Performance of Indian Ports
A Case Study of Tuticorin Port

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Dissertation submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Applied Economics of the Jawaharlal Nehru University

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M.Phil. Programme in Applied Economics
1999-2001

CENTRE FOR DEVELOPMENT STUDIES
June, 2001

I hereby affirm that the work for the dissertation, **Performance of Indian Ports: A Case Study of Tuticorin Port**, being submitted as part of the requirements of the M.Phil. Programme in Applied Economics of the Jawaharlal Nehru University, was carried out entirely by myself and has not formed part of any other Programme and not submitted to any other institution/University for the award of any Degree or Programme of Study.

June 29, 2001

T. K. Subramanian

Certified that this study is the bona fide work of T.K. Subramanian, carried out under my supervision at the Centre for Development Studies.

G. Omkarnath
Associate Fellow

Chandan Mukherjee
Director
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To
My Parents

Acknowledgements

I have been containing my excitement for a long time ever since the beginning of this work to write this final piece of my thesis. As I look back in to the path along which I have trotted I find that many people have been closely associated with me for the past few months. I wish I could acknowledge all of them but not some of them for lack of words and space with me. First and foremost I would like to acknowledge my supervisor G. Omkarnath for having guided me patiently and sincerely during the ups and downs of my thesis. Then I would like to gratefully acknowledge Chandan Mukherjee, the director of our centre, for having enriched my understanding on the handling of data in social sciences and the various problems associated with the same. I can never forget his kindness and magnanimity that he showed me during one of the most difficult times in my thesis. The lectures and seminars delivered at CDS by my teachers and other eminent persons from academic circles provided me with a deep insight about the advancements made in the frontier areas of economic research and about the complexities one has to face while doing research in social sciences. I am extremely grateful to all my teachers at CDS for having helped me at various instances during the course of this program; especially in this regard I would like to acknowledge K.K. Subrahmanian, G.N. Rao, K.P. Kannan, Mohanan Pillai, Achin Chakraborty, D. Narayana, K. Pushpangadhan, K. J. Joseph, and N. Shantha. I had also benefited from the comments and suggestions of Vijayamohan Pillai.

CDS is one of the rare places where one can find the senior research scholars always willing to help their junior ones. In this regard I had greatly benefited from the initial discussion I had with Dennis Raj Kumar and Suresh Babu. The invaluable advises and suggestion provided to me by Sunny Jose, Abdul Azeez, and Veeramani helped me to mould my thesis to a perfect form. I am also deeply indebted to the support and help rendered to me by Parameshwaran and Hari during the troubled times of my thesis. Their role has been instrumental in making the thesis see the light of this day. Subodh my immediate senior helped me a lot during my initial days at CDS. I would also like to acknowledge my other seniors James Kutty, Sharmishta Sen and Chithra.

The fine moments I had spent in the warmth companionship of my batch mates will always remain as a cherished dream in my memory. Each of my batch mates inspired me in their own ways. Ranjan charmed me with his pranks and jokes and also through clarifying concepts, Subrata by his brotherly affection and advices, Rathi kantha through his hard work and sleepless nights glued to the computer screen, Pradeep through his deep understanding of various matters, Saji by his skills in critically viewing matters, and Arasu by his strong usage of words. I also enjoyed the company of Kamna, Sowjanya, and Ann.

The trauma that I had to undergo during the course of my thesis work was relieved very much by my juniors. Indu and Poornima went painstakingly went through my draft and Gaurav helped me in editing certain portions of the draft. Balaji, Kiran, Reji, Tina, and Rakhe made it a point to enquire eagerly about the progress made by me in my study. The stay at the campus was made a memorable and lively experience by Hari Kurup, Antonyto Paul, George Kutty, Anil, Suresh, Rajesh, Ameer, and Shabeer of my hostel. Deepadidi by her affection, SEWA Chechees through the delicacies prepared by them, and Rajesh, and Prabhakaran Nair by their pleasant enquiries made the campus life more enjoyable.

The administrative, academic and library staffs of CDS deserve special thanks for their co-operation and friendly assistance provided to me during the course work as well as during the thesis work.

This work would not have been possible without the kind co-operation of Tuticorin Port Trust Authorities. In this regard I am extremely grateful to S. Machendranathan the Chairman and staff of Tuticorin Port for having permitted me to conduct this study. I had benefited greatly from the informal discussions I had with the port authorities. I received an excellent co-ordination as well as support for the conduct of the study from the employees of the port; in this regard I would like to specially acknowledge Mani and Vijayasimhan of the civil department, Thangavel, Prem Kumar and Venkateshwaran of the mechanical department, Thanu of the finance department, Shanmugavelu of the traffic department, and Ashok kumar of the cargo handling labour pool. All these officials were closely associated with me and went out of their way to help me inspite of their busy schedules. The stay at Tuticorin was made a pleasant delightful experience by Shahjahan, Krishnamurthi, and Gopalakrishnan.

I wish to specially acknowledge the cheerful assistance and co-operation of the library staff of Centre for Economic and Social Studies, Hyderabad. In this regard I acknowledge Vijayakumar and Sudhakar. I can never forget the hospitality and help extended to me by Prasanna Kumar Barik during my stay at Hyderabad. My friend Prashobh through his communications instilled in me the confidence needed to complete this work.

Although, my parents were having a tough time they encouraged my study and made it a point to disturb me the least. Their support and blessings has enabled me to complete this work. The frequent enquiries of my sister and brother-in-law about the progress in my work also provided me a solace to complete the work.

T.K. Subramanian

ABSTRACT OF THE DISSERTATION

Performance of Indian Ports
A Case Study of Tuticorin Port

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Physical infrastructural facilities play a vital role in economic development. They facilitate the production of goods and services in the economy. Ports are an important segment of the physical infrastructure as they handle more than 90 per cent of India's foreign trade. The capacity utilisation in some of the major Indian ports is more than 100 per cent and they are highly congested. These factors together affect their performance. Further, the pressure on the ports sector has been going up since the initiation of economic reforms in India. In this context, the specific objectives of the present study are:

1. To examine the trends and patterns of cargo-handled at all the major ports in India
2. To identify the major problems faced by the Indian ports.
3. To analyse the trends and pattern of output and employment of Tuticorin port and to examine the changes in the physical assets of the port.
4. To understand the role of port-specific factors in affecting the cargo-handling operations at Tuticorin port.

India posses twelve major ports and so it is difficult to make a detailed analysis covering all of them. While the first two objectives mentioned above have been addressed in the context of all the major ports, a detailed analysis has been taken up in the context of a single port, Tuticorin. We have assumed that ports are like firms and cargo-handled is their output. This assumption is plausible, as they charge user fees on a commercial basis for the services they render, despite being regulated public utilities. The study relies on both primary and secondary sources of data. We have utilised information taken from CMIE's publication on Infrastructure, Economic Survey, RBI Handbook of Indian Economy, Tamil Nadu an Economic Appraisal, and various Administrative Reports of Tuticorin Port. A descriptive analytic method has been followed. The inter-port analysis reveals some differences in the shares of traffic handled at the major ports situated along the west coast from that of the east coast. This difference may be a reflection of either the disparity in the level of industrial development among the Indian states or the geographical pattern of India's international trade. The micro level analysis reveals that the problems involved in cargo handling operations are specific to the nature of the cargo. It is found that the two main port efficiency indicators - average turn around time and average output rate per berth hour - has been deteriorating for Tuticorin port since 1997-98. This is a real cause of concern as it can affect the prospects of the port from emerging as a hub in India, if the trend continues. The analysis further indicated that non-port related factors are relatively prominent in influencing cargo-handling operations.

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Chapter I

Introduction

Background of the Study: Adequate and efficient infrastructural facilities are considered to be an essential prerequisite for the economic growth and development of a country. Hence, the development of infrastructural facilities has always got a higher priority in the plans. Today, in a globalised and liberalised economic environment, efficient and well-functioning infrastructural facilities are crucial for achieving higher growth and competitiveness for any economy. In this context, this study examines the performance and problems of an important segment of the infrastructure of the country, namely ports. Ports play an important role by facilitating international trade in commodities. Efficient port infrastructure greatly helps the exporters of the country to sell their products at competitive prices in international markets. It also helps the importers to import raw materials and consumer goods cheaply. This increases the welfare of both consumers and producers. Since India does not posses world-class port facilities and as the existing ports have numerous problems, the performance of its ports is considerably below average. Moreover, Indian ports are not in a position to raise sufficient finances to meet the challenges posed by globalisation. This chapter has been organised into three sections. The first section deals with the conceptualisation of the term infrastructure in general and its relationship with economic development. The second section contains a discussion on infrastructural facilities in India and the changes in the government policies towards infrastructure. The last section spells out the problems, objectives and chapter scheme of the study.

