

**Working Paper 592**

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Major Ports Performance -  
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**Published and Printed by:** Institute for Social and Economic Change  
Dr V K R V Rao Road, Nagarabhavi Post,  
Bangalore - 560072, Karnataka, India.

**ISEC Working Paper No. 592**

December 2024

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ISBN 978-93-93879-83-7

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The Institute for Social and Economic Change,  
Bangalore

Working Paper Series Editor: **Sobin George**

# THE CHANGING LANDSCAPE OF ECONOMIC REFORMS AND MAJOR PORTS PERFORMANCE - EVIDENCE FROM INDIA

Shafeeqe Abdul Kader P K\* and Malini L Tantri\*\*

## Abstract

*As against the existing set of studies on Indian ports, this paper provides a comprehensive analysis of their performances by capturing all the relevant elements and dimensions. This study outlines whether or not their performance has changed against the backdrop of the changing landscape of economic reforms pertaining to the sector. The analysis is based on data collected from Port statistics for the period 1990-91 to 2020-21, which comprises pre- and post-reform period of the port sector.*

**Keywords:** Port performance, operational performance, economic reforms, India

## Introduction

In the current era of globalisation of trade, widely recognised as a catalyst for economic growth, appears to be significantly influenced by the quality of infrastructure and its performance (Limao & Venables, 2001; Nordås & Piermartini, 2004; Bensassi *et al*, 2015). Within that, the performance and efficiency of ports are seen to have the most significant impact on trade among all other indicators of infrastructure (Nordås & Piermartini, 2004). The importance of ports in global trade is apparent, as evidenced by the fact that global sea borne trade accounted for approximately 80 percent of total merchandise trade by volume and 55 percent by value in 2015 (UNCTAD, 2016). Concerning India, marine transport accounted for approximately 95% of trade in terms of volume and 68% in terms of value for the fiscal year 2016-17 (MoS, 2018). During the current pandemic, the role and relevance of ports in world trade and economy were further reinstituted.

Conceptually, a port is formally defined as a transportation system comprising nodes, such as settlements, ports, and terminals, interconnected by links, such as motorways or railway lines, through which flow vehicles carrying people and cargo move (Guelat *et al*, 1990). In contemporary times, ports are also considered economic tools for expanding national influence, as well as indicators of the quality of life and economic well-being of nations (Brockel, 1963). It is in this context that a port is regarded as a multifaceted entity encompassing both engineering and economic aspects. As an economic entity, a port operates as a sophisticated system facilitating commerce and offering various services. Ports play a pivotal role in driving economic activity by providing essential infrastructure for the maintenance of vessels and goods, while also serving as hubs for storage, distribution, and processing operations (Ibid). They enable the transportation of minerals, food products, raw materials, and finished goods across various sectors, reflecting the intricacies of our industrial system and the diverse range of human requirements (Ibid).

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Not surprisingly, due emphasis has been placed on the development of ports even before Independence in India. For instance, the first Port Act, known as The Indian Port Act-1908, was implemented in 1908. This was later succeeded by several significant policies in India after gaining Independence, namely The Dock Workers (Regulation of Employment) Act 1948.; Merchant Shipping Act 1958; The Major Port Trusts Act 1963; The Merchant Shipping (Form of Certificate of Insurance for Civil Liability for Oil Pollution Damage) Rules 1985; The Multimodal Transportation of Goods Act 1993; Amendment of Multimodal Transportation of Goods Act 1993; The Dock Workers (Regulation of Employment) (Inapplicability to Major Ports) Act 1997; Major Ports Regulatory Authority Bill 2009; Port Entry Rules 2012. Though the liberalisation process started in India at the beginning of the 1990s, the port sector has emerged as a major game changer since 1996. Since then, it has witnessed a paradigm shift in the role and functions of different stakeholders in port development. These policy developments, over the years, have resulted in several studies attempting to examine the role of the ports in the economic growth of India, especially in trade competence. The early Indian work on the performance of ports could be traced back to Dickason (1971) who tried to evaluate the efficiency of major Indian seaports. This was subsequently followed by quite a few studies (Ghosh & De, 2001; 2002; De & Ghosh, 2003; Roy, 2004; Deshmukh, 2005; De, 2005; Rajyalakshmi & Devi, 2007; Monteiro, 2010; Gaur *et al*, 2011; Radhika, 2012; Rajasekar & Deo, 2012; 2013; Prakash *et al*, 2013; Rajasekar *et al*, 2014; Regamani & Venkatraman, 2015; Mandal *et al*, 2016; Padmasani & Tamilselvi, 2016; Mantry & Ghatak, 2017).

