interdependence is influenced by various factors such as development of container shipping, development of global supply chains, and increasing demand for logistics services.

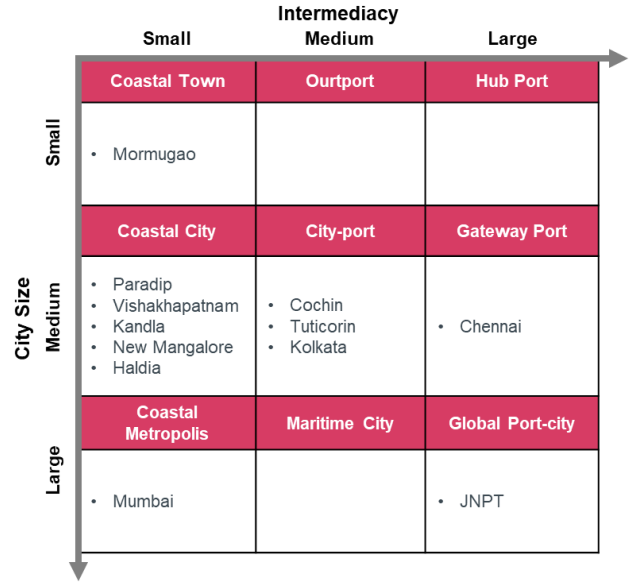
In order to further investigate the role of ports in growth of cities, and vice versa, Indian major ports were divided into several classes based on population size of supporting towns/cities. Cargo of these ports was then examined to understand the key drivers of these ports.



Position of Indian major ports in 2001, 2011 and 2018

Source: Primary analysis

It was observed that in order to develop JNPT (India's largest container port) and Chennai port as global ports, their capabilities to handle increasingly complex container handling operations would have to be augmented. Cochin, Tuticorin and Kolkata ports need a balanced development of both, ports and port-cities in order to strengthen their positioning. Paradip, Vishakhapatnam, Kandla, New Mangalore, Haldia and Mumbai ports have strong urban environment but lack in port functions due to small container handling capacity and related infrastructure. Mormugao port lacks dedicated container terminals and needs larger investments in both port and city infrastructure.



Port-city matrix of major ports in India

Source: Primary analysis

As per the assessment, below listed are possible suggested interventions for Indian ports.

- › Significant investments are required to develop new assets, capacity augmentation, and modernizing terminal operations across all ports in India.
- › There is a need of integrated port development; measures including improving number of container berths, berth lengths, number of quay cranes, designed container handling capacity, improving logistics assets, including rail freight, warehouses, container freight station, private freight station, free trade zones, cold chain logistics.
- › Ports with complex operations, such as transshipment, ship repair and shipping services hubs, container operations, and associated logistics require higher value addition at each stage. This can be ensured by development of port cities, providing value-added services, ranging from logistics hubs, transport services, ship repair, ship building, bunkering, traders, shipping agents, etc.
- › Container handling operations need to be enhanced to ensure capability to accommodate and handle larger ships, bigger and specialized cranes, modern container depots, and modern warehouses.