1.1.1 Conceptualisation of the Term Infrastructure: The term infrastructure is a broad one and is generally defined as the physical framework of facilities through which goods and services are provided to the public. According to World Development Report (1994) "The term infrastructure is an umbrella term for many activities referred to as *Social Overhead Capital* by development economists such as Paul Rosenstein-Rodan, Ragnar Nurkse and Albert Hirschman. Its linkages with the economy are multiple and complex, because it affects production and consumption directly as well as indirectly, creates positive and negative spillover effects (externalities) and involves large flow of expenditure" (P.2).

The 1950s and the 1960s witnessed a surge of attempts in Development Economics to specify the contents of infrastructure or overhead capital as it was termed. Thus, Lewis (1955) includes public utilities, ports, water supplies and electricity in the specification of infrastructure. Higgins (1959) includes transport, public utilities, schools and hospitals. Hirschman (1958) lists law and order, education, public health, transportation, communication, power, water supply, irrigation and drainage. It is Hirschman who distinguishes between a wider concept of social overhead capital as listed above and a *hard core* which he limits to transport and power. Hirschman (1958, pp: 83-84) further presents four conditions which turn out to be reasonably precise guidelines for deciding what is and what is not infrastructure. These guidelines help to distinguish social overhead capital from directly productive activities. They are: Infrastructural services facilitate, or, in one sense, are basic to the carrying out of a wide variety of economic activities. These services are provided in practically all countries by public agencies or by private agencies subject to some public control and are provided free of charge or at rates publicly regulated. The services cannot be imported. The investment needed to provide the services is characterised by lumpiness. Lumpiness means that, owing to technical indivisibilities, large investments rather than small incremental investments are needed to provide the services much ahead of demand.

Most of the infrastructural facilities are in the nature of public goods in that these services are non-excludable and non-rival in character. On the supply side, production of public goods is not free or costless. But the marginal cost of providing the services to an individual is zero, once the goods is produced. Hence, marginal cost pricing is not possible in this case. Further, because of the joint consumption characteristics of the public goods, individual preferences for such goods are hard to ascertain. On account of these reasons, it is usually recommended that these services be provided by the public sector.

For convenience we can classify the term infrastructure into three categories: economic infrastructure, social infrastructure and financial infrastructure. Economic infrastructure in turn can be classified into (a) Public Utilities, (b) Public Works and (c) Other Transport Sector. Where Public Utilities include facilities like power, telecom, piped water supply, sanitation, sewerage and solid waste. Public Works includes facilities such as roads, dams, canals and irrigation and drainage facilities. And Other Transport Sector is inclusive of urban and inter-urban railways, urban transport, seaports, waterways and airports.

1.1.2 Infrastructure and Economic Development: From the above discussion one can easily observe that the term infrastructure per se plays a significant role in economic development. More than that, it helps to increase productivity of factors of production by providing amenities, which enhance the quality of life. It also acts as an intermediate input in almost all the production activities in an economy. Therefore, any reduction in infrastructural service cost in an economy raises the profitability and helps the firms to achieve higher level of output, income and employment. Therefore, in this context, infrastructure is also described as an unpaid factor of production (India Infrastructure Report 1996).

Much research has been carried out to explore the linkages between infrastructure and economic growth and development for instance Munnell (1992), Kessides (1993), Sturm et al (1999) etc. These studies have looked into the issue of economic development from the macroeconomic standpoint. Most of the studies have been done in the context of developed countries and have reported that infrastructure capital has a significant positive effect on the output and growth of the economy. In case of developed economies like United States and Japan, studies on the importance of infrastructure using Input-Output tables have revealed that telecommunications, water and power are used in the production process of nearly every sector and transport is an input for every commodity.

The most beneficial impact that an investment in infrastructure has on the economy is through the multiplier effect. Expenditure incurred in the form of wages and inputs used in the construction of physical infrastructural facilities leads to the multiplier effect. This results in derived demand for output produced by other sectors. The mode by which infrastructure is financed also has an impact on economic development. Although infrastructure has high potential payoffs in terms of economic growth, this knowledge does not provide us with any basis for prescribing appropriate sectoral allocations for making infrastructural investments.

1.2.1 Present Trends in Infrastructure the Case of India: Recognising the significance of infrastructure in economic growth, the Government of India has always given a prominent place to the development of economic infrastructure in the country in each plan. Although India has invested in all forms of physical infrastructure, its supply has not been adequate. Always there has been a gap between the aggregate supply of physical infrastructure and the aggregate demand for it. The infrastructure sector has been under the control of the state with state-owned undertakings operating in all the sub-sectors. Investment policies in this sector,

especially in the case of telecom, railways, roads, seaports, etc., were under state supervision and control. Table 1.1 provides a profile of economic infrastructure in the country over the last five decades.

Table 1.1: *Trends in Various Economic Infrastructural Facilities in India*

Year	*Transport*				*Power*	*Telecom*	
	Surfaced Roads Length	Railway Total Route	Major Seaport	Airports (Int + Dom)	Installed Capacity	Telephone Stations	Direct Exchange Lines
	('000 Km)	Length (Km)	(Nos)	(Nos)	('000MW)	('000 Nos)	('000 Nos)
1950-51	156.1	53,596	5	4	1.7	--	--
1960-61	234.4	56,247	9	4	4.6	--	--
1970-71	397.9	59,790	10	4	14.7	--	--
1980-81	683.7	61,240	10	4	30.2	2,785.10	2,149.50
1990-91	1,025.2	62,367	11	91	66.1	6,020.90	5,074.70
1998-99	1,394*	62,809	12	--	89.1	22,466.30	21,593.70

Note: * denotes that surfaced road statistics belong to 1996-97. Int-International, Dom-Domestic, MW-Mega Watts, Power includes only utilities which is a combination of (Hydro + Thermal + Nuclear).
Source: Planning Commission, CMIE Infrastructure, January (2001), Economic Survey.

Table 1.1 presents the trends in various infrastructural facilities such as transport (roads, railways, seaports and airports) power and telecom over the years. Except railways, which was a legacy of the colonial past, the other infrastructure sectors have grown in their network tremendously over the years. In spite of a tremendous increase in the network of these facilities, the ground reality is that still India continues to face a supply-side deficit.

To overcome this shortage, as part of the new economic policy introduced in 1991, the government changed its policy towards infrastructure development. This policy change was motivated by the fact that better infrastructure facilities were crucial for achieving the declared objectives of economic reform, namely higher growth and competitiveness. Furthermore, financial constraints also compelled the government to change its policy towards infrastructure sector.

1.2.2 Reform measures introduced in Infrastructure sector: The reform measures introduced in the infrastructure sector can be broadly classified into two, viz. sector-specific measures and general measures. The general measures introduced are as follows:

1. As infrastructure sector requires long-term finance for development, the Government floated a new company meant specifically for financing infrastructure projects called Infrastructure Development Finance Corporation (IDFC).

2. Other measures initiated were the granting of a tax holiday for up to five years for new infrastructure projects, the setting up of a foreign investment implementation authority to smoothen FDI flows into the infrastructure sector and the rationalising of import duties levied on infrastructure projects.

Other than these general measures, sector-specific policies were formulated for almost all sub-sectors of infrastructure to alleviate the existing bottlenecks. The sectors in which reforms have been introduced are power, telecommunications, roads, railways, civil aviation, and ports. As the present study is concerned with the ports sector, we provide a detailed discussion on the reforms pertaining to this sector alone.

With globalisation Indian economy is poised to witness a significant acceleration in international trade, some symptoms of which are already visible such as the dramatic surge in imports. To effectively handle this increase in the volume of cargoes, our major ports need to upgrade their cargo handling technology, modernise their equipment, introduce new management practices and raise adequate finances to augment their capacity as well as improve their current facilities. Ports around the world have faced similar problems and in order to overcome these efficiency-related problems; they have introduced four new institutional reforms. They are (a) commercialisation, (b) liberalisation or corporatisation (c) privatisation or deregulation and (d) modernisation of port administration. But the objective behind the introduction of these policy reforms varies from one country to another. For instance, in case of the United Kingdom, the decision to privatise ports was made largely on ideological grounds based on the belief that private ownership is superior to public sector control. In case of some countries, the governments strongly supported the belief that market forces are the most effective way of regulating port capacity and also for stimulating business. Drawing on the experiences of other countries, the Government of India has adopted a combination of three strategies to overcome the problem of inefficiency in this sector. These measures are privatisation, corporatisation, and commercialisation. Some of the areas where new policy changes have been introduced to facilitate private sector participation are as follows:

1. A new independent regulatory authority called Tariff Authority for Major Ports (TAMP) has been formed for the purpose of fixing tariff rates for various commodities handled at the ports.