Measuring the performance of the port sector is a complex issue. It is inappropriate to measure the performance based on a single indicator or over a short period. A comprehensive measure of the performance has to capture operational, physical, financial and trade indicators over a longer period. A comprehensive study, which captures such dimensions of performance, is seen missing in the literature. The available studies either focus on a single indicator or a short period for measuring the performance of the port sector (see for instance; Monteiro, 2010; Padmasani & Tamilselvi, 2016) or they are descriptive (Regamani & Venkatraman, 2015; Gaur *et al*, 2014) or based on reviews of studies or reports (Mantry & Ghatak, 2017). Several studies (Rajasekar & Deo, 2012; 2013; Rajasekar *et al*, 2014) have primarily focused on the correlation between port size and efficiency variables. However, these studies have neglected factors other than operational efficiency that contribute to port efficiency and their significant impact. Thus, there is a relevant need for having a comprehensive study carried out which can analyse the performance of the port sector, capturing all the relevant elements and dimensions of performance reflecting the greater reality with a specific focus on how its performance has changed against the backdrop of the changing landscape of economic reforms. In this context, the paper attempts to analyse the performance of the port sector (with a focus on major ports) using operational, financial, and trade indicators.

The present study concentrates on the performance of major ports in India, as a substantial portion of cargo is handled by them. However, the scope of the current study can be extended to the performance of non-major ports as well but these are kept out of the purview of this study due to the non-availability of data.

The subsequent sections of the paper are structured as follows: The following section provides an overview of the Indian port sector and major policies. Subsequently, the third section delves into the data and methodology used in the study. The fourth section presents the analysis and key findings. Finally, the last section provides a discussion and conclusions of the paper.

## **India's Port Sector: An Overview**

India possesses a coastline spanning 7,517 kilometres, encompassing 12 major ports and 205 officially recognised non-major ports situated across nine coastal states and islands. Major ports, classified as entry 27 of List I in Schedule VII of the Constitution of India, fall under the jurisdiction of the Union Government and are considered a central matter. Conversely, non-major ports are governed by state governments and are included in the concurrent list. The initial comprehensive legislation about the Indian port sector was established in 1908 under the Indian Ports Act. After this enactment, a series of legislative measures have been implemented to accommodate advancements and enhance the organisational framework to enhance the efficiency and effectiveness of Indian ports. Despite India's extensive coastline and the evolution of port policies since 1908, Indian ports continue to exhibit sub-par performance compared to international ports and those in neighbouring countries such as China (Deshmukh, 2005; MoS, 2016; ECMBS, 2017). Following the attainment of Independence, the enactment of the Major Port Trust Act of 1963 (MPT Act 1963) ensued, aiming to establish regulations that govern the administration of major ports in India. This Act has been repealed by the government by enacting the Major Port Authorities Act of 2021 to revamp the administration, control and management of major ports. Along with bringing changes in the Acts, the government of India has embarked on the Sagarmala programme, approved by the Union Cabinet in 2015 to promote port-led development in the country. The programme has identified 805 projects worth Rs. 5.54 lakh crores till now. Additionally, the Merchant Shipping Act of 1958 and the Dock Workers (Regulation and Employment) Act of 1948 hold considerable importance as legislations concerning shipping and port labour.

The Ministry of Shipping, led by a Cabinet minister, serves as the highest authority responsible for regulating and managing the port sector in India. It receives support from the Major Port Trusts in overseeing the administration of major ports, as well as the Tariff Authority for Major Ports (TAMP) in determining tariff rates. Furthermore, the Director-General of Shipping, a department within the Ministry of Shipping, is responsible for overseeing issues related to maritime administration, merchant shipping, maritime education and training, and the advancement of the shipping sector in India. Parallely, the State Maritime Boards/departments concentrate on enhancing non-major ports within their states. Additionally, the Maritime State Development Council is dedicated to facilitating the integration of development efforts for major and non-major ports throughout India.

## **Data and Methodology**

The present study is conducted using three sets of performance indicators, namely, operational, financial, and trade indicators. Five operational indicators have been selected for the present study as listed in Table 1 namely, number of vessels sailed (NVS); average turn round time (ATRT); average pre-berthing detention time (APBDT); percentage of idle time at berth to time at working berth (IT WB);

and output per ship-berth day (O/SBD). These indicators can provide a comprehensive picture of the operational performance of major ports and are used in the reports of the Ministry of Shipping, like basic port statistics and the Ministry's annual reports and are ascertained by the audit report of major port trusts (MoS, 1999; 2000; 2002; 2005; 2007; 2008; 2010; 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2021). These are the most preferred indicators for the operational performance as well as efficiency analysis of Indian major ports (See for detail: Monteiro, 2010; Roy, 2004; Rengamani., *et al*, 2015; Prakash., *et al*, 2013; Mandal., *et al*, 2016; Ghosh., *et al*, 2001; 2002; De., 2003). Moreover, some of the indicators contain other omitted variables like turnaround time which has three omitted variables, namely, inward movement, outward movement and shifting time. Similarly, a part of the operational indicator cargo handled is used as trade indicators.

The trade indicators show the share of each port in the maritime trade. In the present study, overseas cargo loaded and unloaded are selected as a proxy for export and import of cargo through the port. In the category of financial indicators, two variables have been selected which are operating income and expenditure. These are the variables explaining the financial aspects of the operational performance of major ports. This can be duly affected by investment expenditure. However, that part is more related to the policy part of the port sector and has to be discussed as a part of policy studies. Moreover, these are the variables considered for similar studies (Monteiro, 2010; Roy, 2004; Ghosh, *et al*, 2001; 2002; De, 2003).