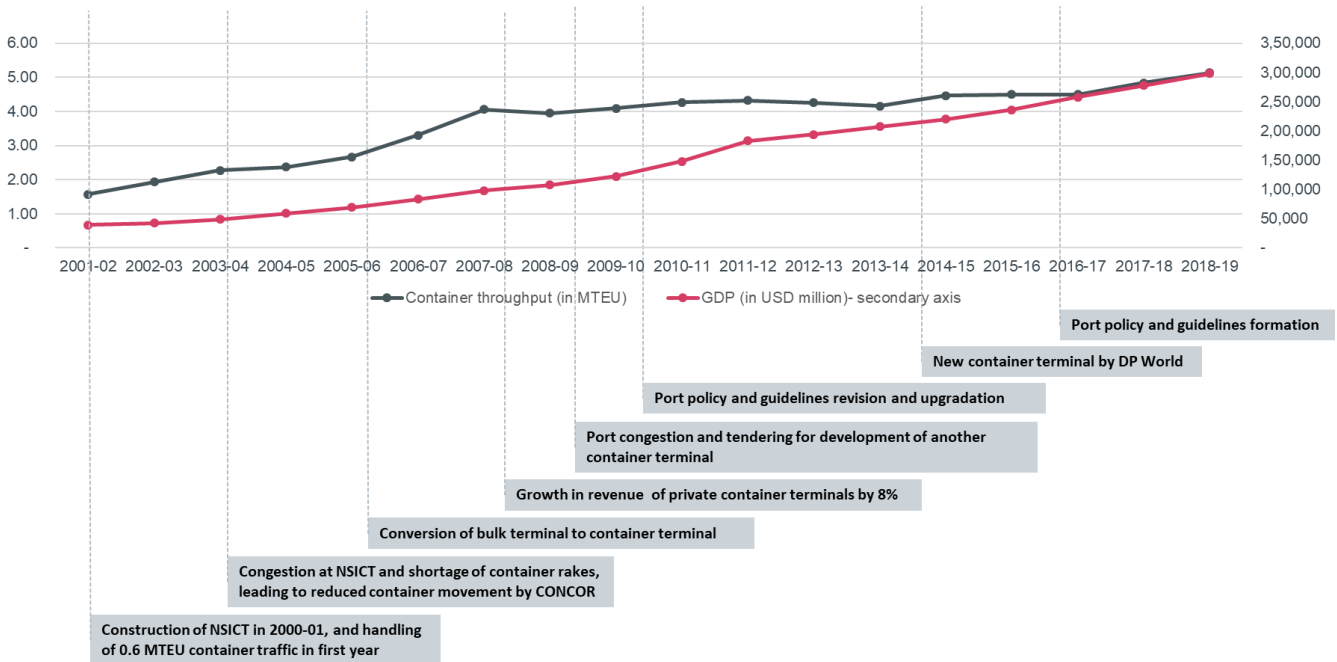
JNPT has potential to become major Indian global port city. Mundra, a non-major port, is rapidly approaching to become the largest shareholder of total container traffic and was around 11% less than JNPT in total container traffic in year 2018-19.

Smart port-city initiative

- Government of India has been planning to build one smart city within port community at the country's 12 major ports, at an estimated total investment of USD 7,000 million.
- Each smart city would be constructed at a cost of USD 400-500 million. Port water would be recycled, vehicles to be incentivized to use biogas, which would be produced from waste at the ports. SEZs, ship-breaking and ship-building centers, allied port activities in these cities would be emphasized.
- First of these is going to be developed at Kandla Port. Land bank of Kandla Port is to be used to develop Smart Industrial Port City (SIPC) at Kandla-Gandhidham-Adipur Complex and township incorporating green initiatives and smart city components. Detailed studies for Kandla and JNPT have been initiated.

Case - JNPT Port Growth

As a largest container handling port of India, JNPT is picked up as a case for this assessment. The port's dependence on city's economic growth, changes in various policy norms, and advancement in port functions is assessed and rendered as below.



Source: Indian Ports Association (IPA) database

JNPT has shown a considerable growth in container handling. Operating as a hub, it handled 5.13 MTEU container throughput in FY 2018-19, accounting for 32% of total container transport volume in India.

- In year 2019, JNPT delivered about 10% of containers through Direct Port Delivery (DPD), (7,600 TEU per month out of import of over 120,000 TEU per month by road). DPD is targeted at 40%, that is about 48,000 TEUs per month in coming months, and 70% over the long term.
- Lack of digitalization at gate entry procedures and low quay crane productivity are major setbacks hindering the growth of JNPT.
- Capacity utilization of terminals is observed to be 78% which requires expansion in the near future.
- Currently, its yard storage utilization is also the lowest among all major ports in India.

Figure below represents growth of JNPT in comparison with GSDP of Maharashtra state over the years. Key milestones that resulted in significant changes in container handling at the port, are also earmarked.

Ministry of Shipping, Government of India is likely to exclude major ports from the purview of Tariff Authority for Major Ports (TAMP). These will be further guided by Major Ports Authority Bill, 2019.

Some of the possible interventions for improving container handling capabilities of JNPT are listed below -

- Port of this scale needs to be linked with its hinterland. Which would in turn support the port in generating induced cargo, efficient evacuation, value added services, and associated logistics operations.
- Sagarmala program, which focuses on port-led development, would provide a much-needed push to the sector.
- Rather than creating new capacities, the port needs to focus on efficiency improvement, particularly cargo and vessel turn around time, and evacuation.

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