2. Private sector participation has been encouraged in establishing captive power plants for supply of uninterrupted power to ports and for the creation of dry docking facilities and ship repair facilities at major ports.
3. Privatisation has been encouraged in other activities such as cargo handling, operation and maintenance of multipurpose cargo berths, container terminals and bulk cargo terminals, warehouses, container freight stations, etc., on a Build-Operate-Transfer (BOT) basis.
4. It has also been decided to lease out existing port assets like cranes, port crafts etc.

No reforms pertaining to cargo-handling labourers have been introduced. This can be a hindrance to the privatisation process. All these policy changes have been introduced with the hope that privatisation of cargo handling and other related activities will bring in competition, upgrade techniques of cargo handling in case of certain specific cargoes and lead to efficiency in management. The major role of the State in such a scenario would be to regulate the natural monopoly elements within the port sector and to prevent inefficiency from creeping in. Another responsibility the state has to shoulder is the development of fixed infrastructural facilities like piers and harbours, since investment in these components of port infrastructure is large, risky and unattractive.

1.3.1 Why Ports Sub-sector? The reasons for having selected port sub-sector are:

(i) India does not possess any world class ports, to handle the expected rise in international trade as most of the existing major ports have already been congested.

(ii) Most of the existing major ports are fully utilised and are costlier compared to other ports in South Asia.

(iii) Though productivity indicators of Indian ports such as average ship berth output has gone up over time and average turn around time has improved these indicators are far from comparison by any international standard.

(iv) The reform process presumes the existence of adequate infrastructure facilities especially ports and facilitates the capacity expansion within the manufacturing sector but this is not true in case of Indian ports.

(v) Inadequacy of available resources prevents ports from undertaking developmental activities such as capacity expansion thereby forcing them to seek alternative modes of resource mobilisation.

1.3.2 Review of Literature: We provide here a brief review of studies conducted in this area. Kim and Sachish (1986) examined the production structure of Ashdod port in Israel, measured technical change and total factor productivity for the port using annual time series data assuming a translog functional form. Technical change was measured as percentage of containerised cargo handled by the port. They found that technical change was biased and it was the main factor affecting total factor productivity. Thomas (1994) in his study on organisational change in seaports stressed the need for a change in organisational set up in the seaports around the world due to organisational deficiencies in public sector. According to him new changes need to be introduced in their management in the form of training designed to change employees attitude to enable them to adapt to the new maritime environment and also to bring efficiency. Few studies are only available related to port sub-sector in India. Anil and Nair (1992) studied about the performance of all major ports in India. To measure the performance of the port they considered its productivity and port efficiency indicators, which they classified into direct and indirect measures. They found that TFP growth was positive for all ports except in case of Bombay port. Sau (1997) in his study discusses about the relationship of port infrastructure with development and the issues concerning port development. He found that the share of cargo-handled at Culcutta and Haldia ports were declining in the total volume of cargo-handled at all major ports. According to him the major factors responsible for the reduction in cargo-handled was low and undiversified economic growth of the hinterland, port specific factors like deficiency of drafts, low productivity, labour problems and high turn around time also contributed to the delay.

1.3.3 Objectives of The Study: The above mentioned problems have a bearing on the performance of Indian ports. Moreover, for corporatisation of existing major ports or to facilitate private sector entry performance matters therefore, in this context, the specific objectives of the present study are:

- To examine the trends and patterns of cargo-handled at all the major ports in India.
- To identify the major problems faced by the Indian ports.
- To analyse the trends and pattern of output and employment, of Tuticorin port and to examine the changes in the physical assets of the port.
- To understand the role of port-specific factors in affecting cargo-handling operations at Tuticorin port.

1.3.4 Sources of Information and its Limitation: The study relies on both secondary and primary sources of Information.

Secondary Sources of Information: The secondary sources from which information, needed for the study has been collected are Centre for Monitoring Indian Economy (CMIE's) publication on Infrastructure, Economic Survey, various issues of RBI Report on Currency and Finance, RBI Handbook on Statistics of Indian Economy, and Tamil Nadu an Economic Appraisal.

Primary Sources of Information: The primary information needed for the study has been gathered through a primary survey of Tuticorin port. Specific information pertaining to Tuticorin port has been collected from the various Administrative Reports of Tuticorin port and also through informal discussions with the port authorities.

Limitations of Primary Information: The database collected by us from the field had the following limitations. They are: The Administrative Reports of the port did not furnish any details pertaining to cargo handling labourers as cargo handling operations at the port were carried out by private stevedoring firms. Any specific information pertaining to these labourers could not be collected, even from the office of the cargo handling labourers - Tuticorin Port Trust Cargo Handling Labour Pool (TPTCHLP) earlier known as Tuticorin Stevedores Association (TSA). The organisation (TSA) was not maintaining continuous records about these labourers due to absence of official obligation. Details about, the value added each year through port services, tariff rates levied and revenue obtained by handling of principal commodities, etc., were not available in the database collected.

1.3.5 Framework of the Study: The study is based on the following framework. Although, ports fall under the categories of public utilities they function on commercial lines. Their objective is not to maximise profits but rather some notion of social benefits. We have assumed that all-major Indian port together act as an industry and an individual major port acts as a firm. A Terminal with one or two berths has been considered as production unit. Based on time series data we first look into the trends and patterns of cargo handled at all major ports in India. Then we look into the same in case of Tuticorin port and also analyse the factors, which affect the partial productivity of the port by taking a ratio of output to input. A descriptive analytic method has been adopted for the purpose of analysis.

1.3.6 Chapterisation Scheme: The study has been structured as follows. Chapter two provides a broad overview of all the major ports in India followed by a brief discussion about the trends and pattern of cargo-handled at all the major Indian ports. In Chapter three we have discussed the economic and historical factors that had favoured the development of New Port of Tuticorin through a historical narration followed by a detailed presentation on the trends and pattern of cargo-handled at Tuticorin port. In Chapter four we have discussed the role of port-specific factors in affecting the cargo handling operation at Tuticorin port. The last chapter presents the summary and findings of the study.

Chapter II

An Overview of Major Ports in India

Introduction: In this chapter we have discussed about the physical features, performance and problems of Indian ports. Specifically, this chapter deals with the major features of Indian ports in terms of their physical dimensions such as their depth and width, berth and handling capacity, storage, and transportation facilities, as well as total cargo-handled at major ports and their commodity wise distribution. The data sources such as Basic Port Statistics, Economic Survey, India Statistical Abstract, and India Ports are the various publications from which one can get information about Indian ports. Another major source of data on Indian ports is the Centre for Monitoring Indian Economy's (CMIE) publication on infrastructure. Since Basic Port Statistics was not available the data source used by us in this chapter has been taken from CMIE's publication on infrastructure. The structure of this chapter is as follows. The chapter starts with a brief general discussion on ports and their importance. After this we have reviewed the physical features and capacities available for cargo handling at all the major ports in India. Following this we have discussed about the trends and patterns of cargo-handled at all major Indian ports. The Penultimate section of this chapter contains a discussion on the various problems faced by the major ports in India. Finally the chapter concludes by making a case for a detailed study at the micro level to get more insights into the functioning and problems of the Indian ports.

2.1.1 Ports: In general terminology, a port is a point or place from where goods or commodities are loaded and unloaded from a water–based to a land–based mode of transport. A port can also be defined as a nodal point through which an economy or region is connected to the outside world. It is a node through which the imports and exports of a nation take place. According to Bird, "A seaport is best defined in terms of its function as a place where each-way exchanges between land and sea transport regularly takes place." (P.13). Therefore, ports are vital assets for an economy. Ports are mostly located on seacoasts but inland ports on riverbanks also do exist.