The data has been gathered from multiple editions of the Basic Port Statistics report released by the Ministry of Shipping, Government of India. The period of the study will be 1990-91 to 2020-21, which include both pre- and post-economic reforms period. The analysis is done by dividing the data period into four phases based on the major policy initiatives introduced in the port sector which are guidelines for private sector participation in 1997, the National Maritime Development Programme (NMDP) of 2004 and the National Maritime Agenda 2010. According to these policy initiatives, four phases of the study are pre-reform period as the first phase, which is from 1990-91 to 1996-97. The Ministry of Surface Transport released guidelines about private sector participation in 1996, which defines the options for the involvement of private investment in the port sector (Shahi, 2002). The other three phases are the post-reform period (1997-98 to 2020-21): Within this, the phase from 1997-98 to 2003-04 is before the introduction of the National Maritime Development Programme (NMDP). The period of NMDP (i.e., 2004-05) to the introduction of the National Maritime Agenda 2010 is the third phase 2004-05 to 2009-10). The fourth phase is the period of National Maritime Agenda, i.e., 2010-11 to the latest. The present study uses a descriptive statistics approach for the analysis of data.

**Table 1: Performance Indicators Considered for the Study**

| SI No | Operational                                                                                                                                                                                                                                                                                                                                                                                                                                           | Financial                                                                                                                                                                                                                                                                 | Trade                                                                                                                            |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1.    | <p>Number of Vessels Sailed (NVS)</p> <p>The number of cargo and non-cargo ships that sailed from the port during a specified period.</p>                                                                                                                                                                                                                                                                                                             | <p>Operating Income</p> <p>Charges for cargo handling and storage, fees for port and dock services, earnings from railway operations, and rentals for estate properties.</p>                                                                                              | <p>Cargo loaded.</p> <p>Considered as a proxy for export cargo. It includes the cargo loaded to transport to a foreign port.</p> |
| 2.    | <p>Turn Round Time (TRT)</p> <p>The cumulative duration of the vessel's presence at the port, encompassing the period from its arrival at the reporting station to its departure from the reporting station, comprises of the time spent in pre-berthing detention, the duration of navigation for both inward and outward movement, the duration of the vessel's stay at working and non-working berths, as well as the time taken for shifting.</p> | <p>Operating Expenditures</p> <p>Expenses related to the handling and storage of cargo, the provision of port and dock facilities for shipping, the operations of railways, the rental of land and buildings, and the management and general administrative expenses.</p> | <p>Cargo unloaded.</p> <p>Considered as a proxy for export cargo. It includes the cargo unloaded from a foreign port.</p>        |
| 3.    | <p>Pre-Berthing Detention Time (PBWT)</p> <p>The duration between a ship's arrival at the anchorage and its report to the reporting station until it reaches the operational berth, excluding the duration of the inward movement, is considered.</p>                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                           |                                                                                                                                  |
| 4.    | Percentage of Idle time at working berth                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                           |                                                                                                                                  |
| 5.    | <p>Average Output Ship Berth-Day (AO/SBD)</p> <p>The ratio of the aggregate cargo handled by vessels sailed to the overall duration of their stay at the working berth.</p>                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |                                                                                                                                  |

**Source:** Manual of Port Statistics, 2015

## Performance Analysis of Major Ports in India

Roughly, 95 percent of India's trade volume is transported via maritime routes, and the major ports in India contribute significant cargo shares handled through the Indian ports. Since sea transport is the most-favoured means of international commodity transport, the performance of major ports will have a significant influence on the trade competence of the country. This section deals with the performance of major ports in India at an aggregate level across three major performance categories, namely, operational, financial and trade performance.

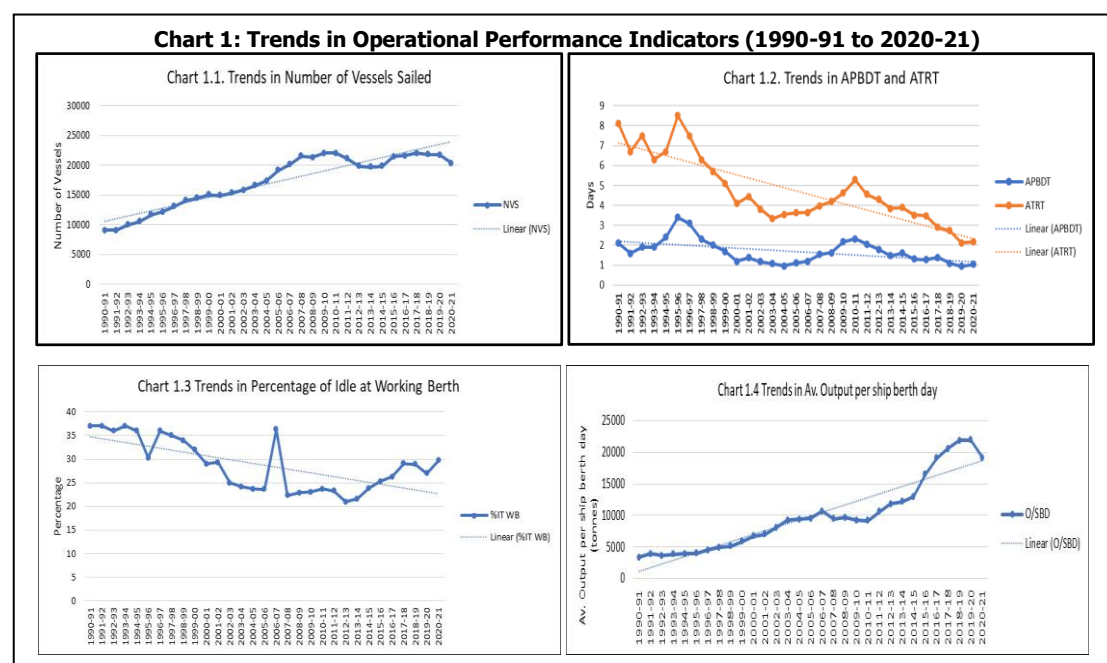
### Operational Performance of Major Ports

An upward movement in the trend line or increase in the values of the variables NVS and O/SBD shows improvement in the operational performance, whereas, for the variables APBDT, ATRT and % IT WB

downward movement of the trend line or decrease in the values shows improvement in the performance. Charts 1.1 to 1.5 show trend lines of five operational performance indicators for all ports for 31 years (1990-91 to 2020-21). At the same time, Chart 2 shows the year-on-year growth rate of the operational variables. The number of vessels sailed and the output per ship-berth day show the level of economic activity of the port directly and indirectly. These variables had shown a relatively steady improvement in their performance over the study period; however, it was largely affected by the world economic recession of 2008. At the same time, other operating performance variables, such as APBDT, ATRT and % IT WB had shown fluctuating trends over the years.

The general trends of these variables are in connection to the policy actions in the port sector for performance improvement. These include the first major policy, the liberalisation of the port sector and related policies. Variables show improvement after liberalisation till 2004-05, later, the performance started to decline. All variables have shown improvement in their values in the last year compared to the beginning year. Moreover, the least-performing values are found in the initial years, especially in the first phase for all the five indicators. However, the best performance values of variables were from the end of the second phase to the end period of the fourth phase.

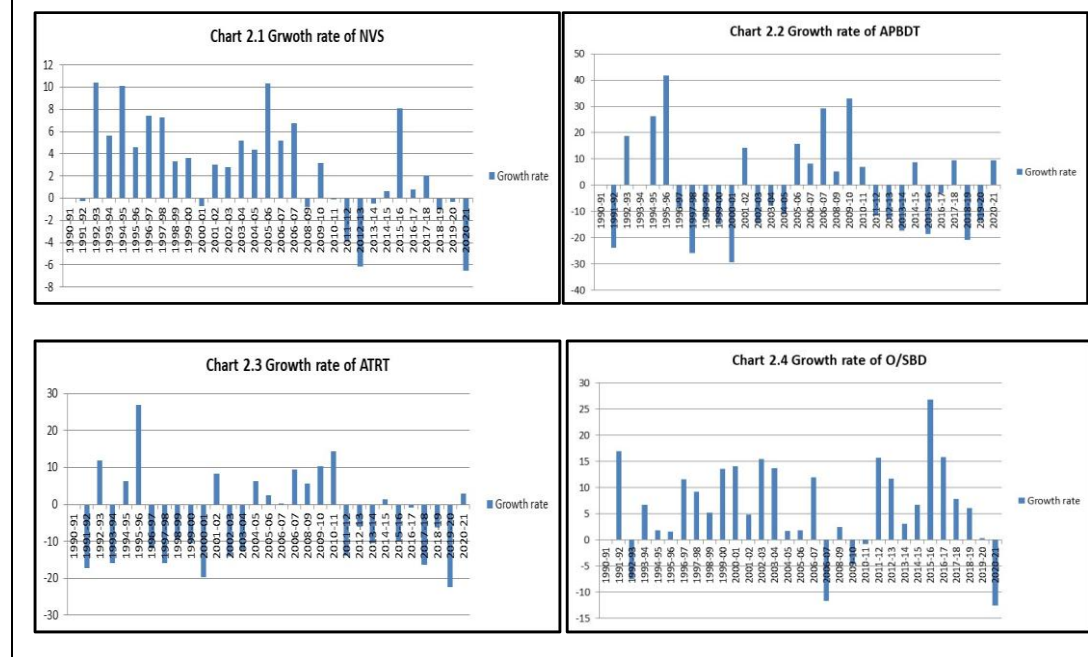
Operational performance of almost all the indicators was found to be declining from 2008 to 2012. The same is evident in the total cargo handling of the port as well. During 2010-11 and 2011-12, there was a decline in the export cargo at major ports that in turn reduced the total cargo handled by the major ports, which again deteriorated the values of all indicators especially the time-related indicators of operational performance.