2.1.2 Importance of Ports: Ports are strategic assets for a nation from both economic and security point of view. They play a very important role in facilitating the economic development of a country. Economic historians have well documented the role played by ports

in the development of hinterland[1]. They facilitate the transfer of knowledge, wealth, goods and technology from one region to another in a country or from one country to another. For instance ports played a crucial role in the rise of the colonial powers. The industrial revolution was confined especially to the regions along the coasts as ports favoured their development. Rapid industrialisation required raw materials such as iron ore, coal and wood in large quantities. These materials could easily be shipped from colonies in Africa and Asia by ships and unloaded at seaports in the west. Thereby enabling those regions, near to the ports to have an easy access to these materials. Even in the case of India industrialisation had its birth in Mumbai, as it was a port city. Moreover, the existence of an efficient port system increases the competitiveness of a county in international trade. This paves the way for the hinterland to export the surplus produce and import the necessary goods in return. With the advent of globalisation the role played by port in facilitating trade has increased. Exports are being increasingly perceived as a tool for economic development by many developing countries. As a result they are setting up Export Processing Zones, (EPZ) and Special Economic Zones, (SEZ) to increase their export competitiveness. These zones are normally located at a close proximity to seaports or airports. The success of this policy critically depends on the efficiency of port facilities available in the country.

2.1.3 About Indian Ports: India is gifted with an extensive coastline extending over 6,000 km. Since ancient times she has a good maritime relationship with many parts of the world. She was known far and wide for her prosperity and for the produce she produced. Despite possessing such a vast coastline "India has not been able to emerge as a frontrunner in international trade. This has been due to several reasons including her conscious policy of self–reliance through import substitution and her lack of adequate thrust on export promotion." (India Infrastructure Report 1996, p: 414). However, since 1991 India has been following an outward oriented policy regime with the objective of increasing the growth and competitiveness of Indian economy, particularly with respect to industry. In this context improving the available facilities and operational efficiency of 12 major ports and 139 minor ports located along India's vast coastline assume vital importance. Table 2.1 presents the state wise distribution of the 12 major ports and 139 minor ports in India.

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1 The hinterland could be defined as a continuous area behind the port served by it.

Table 2.1: *Distribution of Major and Minor Ports Across Indian States*

State /UT	*Number of Major Ports*	*Number of Minor Ports**	*Total Number of Ports*
West Coast			
Gujarat	1 Kandla	39	40
Maharastra	2 Mumbai, Nava Sheva / Jawaharlal Nehru	52	54
Goa	1 Mormugao	6	7
Karanataka	1 New Mangalore	13	14
Kerala	1 Cochin	13	14
East Coast			
Tamil Nadu	3 Madras, Ennore, Tuticorin		10
Pondicherry	--	2	2
Andhra Pradesh	1 Vizag	9	10
Orissa	1 Paradip	1	2
West Bengal	2 Culcutta, Haldia	--	1
Lakshadweep Islands	--	1	1
Andaman & Nicobar Islands	--	19	19
Total	13	163	174

*Only 139 minor ports have been operating.
Source: India Infrastructure Report (1996).

The primary responsibility for development and management of major ports rests with the central government, while that of intermediate and minor ports fall under the jurisdiction of state governments. The laws and regulations like The Major Ports Act, 1963 and The Indian Ports Act, 1908 enables the Government to exercise its control over the ports. The other acts applicable to the port sector are The Merchant Shipping Act, 1958 (this act describes the powers of the regulatory authority, i.e. the director general of shipping), The Dock Workers (Regulation and Employment) Act, 1948 and the Dock Workers (Safety, Health & Welfare) Act of 1986, which regulates the conditions of employment, service and other matters relating to dock workers.

2.1.4 Management of Indian Ports: In this section we have discussed briefly about the ownership and the governing body of major ports in India. Each major port has a Board of Trustees representing various interests connected with the port operation and the shipping industry. The chairman of each major port is appointed by the central government. Besides the chairman, who is usually an IAS officer, the Port Trust Board comprises of the deputy chairman (usually from the port cadre) and representatives of customs, railways, defence, state government, ship owners, shippers, labour unions etc. Apart from the Chairman and Deputy Chairman all others are part-time members.

2.2.1 Capacities and Facilities Available at All Major Ports in India: In this section we have discussed about the capacities and facilities available at all major ports in India. The capacity of a port is defined as the aggregate capacity of its individual berths. In other words it includes the over all capacity to handle different types of cargo such as liquid bulk, break bulk, dry bulk and containers. Other important facilities required in a port are warehouses, equipment for cargo handling and transport facilities. For convenience as well as for comparison purposes we have classified all the major ports in India based on their geographical location into east coast and west coast ports. Table 2.2 provides some basic information about the physical features and storage capacities of the west coast ports.

Table 2.2: *Physical Features and Storage Facilities Available at Major Ports in West Coast (As at January 2001)*

	Kandla	*Jawaharlal Nehru*	*Mumbai*	*Mormugao*	*New Managalore*	*Cochin*
Physical Features						
Entrance Channel Minimum Depth*	5	11	11	13	15	12
Entrance Channel Minimum Width*	200	350	366	250	245	185
Number of Turning Circles	--	1	1	2	1	2
Turning Circle Diameter*	--	600	366	480	570	260
Total Berth (Nos)	15	15	46	4	9	14
Storage Facilities						
Area of Transit Sheds (Sq. Meters)	17,567	1,00,630	1,33,135	7,700	23,634	28,263
Area of ware houses (Sq. Meters)	44,622	--	1,24,951	17,096	4,380	16,246
Open Area (Sq. Meters)	5,78,020	6,30,000	25,647	1,31,532	37,857	--
Area of Container Freight Stations (Sq. Meters)	--	--	--	--	--	10,732

Note: '--' indicates not available, *denotes that all these features have been expressed in meters
Source: CMIE, "Infrastructure", January (2001).

Table 2.2 reveals that except Kandla all other ports in the West Coast have an entrance channel with draught more than 12 metres. More deepness of the entrance channel enables the port to handle higher capacity ships. The number of berths available at major ports along the west coast varies from 46 in Mumbai to 4 in Mormagao. Similarly warehouses area also varies from a high of about 1,24,951 Sq. Mts. in case of Mumbai to a low of about 4,380 Sq. Mts. in case of New Managalore.

Table 2.3 presents some of the basic physical features and storage facilities available at all major ports along the east coast. The depth of the entrance channel varies from 19 meters in Chennai to 3 meters in Culcutta. The total berths available in the major ports along the east coast vary from 33 in Culcutta to 9 in Paradip. Similarly warehouses area also vary from a

high of about 65,686 Sq. Mts. in case of Chennai to a low of about 7,504 Sq. Mts. in case of Paradip.

Table 2.3: *Physical Features and Storage Facilities Available at Major Ports in East Coast (As at January 2001)*

	Culcutta	*Haldia*	*Paradip*	*Visakhapatnam*	*Chennai*	*Tuticorin*
Physical Capacity						
Entrance Channel Minimum Depth*	3	7	13	107	19	10
Entrance Channel Minimum Width*	200	467	160	122	244	162
Number of Turning Circles	2	1	1	1	1	1
Turning Circle Diameter*	288	549	520	366	548	488
Total Berth (Nos)	33	12	9	19	20	10
Storage Facilities						
Area of Transit Sheds (Sq. Meters)	1,56,396	22,070	11,200	25,935	36,000	10,800
Area of ware houses (Sq. Meters)	--	--	7,504	10,482	65,686	15,500
Open Area (Sq. Meters)	1,55,165	33,310	6,50,000	10,00,663	3,25,000	72,000
Area of Container Freight Stations (Sq. Meters)	--	--	--	--	12,600	--

Note: '--' indicates not available, * denotes that all these features have been expressed in meters.
Source: CMIE, "Infrastructure", January (2001).

Table 2.4 presents information about the total berth capacity, handling and transportation facilities available at all major ports along the west coast. As already mentioned the total berth capacity has been obtained by aggregating the capacity of the individual berths in a port. Where "Berth capacity is determined by the berth's size and length and the size of the vessel it can handle"(India Infrastructure Report 1996, p: 414).

The total berth capacity varies form 39 million tonnes in Kandla to 13.45 million tonnes in Cochin. The capacities available for handling different types of commodities such as liquid bulk, container, break bulk etc have also been given in the table. The Table 2.4 also gives details about equipment available for handling and transportation of cargo.

Table 2.4: *Berth Capacity, Cargo Handling and Transportation Facilities Available at All Major Ports in West Coast* (As at January 2001)

	Kandla	*Jawaharlal Nehru*	*Mumbai*	*Mormugao*	*New Managalore*	*Cochin*
Berth Capacity (Million Tonnes)						
Total Capacity	39	14.6	30.5	19.48	20.25	13.45
Break Bulk	--	--	--	--	--	--
Container	--	10.6	5.5	--	--	1.0
POL	31	--	21	1.5	11	10.5
Thermal Coal	--	--	-	--	--	--
Fertilisers Finished	--	1.5	--	--	--	6
Iron ore	--	--	--	16.5	7.5	--
Cargo Handling Equipment (Nos)						
Wharf Cranes	16	4	52	--	3	7
Mobile Cranes	--	2	27	1	3	14
Forklift Trucks	9	6	54	9	7	47
Transportation Facility (Nos)						
Payloaders & Shovel dozers	2	20	--	--	1	--
Tractors	3	38	30	--	1	29
Trailers	1	136	--	--	1	32
Locomotives	--	--	11	2	--	--

Note: '--' indicates not available.
Source: CMIE, "Infrastructure", January (2001).

Table 2.5: *Berth Capacity, Cargo Handling and Transportation Facilities Available at All Major Ports in East Coast* (As at January 2001)

	Culcutta	*Haldia*	*Paradip*	*Visakhapatnam*	*Chennai*	*Tuticorin*
Berth Capacity (Million Tonnes)						
Total Capacity	8.3	28.7	12.85	30.8	27.62	12.5
Break Bulk	1.9	--	--	--	--	--
Container	3.0	0.3	3.0	--	2.5	1.8
POL	3.4	17	1.5	10.8	8.5	2.3
Thermal Coal	--	--	--	--	--	--
Fertiliser Finished	--	--	0.85	0.5	--	--
Iron ore	--	--	3.0	8	8	1
Cargo Handling Equipment (Nos)						
Wharf Cranes	37	--	4	--	26	10
Mobile Cranes	24	2	4	--	10	8
Forklift Trucks	26	7	10	--	58	6
Transportation Facility (Nos)						
Pay loaders & Shovel dozers	--	12	4	--	6	3
Tractors	42	1	1	--	47	--
Trailers	94	5	1	--	53	--
Locomotives	20	11	7	--	12	--

Note: '--' indicates not available
Source: CMIE, "Infrastructure", January (2001).

Table 2.5 presents the total berth capacity, handling and transportation facilities available at all major ports located in the east coast. The table reveals that total berth capacity varies from 30.8 million tonnes in case of Visakhapatnam to about 8.3 million tonnes in the case of Culcutta. The distribution of berth capacity to handle different types of commodities across

ports is determined by the proximity of the port either to the suppliers of the commodity or to the users of the commodity. For instance ports that are located near to oil refineries have a higher liquid bulk capacity to facilitate the handling of petroleum products.

2.3 Trends and Patterns of Traffic Handled at All Major Ports in India: In the following subsections we have discussed about the trends and pattern of traffic handled at all major ports in India. This comprises of the commodity wise distribution of cargo-handled, classification of total cargo-handled into import and export traffic, overseas and coastal traffic, category-wise cargo-handled and container traffic. We begin with the commodity-wise distribution of cargo-handled at all major Indian ports.

2.3.1 Trends and Patterns of Major Commodities Handled at All Major Indian Ports: In this section we have discussed about the trends and patterns of principal commodities handled at all major Indian ports. The total cargo-handled registered a growth rate of 5.43 per cent during the period 1970-71 to 1999-00 and the average tonnage handled was around 128.68 million tonnes during this period[2]. The decade wise growth rates of cargo-handled revealed that it was high during the second and third period compared to the first. To understand the reasons behind the increase in the growth rates of total cargo-handled over the period one needs specific information about the economic situation of the hinterland as well as the international economic scenario. Although one can expect an increased growth rate for the total cargo-handled during the nineties because of the trade liberalisation policies introduced in India, the data does not support this expectation. However, we make an attempt to explain this phenomenon briefly in the ensuing paragraphs. The following paragraphs contain a discussion on the commodity-wise distribution of total cargo-handled at all major ports in India. Due to the non-availability of data on all the commodities handled we confine our analysis to the principal commodities only. These commodities are POL, fertiliser finished, fertiliser raw materials, food grains, iron ore, and coal. All the other commodities are included in the category of other cargo. All these commodities have been expressed in million tonnes. The period of analysis remains the same as mentioned above.

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[2] The formula that has been used for computing growth rate is $Y_t = Y_0(1+r)^t$ where Y_t is the final time point, Y_0 is the initial time point, t indicates the number of years and r the compound growth rate.

Table 2.6: *Growth Rates and Shares of Major Commodities Handled at All Major Ports in India During 1970-71 to 1999-00*

	POL	*Fertiliser Finished*	*Fertiliser Raw Materials*	*Food grains*	*Iron ore*	*Coal*	*Other Cargo*	*Total Cargo*
Decade wise Summaries								
				1970-71 to 1979-80				
CGR (%)	3.5	11.74	8.55	-10.22	1.76	11.77	5.21	3.39
Avg Share (%)	35.39	3.47	2.43	4.75	32	1.81	20.15	100
				1980-81 to 1989-90				
CGR (%)	6.32	-3.74	10.39	4.63	3.81	23.69	5.59	6.28
Avg Share (%)	44.24	2.82	2.57	1.79	24.29	6.50	17.80	100
				1990-91 to 1999-00				
CGR (%)	4.34	6.76	-2.80	5.76	-0.5	6.55	13.86	6.01
Avg Share (%)	42.04	2.06	2.11	1.08	16.37	14.86	21.48	100
Overall Summaries								
				1970-71 to 1999-00				
CGR (%)	5.64	5.15	5.05	-0.59	1.54	14.29	7.30	5.43
Avg Share (%)	40.55	2.78	2.37	2.54	24.22	7.72	19.81	100

Source: CMIE, "Infrastructure", January (2001)

Table 2.6 presents the growth rates and shares of each principal commodity in the total cargo-handled at all major ports in India during the period 1970-71 to 1999-00. The growth rates and shares have also been computed for the three-sub period namely, 1970-71 to 1979-80, 1980-81 to 1989-90 and 1990-91 to 1999-00. From the table it is clear that POL occupied a substantial share in the total cargo-handled. For the entire period the share of POL in the total cargo-handled was 40.55 per cent, and its share increased from the first period to the second period and it marginally declined during the last period. The growth rates revealed that in the second sub period POL had a higher growth rate compared with the entire period as well as the other sub periods. This higher share of POL in total cargo-handled can be due to India's dependency on oil producing countries for her oil requirements. The share of coal in the total cargo-handled has also been increasing over time. It occupied a share of 1.81 per cent during the first period 6.5 per cent during the second period and it further increased to 14.86 per cent during the third period. This increase in the share of the coal can be due to the increased demand from the thermal power stations in the country. The table also revealed that the shares of fertiliser finished, food grains and iron ore has been declining from one period to another. The declining trend observed in the shares of these commodities can be either due to an increase in their imports or due to an increase in their exports. (The detailed results of this analysis have been given in the appendix refer to tables A 2.1 and A 2.2 and Figure A 2.1 and A 2.2)

Having looked into the trends in major commodities handled at all major ports during 1970-71 to 1999-00. An attempt has been made in the following section to understand the trends in import and export of principal commodities handled at all major Indian ports during the period 1992-93 to 1999-00. The results have been presented in Table 2.7

Table 2.7: *Summary Details of Imports and Exports of Major Commodities Handled at All Major Ports During 1992-93 to 1999-2000*

	POL	*Fertiliser Finished*	*Fertiliser Raw Materials*	*Food grain*	*Iron ore*	*Coal*	*Other Cargo*	*Containers*	*Total Cargo*
Imports (mt)									
AVG	67.52	4.55	5.17	1.04	0.41	22.46	7.49	8.58	125.89
Avg Share (%)	53.93	3.68	4.02	0.81	0.31	17.72	5.95	6.60	--
CGR (%)	5.78	5.60	6.76	-0.58	37.84	8.59	4.35	16.77	6.89
Exports (mt)									
AVG	16.17	--	--	1.45	34.36	11.7	5.55	9.95	83.32
Avg Share (%)	19.61	--	--	1.7	41.37	13.97	6.61	11.74	-
CGR (%)	-2.39	--	--	8.06	2.5	5.28	7.6	13.36	3.36

Source: CMIE, "Infrastructure", January (2001).

We begin our discussion by considering the trends in the import traffic of these commodities handled at all the major ports in India. The data revealed that, the average tonnage of import cargo-handled at all major ports during the period 1992-93 to 1999-00 was 125.89 million tonnes, and it registered a growth rate of 6.89 per cent during the same period. POL was the most prominent commodity to be imported during this period. Although import of iron ore recorded the highest growth rate (37.84 per cent) it occupied only a meagre share in the total import cargo (0.31 per cent). Coal and container cargo registered a growth rate of 8.59 per cent and 16.77 per cent and their share was17.72 per cent and 6.6 per cent respectively during the same period. The other commodities share was nominal and its growth rate was positive with food grains alone being an exception.