**Source:** Basic Port Statistics, different years, authors own calculation.



**Chart 2 Growth Rates of Operational Performance Indicators (1990-91 to 2020-21)**



**Source:** Basic Port Statistics, different years, authors own calculation.

NVS – Number of Vessels Sailed, APBDT – Average Pre-Berthing Detention Time, ATRT – Average Turn Round Time, AO/SBD- Average Output per Ship Berth Day

**Table 2: Averages and CAGRs of Operating Indicators for All Ports**

| Phases                                        | NVS<br>(in numbers) | ATRT<br>(in Days) | APBDT<br>(in Days) | %IT WB<br>(in Percentage) | O/SBD<br>(tonnes) |
|-----------------------------------------------|---------------------|-------------------|--------------------|---------------------------|-------------------|
| 1 <sup>st</sup> Phase<br>(1990-91 to 1996-97) | 10840<br>(6.54)     | 7.34<br>(-1.3)    | 2.41<br>(6.7)      | 35.61<br>(-0.5)           | 3907<br>(4.9)     |
| 2 <sup>nd</sup> Phase<br>(1997-98 to 2003-04) | 15217.28<br>(2.48)  | 4.64<br>(-10.1)   | 1.53<br>(-11.8)    | 29.79<br>(-0.6)           | 6714<br>(11.1)    |
| 3 <sup>rd</sup> Phase<br>(2004-05 to 2009-10) | 20276.5<br>(5.61)   | 3.96<br>(5.5)     | 1.46<br>(17.7)     | 25.32<br>(-0.5)           | 9654<br>(-0.3)    |
| 4 <sup>th</sup> Phase<br>(2010-11 to 2020-21) | 21158<br>(-0.1)     | 2.85<br>(-9.7)    | 1.52<br>(-9.4)     | 25.44<br>(1.5)            | 15658<br>(10.2)   |
| Total Period                                  | 17188<br>(3.4)      | 4.75<br>(-4.5)    | 1.58<br>(-2.7)     | 28.69<br>(-0.7)           | 9936<br>(6.7)     |

**Source:** Basic Port Statistics, different years, authors own calculation.

Values in parenthesis show compound annual growth rate.

NVS – Number of Vessels Sailed, APBDT – Average Pre-Berthing Detention Time, ATRT – Average Turn Round Time, AO/SBD- Average Output per Ship Berth Day.

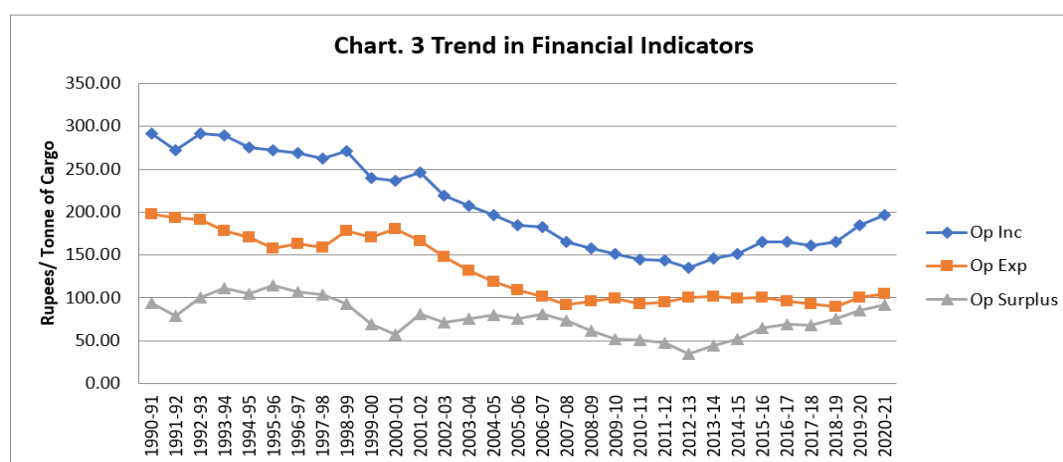
The analysis of the performance over the phases revealed that the average operational performance of all three phases in the post-liberalisation period is better than the performance in the pre-liberalisation period for all indicators (Table 2). This was in line with the results of Monteiro (2010) about the performance of ports after liberalisation. However, the compound annual growth rates have shown mixed levels in different phases.

The performance indicators are classified as positive and negative indicators. Positive indicators are the ones with higher value and show better performance, for example., NVS, O/SBD. However, for the negative indicators smaller the value better the performance, for example, APBDT, ATRT, %ITWB. As a larger view, the performances of all the indicators are better in the post-reform period compared to performances in the pre-reform period. Moreover, the positive indicators showed a gradual and continuous improvement in their performance during all the phases. The best performance values of O/SBD and ITWB are found in the fourth phase. Simultaneously, the optimal performance values of the NVS, APBDT, and ATRT are observed during the third and second phases. This implies that there are some setbacks in the operational performance of major ports, especially at the end of the third phase and at the beginning of the fourth phase. The decline in performance can be attributed to the decrease in total cargo handled from 2010 to 2012, primarily resulting from the decrease in export cargo. It was possibly the result of the global economic recession in 2008, where Indian exports were majorly affected. The performance of ATRT and APBDT have shown a similar trend as identified by Goldar & Paul (2018).

The compound annual growth rates of all operational indicators were better in the first phase. The number of vessels sailed and output per ship berth-day show a higher compound annual growth rate in the first phase. Similarly, the average pre-berthing detention time and the average turn-round time decrease at higher compound annual growth rates in the first phase. Moreover, the compound annual growth rate of the percentage of idle at working berthing is smaller in the first phase compared to the second.