On the export front the data revealed that, the average tonnage of the export cargo handled was 83.32 million tonnes, and it registered a growth rate of 3.36 per cent during the period 1992-93 to 1999-00. In the export cargo basket iron ore was the most prominent commodity to be handled. It occupied a share of 41.37 per cent and it registered a growth rate of 2.5 per cent during the same period. The share of POL in export basket was19.61 per cent and it recorded a negative growth rate of -2.39 per cent. In case of containers the share of export traffic was higher than the share of import traffic. Raw material for fertiliser and fertiliser finished did not

figure in the export basket. Analysis of transhipment traffic[3] revealed that on average 10.91 million tonnes of cargo was transhipped. Its share was 4.69 per cent of the total cargo-handled. Transhipment traffic registered a growth rate of 25.3 per cent during the same period.

In the above two paragraphs we have analysed the trends in export and import of principal commodities handled at all major ports in India. The analysis revealed that import cargo grew at a higher rate than export cargo. This result has been in agreement with the macro picture of a higher import growth rate registered during 1990s. Trade liberalisation policies introduced since 1991 has been stimulating the import growth rate of the economy rather than exports. Moreover, export usually responds to this kind of polices with a lag. This can be a cause for the lower growth rate of export cargo.

2.3.2 Analysis of Import, Export and Transhipment Traffic Handled at All Major Ports:
In the following paragraphs we have analysed the export, import and transhipment traffic handled at each major port individually. The period of analysis has been from 1992-93 to 1999-00. We have first looked into the import traffic handled at all major ports. We have computed the following summary measures such as average, coefficient of variation (CV) and compound growth rate (CGR) for the import traffic handled at each major port. Based on the growth rates computed we have sorted the ports in ascending order. We have also calculated the share of each major port in the combined import traffic of all major ports. For the shares also we have computed growth rates and arranged the ports in ascending order based on this growth rate computed. This second sorting kept the earlier order intact. The same procedure has been followed for the exports and transhipment traffic also. The results have been provided in the Table 2.8, Table 2.9, and Table 2.10.

[3] Transhipment traffic refers to the transfer of cargo from one ship to another at sea with the objective of sending it to another destination.

Table 2.8: *Descriptive Summaries of Import Traffic Handled at All Major Ports During 1992-93 to 1999-00*

Imports	*Avg*	*CV*	*CGR*	*Import Traffic as % of Major Port Total Import Traffic*	*CGR of Import Traffic Percentages*	*Import Traffic as % Major Ports Total Traffic*	*CGR of Total Traffic Percentages*
Mumbai	17.71	7.87	2.96	14.38	-3.68	8.17	-3.16
Culcutta	4.11	11.35	3.59	3.32	-3.09	6.89	-2.56
Tuticorin	7.29	16.56	4.91	5.83	-1.86	3.32	-1.33
Visakhapatnam	14.15	13.77	5.19	11.37	-1.59	6.47	-1.06
Cochin	8.72	19.17	5.59	6.94	-1.22	3.95	-0.68
Chennai	20.62	18.44	6.50	16.41	-0.37	9.35	0.17
Haldia	11.72	20.86	7.00	9.3	0.10	5.30	0.64
Kandla	27.12	22.12	7.30	21.47	0.38	12.24	0.93
Mormugao	2.07	27.78	9.03	1.64	2.00	0.94	2.55
Paradip	3.70	27.36	9.96	2.9	2.87	1.65	3.43
JNPT	4.66	52.04	19.72	3.5	12.00	2.01	12.60
New Mangalore	4.02	70.62	23.79	2.93	15.81	1.69	16.44
All Major Ports	125.89	19.80	6.89			56.98	0.54

Source: CMIE, "Infrastructure", January (2001)

Table 2.9: *Descriptive Summaries of Export Traffic Handled at All Major Ports During 1992-93 to 1999-00*

Exports	*Avg*	*CV*	*CGR*	*Export Traffic as % of Major Port Total Export Traffic*	*CGR of Export Traffic Percentages*	*Export Traffic As % Major Ports Total Traffic*	*CGR of Total Traffic Percentages*
Mumbai	13.57	15.50	-3.69	16.47	-6.83	6.4	-9.41
Calcutta	1.53	15.76	-2.68	1.86	-5.85	.72	-8.46
Mormugao	15.81	9.78	0.88	19.05	-2.40	7.34	-5.12
Haldia	5.14	20.21	2.56	6.14	-0.77	2.34	-3.53
Chennai	9.55	8.49	2.79	11.49	-0.56	4.41	-3.32
Visakhapatnam	12.84	11.31	4.64	15.39	1.23	5.89	-1.52
Kandla	3.81	17.36	5.41	4.55	1.98	1.75	-0.86
New Mangalore	7.49	16.85	6.43	8.95	2.96	3.42	0.10
Paradip	7.33	19.31	6.94	8.73	3.46	3.32	.59
Cochin	1.94	29.14	8.82	2.29	5.28	.87	2.36
Tuticorin	1.41	27.75	12.44	1.67	8.78	.63	5.76
JNPT	2.93	56.79	26.21	3.41	22.10	1.25	18.71
All Major Ports	83.32	9.98	3.36			38.32	-2.78

Source: CMIE, "Infrastructure", January (2001)

Table 2.10: *Descriptive Summaries of Transhipment Traffic Handled at All Major Ports During 1992-93 to 1999-00*

Transhipment	*Avg*	*CV*	*CGR*	*Transhipment As % of Major Ports TOTAL Transhipment Traffic*	*CGR of Transhipment Traffic in Percentages*	*Transhipment as % Major Ports Total Traffic*	*CGR of Total Traffic in Percentages*
Paradip	0.10	0.17	-42.74	1.88	-55.23	0.05	-46.19
Mormugao	0.46	0.55	-40.35	7.84	-52.39	0.24	-45.02
New Mangalore	0.01	0.03	-28.31	0.09	-37.89	0.01	-31.45
Chennai	1.34	0.44	-2.57	16.79	-22.24	0.63	-8.36
JNPT	0.16	0.15	-0.89	1.45	-19.05	0.07	-6.05
Cochin	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haldia	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Tuticorin	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Visakhapatnam	5.12	3.03	26.14	47.46	0.68	2.22	18.65
Mumbai	0.35	0.49	41.05	2.85	12.57	0.15	32.67
Culcutta	1.32	2.21	85.58	8.17	55.27	0.51	74.85
Kandla	2.05	2.87	86.87	13.47	52.63	0.81	77.14
All Major Ports	10.91	7.29	25.30			4.69	17.85

Source: CMIE, "Infrastructure", January (2001)

On the basis of the above analysis we have arrived at the following conclusions. The growth rates of import and export traffic handled at JNPT were higher during the period of analysis. In case of Tuticorin, export traffic registered a higher growth rate than import traffic. Mumbai and Culcutta ports have emerged as prominent transhipment ports among all the major ports. They have lost their respective share of import and export cargo handling to newly constructed ports like JNPT and Haldia. During the period under consideration transhipment traffic handled at all major ports grew at a faster rate compared to import and export traffic.

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2.3.3 Trends in Overseas and Coastal Cargo-handled at All Major Ports: The total cargo-handled at a port can be classified into two, namely overseas bound cargo and coastal bound cargo. Overseas cargo traffic refers to the cargo movement from the home country to a foreign country or otherwise. Coastal traffic on the other hand refers to the movement of cargo from one port to another inside the home country. The period of analysis is from 1991-92 to 1999-00. Table 2.11 presents the growth rates and shares of overseas and coastal cargo traffic handled at all major Indian ports.

DISS
X,428.44 P
P1

DISS
387.10954
Su165 Pe
TH9642

Table 2.11: *Growth Rates and Shares of Overseas & Coastal Cargo Traffic Handled at All Major Ports During 1991-92 to 1999-00*

	Total Overseas Cargo (MT)	*Total Coastal Cargo (MT)*	*Total Cargo (MT)*
Avg Share (%)	70.75	29.25	100
CGR (%)	7.31	4.74	6.51

Source: CMIE, "Infrastructure", January (2001)

The total cargo-handled (sum of overseas and coastal) registered a growth rate of 6.51 per cent during the period 1991-92 to 1999-00. A disaggregation of the data into overseas and coastal[4] revealed that overseas cargo registered a growth rate of 7.31 per cent and it was higher than that of coastal cargo-handled (4.74 per cent). In terms of shares also overseas cargo occupied a higher share than coastal cargo 70.75 per cent compared with 29.25 per cent. The analysis revealed that coastal traffic handled at all major ports at the aggregate level showed a relative decline. This decline in the share as well as in the growth rate of coastal traffic handled could be due to competition faced by water transport from other modes of surface transport.

2.3.4 Category-wise Cargo-handled at all Major Indian Ports: In this section we have discussed about the category-wise cargo-handled at all major ports in India. Based on the nature of the commodity, the cargo-handled can be broadly classified into break bulk, conventional dry bulk, liquid bulk and containers.[5] The period of analysis is from 1993-94 to 1999-00. The total volume of cargo-handled based on this classification registered a growth rate of 6.13 per cent during 1993-94 to 1999-00 (refer to Table 2.12)

Table 2.12: *Summary Results of Category-wise Cargo-handled at All Major Ports During 1993-94 to 1999-00*

	Break Bulk	*Con Dry Bulk*	*Mech Dry Bulk*	*Liquid Bulk*	*Container*	*Total Cargo*
Avg Share (%)	6.88	18.06	20.46	45.92	8.68	100
CGR (%)	3.87	7.76	1.37	6.86	12.36	6.13

Source: CMIE, "Infrastructure", January (2001)

Category-wise analysis of cargo-handled revealed that container traffic recorded the highest growth rate (12.36 per cent) during the period under observation and break bulk recorded the lowest growth rate. Liquid bulk with a share of 45.92 per cent was the most prominent commodity to be handled during the period. The growth rate of container traffic was higher

[4] Coastal refers to cargo movement from one port in India to another.

[5] Break bulk includes commodities like bauxite, sugar, cement, timber, granite etc. Dry bulk includes commodities like thermal, industrial and coaking coal, rock phosphate, iron scrap, iron pellets etc. Liquid bulk includes commodities like POL, liquid ammonia, naphtha, furnace oil, molasses, LPG etc.

when compared with others. This indicates that in the future Indian ports will be handling a higher share of container traffic. Moreover, technological changes taking place in packing indicate that the chances for containerisation of break bulk commodities are also high. Demand for liquid bulk commodities would also go up in the coming years as India has been depending on foreign countries for supply of POL and other related products. Therefore, the shares of these two categories of commodities handled at all major ports can be expected to go up in future.

2.3.5 Container Traffic Handled at All Major Ports in India: Containerisation has been acclaimed as a major breakthrough in maritime transport though functionally it is no more than a box. As a technological revolution it has economised the number of movements required to convey a given quantity of good with speedy inter-modal transfers, low handling costs and also greater protection from damage and loss than they would other wise have received.

Table 2.13: *Summary Results of Container Traffic and its Shares Handled at All Major Indian Ports During 1993-94 to 1999-00*

	Stdev	*Avg*	*CV*	*CGR*	*PCT TO TCT*	*CGR Share*	*PCT TO TC*	*CGR Share*
New Mangalore	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Paradip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mumbai	0.90	6.81	13.16	2.47	35.45	-8.81	3.01	-3.45
Culcutta	0.25	1.88	13.37	6.10	9.67	-5.58	0.83	-0.03
Kandla	0.21	1.00	20.84	6.49	5.12	-5.22	0.44	0.34
Chennai	0.77	2.63	29.36	13.83	13.06	1.31	1.13	7.25
Cochin	0.27	0.88	30.31	16.58	4.34	3.76	0.38	9.85
Visakhapatnam	0.06	0.15	40.27	18.26	0.73	5.25	0.06	11.42
Tuticorin	0.41	0.95	42.52	22.04	4.57	8.61	0.40	14.99
Haldia	0.18	0.23	78.74	25.81	1.02	11.97	0.09	18.54
Mormugao	0.01	0.03	52.01	25.85	0.13	12.00	0.01	18.58
JNPT	2.93	5.52	53.05	25.92	25.88	12.06	2.31	18.64
Total Containers	27.89	29.24	95.39	33.34			8.68	5.87
Total Cargo All India	33.00	227.77	14.49	6.13				

Note: CV & CGR are in percentages. PCT to TCT-Proportion of Container Traffic handled to Total Container Traffic. PCT to TC-Proportion of Container Traffic handled to Total Cargo- handled.
Source: CMIE, "Infrastructure", January (2001)

In this section we have discussed about the trends in container traffic handled at all the major ports in India during the period 1993-94 to 1999-00. Total Container Traffic (TCT) handled at all major ports registered a growth rate of 33.34 per cent during the period 1992-93 to 1999-00. The proportion of container traffic handled to total cargo-handled (PCT to TC) stood at 8.68 per cent during the same period. A disaggregated level analysis carried at the individual

port level revealed that JNPT registered the highest growth rate in container traffic (25.92 per cent) during the period from 1993-94 to 1999-00. The share of JNPT in total container traffic handled at all major ports combined (PCT to TCT) was 25.88 per cent and its share in total cargo-handled at all major ports was (PCT to TC) was 2.31 per cent. The share of container traffic handled at Tuticorin port in total container traffic was 4.57 per cent during the same period. The ports of New Mangalore and Paradip handled negligible or no container traffic.

From the trends it is clear that the steps taken by Government of India to build container terminals at major Indian ports have proved fruitful. This is evident from the high container traffic handled at Jawaharlal Nehru, Tuticorin, Haldia and Mormugao ports. The ports of Mumbai, Culcutta and Kandla showed a declining trend in their shares of container traffic. This could be mainly due to the development of new container terminals in other ports close to their location[6]. As new private sector ports begin to emerge, and with the entry of private operators in container handling within existing major Indian ports India's container traffic market can surely be expected to grow.

2.4 Problem's Faced by Indian Ports[7]: Although, there has been an increase and also diversification in the cargo basket handled at all the major Indian ports over the years, they have also been facing many problems. Resolution of these problems is necessary to equip the Indian ports to meet the challenges of globalisation and liberalisation. So an analysis of the problems faced by major Indian ports has been attempted in this section. One of the major problems faced by Indian ports is that they are much costlier than the other ports in the region (According to World Bank estimate container delays at Indian ports cost $70 million a year). This higher cost has been mainly due to two-reason (1) Lower productivity of the ports and (2) Increased turn around time at Indian ports. This increased cost has the effect of diverting the cargo traffic to other ports in the region.

Possible reasons for the lower productivity of major ports can be many such as wrong specification of the berths in Indian ports. To quote from Peters (1997) "India's ports were originally designed to handle specific categories of traffic which have declined over time while other types traffic have gained importance. But the ports' berth configurations were not

[6] Mumbai port faces inter-port competition in container traffic from Nava Sheva Port or Jawaharlal Nehru Port Trust (JNPT), Culcutta port from Haldia Port, Kandla from JNPT and recently it has started facing competition from India's first private the sector port Pipav.

[7] The India Infrastructure Report (1996)

adjusted to the categories of cargo, which grew most. In almost all ports productivity levels are extremely low by the international standards. The documentary procedures related to cargo handling ... are extremely complicated. Land-side port access facilities and arrangements for moving inbound and outbound cargo are unsatisfactory" (pp.7-8).

Besides the incompatible berth configuration, the other frequently mentioned reasons for lower productivity of Indian ports are

1. Inadequate facilitates for cargo handling and insufficient equipments for deepening of entrance channel and wharves.
2. Operational constraints faced by major ports in cargo handling operations such as frequent breakdowns of cargo-handling equipment due to obsolescence or wrong specification of equipment, poor maintenance of equipment etc.
3. Inefficient and non-optimal deployment of port equipment.
4. Inadequate and inefficient supporting infrastructure facilities such as communication networks, poor road and rail links, erratic power supply etc.
5. Labour intensive methods adopted for handling bulk cargo and sensitive commodities like thermal coal, at major ports causes excessive delay in the loading and unloading operations.
6. Poor co-ordination among the different departments likes customs and port authorities further hampers cargo handling.
7. Insufficient depth along the coastline especially in the case of east coast ports
8. Apart from the efficiency in its own operations, the productivity of a port crucially depends on the efficiency of various operators such as stevedores, truckers, railways etc.

One of the important commodities handled at Indian ports is POL. Some of the major problems faced by Indian ports while handling POL are as follows:

The availability of POL jetties at major ports have not been adequate to cater to the number of tankers calling at these ports for discharging and loading operations. Some of these jetties are shared with non-POL traffic and also for parallel marketing of cargoes.

Another problem, which we have mentioned above, is the higher turn around time at the Indian ports. This high turn around time increases the cost of shipping and thus, compels the

international shipping liners not to anchor at Indian ports. The average ship turn around time in 1996-97 was 7.8 days; it was even higher, 8.1 days in 1990-91 (Government of India, 1998, p.138). According to Sreenivasan (2000) "Compared to Singapore port where the turn around time is a few hours rather than several days, and other ports in the Asian region, Indian ports are abysmally inefficient" (pp.59).