### Financial Performance of Major Ports

The financial performance analysis of major ports is also conducted for 31 years from 1990-91 to 2020-21. Two variables, namely, operating income and expenditure, have been taken as financial indicators, and both are calculated in rupees for a tonne of cargo. As operational performance indicators were classified, for financial performance operating income is classified as the positive indicator and operating expenditure as the negative indicator. Both the variables are taken in real numbers (2011-12 base year).



**Source:** Basic Port Statistics, different years, authors own calculation. Op Inc- Operating income, Op Exp- Operating expenditure, Op Surplus- Operating surplus.

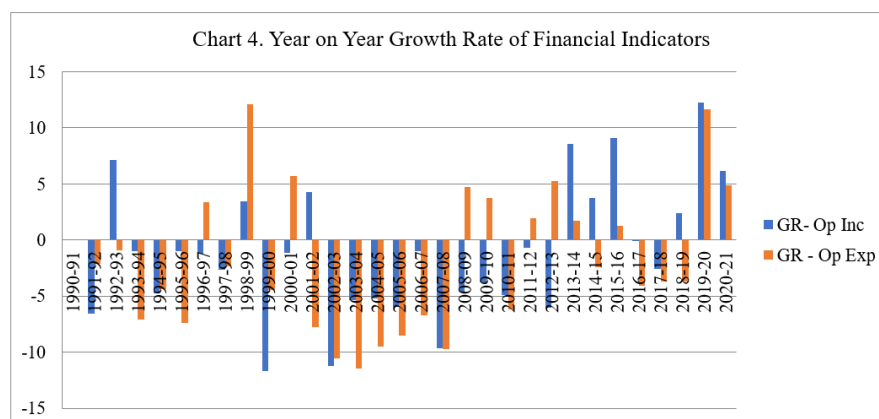
Chart 3 shows the trends of financial indicators, namely, operating income and expenditure, over the years. In the broader sense, expenditure and income show a similar decreasing trend over the years and operating income is always higher than operating expenditure. This gives some operating surplus to the port operators. Both operating income and expenditure values were declining in general and the change in the trend pattern of operating income was transitory and it lasted for a year or two till 2012-13. At the same time, fluctuations in its trend pattern of operating expenditure are non-transitory and last for two or more years. The trend lines of two indicators sometimes converge or diverge mainly due to the differences in the pace of the movement and those movements led to the increase and decrease in the level of operating surplus. The operating surplus recorded its highest value in the year 1995-96 and is mainly contributed by the difference in the pace of movement. However, the smallest value of operating surplus recorded in 2012-13 is mainly due to the shift in the trend pattern. The operating income continuously decreased for ten years after 2002-03 and showed fluctuations in recent years. On the other hand, the operating expenditure showed a decreasing trend during 2001-02 and 2007-08 for seven years, and then it started to fluctuate. The operating expenditure continuously increased from 2008-09 in line with the decrease in operational performance and reduction in export cargo. This has resulted in the smallest operating surplus in 2012-13. After 2012-13, operating income started to increase while operating expenditure decreased, which helped increase operating surplus.

**Table 3: Averages of Financial Indicators for All Ports**

| Phases                | Operating Income<br>(Rupees) | Operating Expenditure<br>(Rupees) | Operating Surplus<br>(Rupees) |
|-----------------------|------------------------------|-----------------------------------|-------------------------------|
| 1 <sup>st</sup> Phase | 280<br>(-1.3)                | 179<br>(-3.2)                     | 102<br>(2.0)                  |
| 2 <sup>nd</sup> Phase | 240<br>(-3.8)                | 162<br>(-3.1)                     | 79<br>(-5.0)                  |
| 3 <sup>rd</sup> Phase | 173<br>(-5.1)                | 103<br>(-3.5)                     | 71<br>(-8.1)                  |
| 4 <sup>th</sup> Phase | 156<br>(2.8)                 | 97<br>(0.8)                       | 59<br>(5.9)                   |
| Total Period          | 208<br>(-1.3)                | 131<br>(-2.1)                     | 76<br>(-0.1)                  |

**Source:** Basic Port Statistics, different years, authors own calculation.

**Note:** Values in Parenthesis show the compound annual growth rate in the phase.



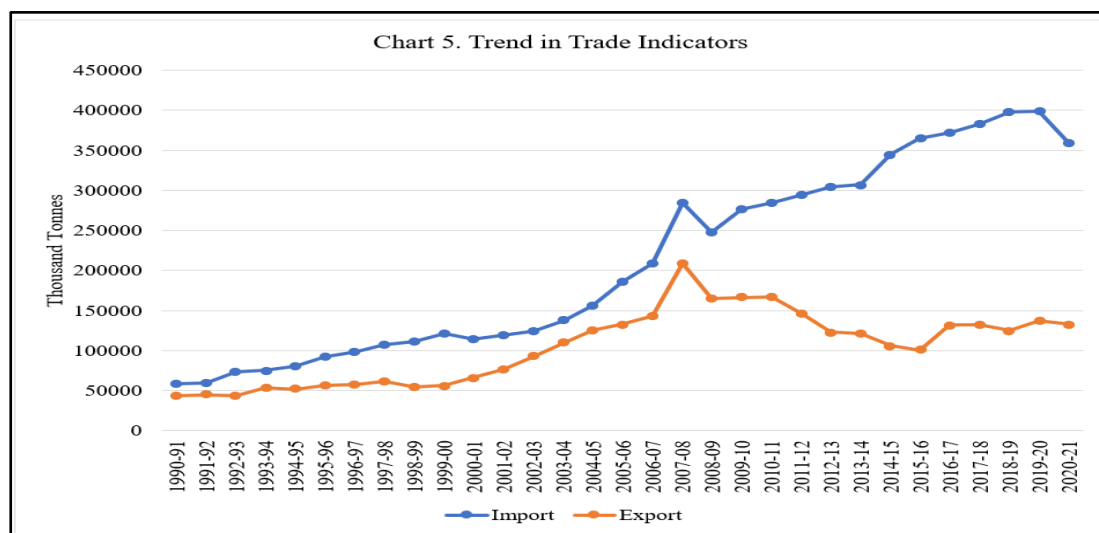
**Source:** Basic Port Statistics, different years, authors own calculation.

Both the operating income as well as operating expenditure showed varying growth rates over the years (Chart 4). The growth rate of these two variables, the growth rate of operating income is comparatively stable in the first phase and it highly fluctuates in the last phase. However, fluctuations in the last stage show some positive effects as it reveals more growth for operating income along with a negative growth for operating expenditure. That in turn helps to move to operating surplus in the upward direction.

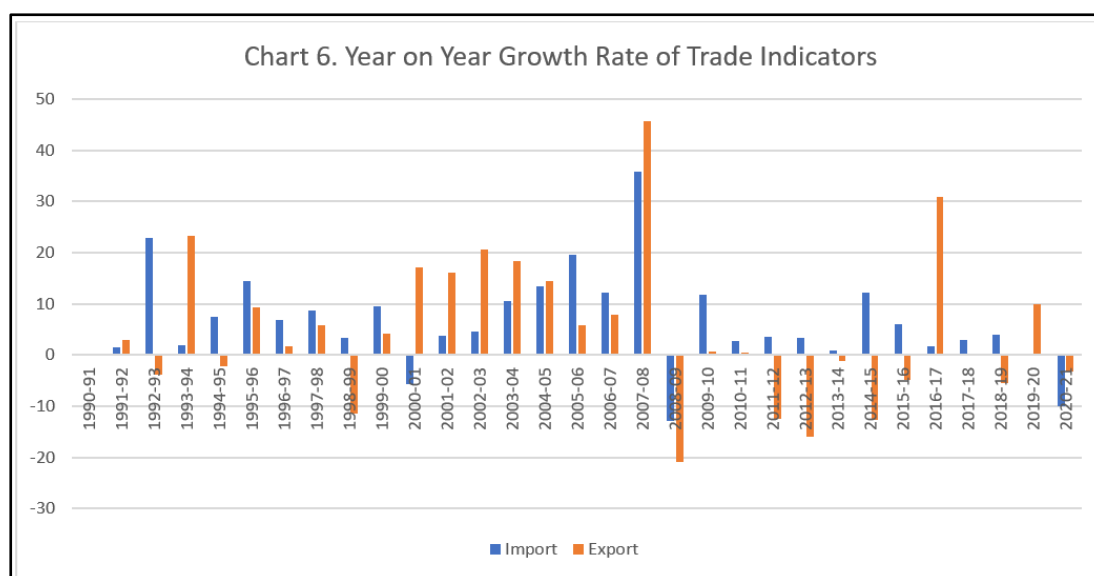
The averages of operating income, operating expenditure and operating surplus are higher in the first phase (Table 3). Moreover, the difference between the negative CAGRs of operating income and expenditure is also higher in the first phase, which gave a positive CAGR for operating surplus. All the averages of financial indicators decreased over the phases and recorded their lowest averages in the last phase. However, the highest difference between CAGRs was recorded in the last phase. Accordingly, the highest positive CAGR for the operating surplus is also recorded in the same phase. All CAGRs were negative for the total period, since there is a general decreasing trend.

### Trade Performance of Major Ports

Analysis of the trade performance of major ports in India involves examining the overseas cargo loaded and unloaded by these ports as a proxy of cargo export and import activities. Both the variables are taken in 1000 tonnes scale from 1990-91 to 2020-21. The general trend of both imports and exports is rising upward with a positive CAGR for the total period. This rise is led by imports with a relatively large value for average and a higher CAGR compared to exports. It shows the general trend in the total export-import of the nation. Import has more consistent with the upward trend and as time goes it is increasing at a faster rate than export (Chart 5). At the same, Indian export declined continuously during the global recession of 2008 and they persisted till 2015-16 (Chart 6).



**Source:** Basic Port Statistics, different years, authors own calculation



**Source:** Basic Port Statistics, different years, authors own calculation.

**Table 4: Averages of Trade Indicators for All Ports**

| Phases                | Imports (in 000 tonnes) | Exports (in 000 tonnes) |
|-----------------------|-------------------------|-------------------------|
| 1 <sup>st</sup> Phase | 76984.42<br>(8.9)       | 50227.14<br>(4.8)       |
| 2 <sup>nd</sup> Phase | 119281<br>(4.2)         | 73843.14<br>(10.2)      |
| 3 <sup>rd</sup> Phase | 219492<br>(12.8)        | 149728<br>(5.9)         |
| 4 <sup>th</sup> Phase | 346527<br>(2)           | 129345.73<br>(-1.0)     |
| Total Period          | 211117<br>(6.2)         | 104276<br>(3.8)         |

**Source:** Basic Port Statistics, different years, authors own calculation.

**Note:** Values in Parenthesis show the compound annual growth rate in the phase.

The trend explained in the above paragraph is replicated in the averages and CAGRs of trade indicators over the four phases as explained in Table 4. Imports showed positive CAGRs in all the phases and their averages were increased from the first to the last phase. At the same time, exports increased in their averages till the third phase and till then the CAGRs were also positive. The economic recession in 2008 hurdled the growth of Indian exports which led to a negative CAGR and low average value for exports. However, for the total period, both exports and imports have positive CAGRs and show an increasing trend.

**Table 5: Overview of Major Port Performance**

| SI No | Performance Yard | First Phase                                                                      | Second Phase                                                                 | Third Phase                                                                   | Fourth Phase                                                                             |
|-------|------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1     | Operational      | As light Improvement in operational performance                                  | Improvement for all variables                                                | Improvement in NVS only                                                       | Improvement for most of the variables                                                    |
| 2     | Financial        | Improvement in all parameters and operational surplus                            | Improvement in parameters with a steady operational surplus.                 | Improvement in the beginning and deterioration of performance towards the end | Evident improvement with an increase in surplus                                          |
| 3     | Trade            | Imports grow faster than exports and it led to an increase in the trade deficit. | Exports increased at a faster rate and helped to decrease the trade deficit. | Imports declined towards the end, leading to an increase in the deficit       | Imports continue to increase while exports increased. Further widened the trade deficit. |

**Source:** Authors compilation.

The first phase is the pre-liberalisation period, where minimum values of performance for all the indicators have been found, and all indicators have shown an improvement in performance over the phases. The improvement in the performance for most of the indicators began in the first phase itself, where trade and operational indicators improved at a smaller rate compared to financial performance. The second phase recorded the second-best performance values of APBDT and ATRT along with a steady improvement in other operational indicators. Trade indicators also show an improvement in the absolute values with a higher rate of increase for exports, which helps to reduce India's trade deficit. Operational expenditure decreased at a higher rate than operational income towards the end of the second phase, which helps the operating surplus from falling further. The third phase shows a fall in the performance of operational indicators except for NVS, which reaches its best value in this phase. Moreover, financial indicators and trade indicators also show a setback in their performance during the third phase, with the global economic recession in 2008. The effects of global economic shocks experienced in the third phase continue in the fourth phase as well. However, all the variables revived from the effect and continued to improve in the fourth phase. The operational indicators lead the momentum followed by the financial indicators. At the same time, trade indicators reached the path of improvement only later in the fourth phase.

## Discussion and Conclusions

Over the years, the port sector has received increased attention in every consecutive budget/economic survey of India. The increasing reliance on the port sector is largely due to their multiplier effects on the economy in general and trade in particular. In this context, any fresh evidence on the sector's performance is pivotal in addressing any problems in the sector. The port sector in India plays a crucial role in the country's merchandise trade, as 95 percent of India's trade volume is transported via maritime transport. Given this, it is important to outline the performance of ports as they determine the country's trade competence. The aggregate level performance analysis reveals that there are improvements in the performance of major ports in different performance areas over the period, specifically in the post-liberalisation period. In operational performance, the number of vessels sailed

and output per ship-berth day show a more stable increase over the years. At the same time, the improvement shown by other indicators fluctuates. The financial indicators are calculated per tonne of cargo, and it showed a decrease in real terms over the years which is a positive indicator of improvement in handling charges and an incentive for port agents with the increase in total cargo handled. Trade has increased in huge volumes during the study period. This is mainly driven by the rise in import volumes, which are not much affected by the recession in 2008. However, the recession had a big impact on India's export volume over eight years. This impacted some of the operational indicators like the number of vessels sailed, and output per ship-berth day. There are some setbacks in the improvements of other operational indicators like average pre-berthing detention time and average turnaround time. Moreover, a shift in the trend pattern of operating expenditure is also visible during the period. The first phase, (pre-liberalisation period), has shown the lowest performance values for different sets of indicators along with a slow rate of improvement. The economic reforms positively affected the performance of major ports in terms of operational financial and trade indicators which is visible from the second phase itself. However, the economic recession again hurdled the process and continued in the last phase on at least a few indicators. On the limitation side, the present paper has discussed only whether or not the port sector as a whole has responded to changes in policy and has not elaborated on the performance of ports at the disaggregate level. Specifically answering which ports are performing better and which ports are lagging in their performance was outside the scope of the current work. This can be taken up in future research to substantiate one's understanding of the sector.

Policy suggestions emanating from the paper are:

- To improve the overall performance of the port sector, the role of the negative indicators (ATRT, APBDT, ITWB) are vital. The government can improve the efficiency of these indicators to improve operational performance.
- The measures to control operating expenditure and increase operating income contributing to a better operating surplus, which can be considered the right approach to move in the same direction.

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