All these problems coupled together act as major hindrance to the port users especially to the export oriented manufacturing industries, which prevent these firms from enjoying a comparative advantage in the world market. These factors also prevent India from enjoying the fruits of liberalisation and globalisation.

2.5 Summary and Conclusion: In this chapter we began with a brief discussion about ports and their importance. Then we looked into the physical features, berth capacity, cargo handling equipments capacity, storage, and transportation facilities available at all major Indian ports. We then focussed on the trends in principal commodities handled at all major Indian ports followed by export, import and transhipment traffic handled at each major port in India during 1992-93 to 1999-00. Then we analysed overseas and coastal traffic, after that we analysed category-wise cargo handled at all major ports. After this we discussed about container traffic handled at all major ports in India. Finally in the last section we discussed about the problems faced by all major ports India.

The findings of this chapter are during the period 1970-71 to 1999-00 the total cargo-handled at all major ports grew by 5.43 per cent. Of all the principal commodities handled at the major ports the share of iron ore has been falling over time. The results of the sub period wise analysis indicated that the growth rate of total cargo-handled at all major ports in the country grew at a marginally slower rate during nineties than compared with the eighties. Analysis of exports and imports of principal commodities during nineties revealed that import of these commodities registered a higher growth rate compared to export of these commodities confirming the fact that exports usually respond to trade related policy changes with a lag. Analysis of import, export and transhipment traffic handled at all the major ports revealed that in case of both exports and imports traffic JNPT performed well. Tuticorin port registered a high growth rate in export traffic during the nineties. The ports of Mumbai and Culcutta recorded a higher growth rate for transhipment traffic indicating that they have been increasingly receiving high transhipment traffic compared to other major ports. Comparison

between overseas and coastal traffic revealed that overseas traffic grew at a faster rate than coastal traffic. Further, it also revealed that over time coastal traffic handled at all the major ports was declining due to competition from other modes of surface transport. Category-wise classification of cargo-handled revealed that container traffic registered a higher growth rate compared to others. Liquid bulk figured prominently in the category-wise cargo classification list followed by bulk commodities. Analysis of container traffic handled at all the major ports revealed that JNPT registered the highest growth rate in container traffic but in share terms Mumbai port handled a substantial portion of the container traffic. Tuticorin also registered a robust growth rate in terms of container traffic. After looking into the trends and patterns in traffic handled at all the major Indian port we have focussed our attention on the problems that hinder cargo-handling operations at the major ports. The discussion on the problems faced by Indian ports revealed that lower productivity and higher turn around time at Indian ports adversely affect cargo-handling operations. Since India has already entered into an era of open policy regime infrastructure bottlenecks like this demands immediate attention by the policy makers. But effective policy actions to resolve these problems require a lot of information on the reasons and inter linkages of these problems at the micro level. This warrants a detailed study on the functioning of major Indian ports. Since it is not possible to include all the major ports in India in a single study, we have taken Tuticorin port as case for such a study. Hence, in the following two chapters we have discussed about the trends and patterns of cargo handling and the factors, which hinder the same in case of Tuticorin in detail.

Appendix Tables

Table A 2.1: *Summary Details of Major Commodities Handled at All Major Ports in India During 1970-71 to 1999-00*

(In Million Tonnes)

	POL	*Fertiliser Finished*	*Fertiliser Raw Materials*	*Food grains*	*Iron ore*	*Coal*	*Other Cargo*	*Total Cargo*
Decade wise Summaries								
1970-71 to 1979-80								
CGR	3.50	11.74	8.55	-10.22	1.76	11.77	5.21	3.39
STDEV	2.65	0.80	0.42	2.09	1.15	0.43	2.58	6.51
AVG	23.10	2.30	1.60	3.06	20.78	1.20	13.22	65.27
CV	11.48	35.01	26.17	68.35	5.56	36.15	19.51	9.97
MAX	27.40	3.72	2.36	6.86	22.85	2.05	18.85	77.59
MIN	18.89	1.23	1.04	0.92	19.20	0.68	10.56	55.58
1980-81 to 1989-90								
CGR	6.32	-3.74	10.39	4.63	3.81	23.69	5.59	6.28
STDEV	10.42	1.10	1.50	0.89	4.22	5.45	4.94	24.47
AVG	50.20	2.96	3.04	1.96	27.23	8.06	20.28	113.74
CV	20.75	37.16	49.36	45.53	15.50	67.56	24.36	21.51
MAX	63.17	4.28	5.19	3.42	33.19	17.69	26.96	147.58
MIN	33.58	1.42	0.24	0.98	21.95	2.11	14.56	80.27
1990-91 to 1999-00								
CGR	4.34	6.76	-2.80	5.76	-0.50	6.65	13.86	6.01
STDEV	15.30	1.00	0.76	0.94	2.26	8.02	20.96	43.07
AVG	86.44	4.25	4.17	2.28	32.61	31.01	46.27	207.02
CV	17.70	23.46	18.15	41.28	6.94	25.87	45.30	20.80
MAX	107.40	5.78	6.06	3.57	35.87	42.50	93.86	271.92
MIN	64.00	2.88	3.19	0.88	29.40	19.66	10.56	151.67
Over all Summaries								
1970-71 to 1999-00								
CGR	5.64	5.15	5.05	-0.59	1.54	14.29	7.30	5.43
STDEV	28.37	1.25	1.44	1.45	5.63	14.05	18.84	65.99
AVG	53.25	3.17	2.94	2.43	26.87	13.43	26.59	128.68
CV	53.28	39.43	49.02	59.64	20.95	104.64	70.84	51.28
MAX	107.40	5.78	6.06	6.86	35.87	42.50	93.86	271.92
MIN	18.89	1.23	0.24	0.88	19.20	0.68	10.56	55.58

Note: CGR refers to Compound Growth Rate, STDEV refers to standard deviation, AVG refers to average, CV refers to Coefficient of Variation, MAX refers to maximum value and MIN refers to minimum value.
Source: CMIE, "Infrastructure", January (2001)

Table A 2.2: *Summary Details of Shares of Major Commodities Handled at All Major Ports in India During 1970-71 to 1999-00*

	POL	*Fertiliser Finished*	*Fertiliser Raw Materials*	*Food grains*	*Iron ore*	*Coal*	*Other Cargo*
Decade wise Summaries of Proportions							
1970-71 to 1979-80							
MAX	38.61	4.98	3.04	10.39	34.55	2.65	24.29
MIN	32.08	2.21	1.69	1.30	28.34	1.21	16.59
STDEV	2.01	0.94	0.47	3.17	2.06	0.51	2.23
AVG	35.39	3.47	2.43	4.75	32.00	1.81	20.15
CV	5.69	27.10	19.11	66.79	6.42	28.23	11.08
CGR	0.11	8.07	4.99	-13.16	-1.58	8.10	1.75
1980-81 to 1989-90							
MAX	49.75	5.53	3.52	3.55	28.54	11.99	20.57
MIN	38.82	1.05	0.26	0.95	21.36	2.63	15.22
STDEV	3.32	1.42	0.92	0.90	2.45	3.17	1.76
AVG	44.24	2.82	2.57	1.79	24.29	6.50	17.80
CV	7.50	50.28	35.90	50.52	10.11	48.70	9.90
CGR	0.04	-9.43	3.87	-1.55	-2.32	16.39	-0.65
1990-91 to 1999-00							
MAX	44.19	2.68	4.00	1.43	21.04	16.88	34.52
MIN	35.99	1.47	1.61	0.44	11.16	12.96	16.25
STDEV	2.31	0.33	0.73	0.33	3.43	1.24	5.29
AVG	42.04	2.06	2.11	1.08	16.37	14.86	21.48
CV	5.51	15.79	34.42	30.73	20.98	8.32	24.62
CGR	-1.58	0.71	-8.31	-0.24	-6.14	0.51	7.40
Over all Summary of Proportions							
1970-71 to 1999-00							
MAX	49.75	5.33	4.00	10.39	34.55	16.88	34.52
MIN	32.08	1.05	0.26	0.44	11.16	1.21	15.22
STDEV	4.58	1.13	0.73	2.46	7	5.81	3.69
AVG	40.55	2.78	2.37	2.54	24.22	7.72	19.81
CV	11.29	40.52	30.77	96.70	28.89	75.27	18.60
CGR	0.19	-0.27	-0.36	-5.71	-3.70	8.40	1.77

Source: CMIE, "Infrastructure", January (2001)

Appendix Figures

Figure A 2.1: *Trends in Principal Commodities Handled at All Major Ports in India During 1970-71 to 1999-00*

(Million Tonnes)

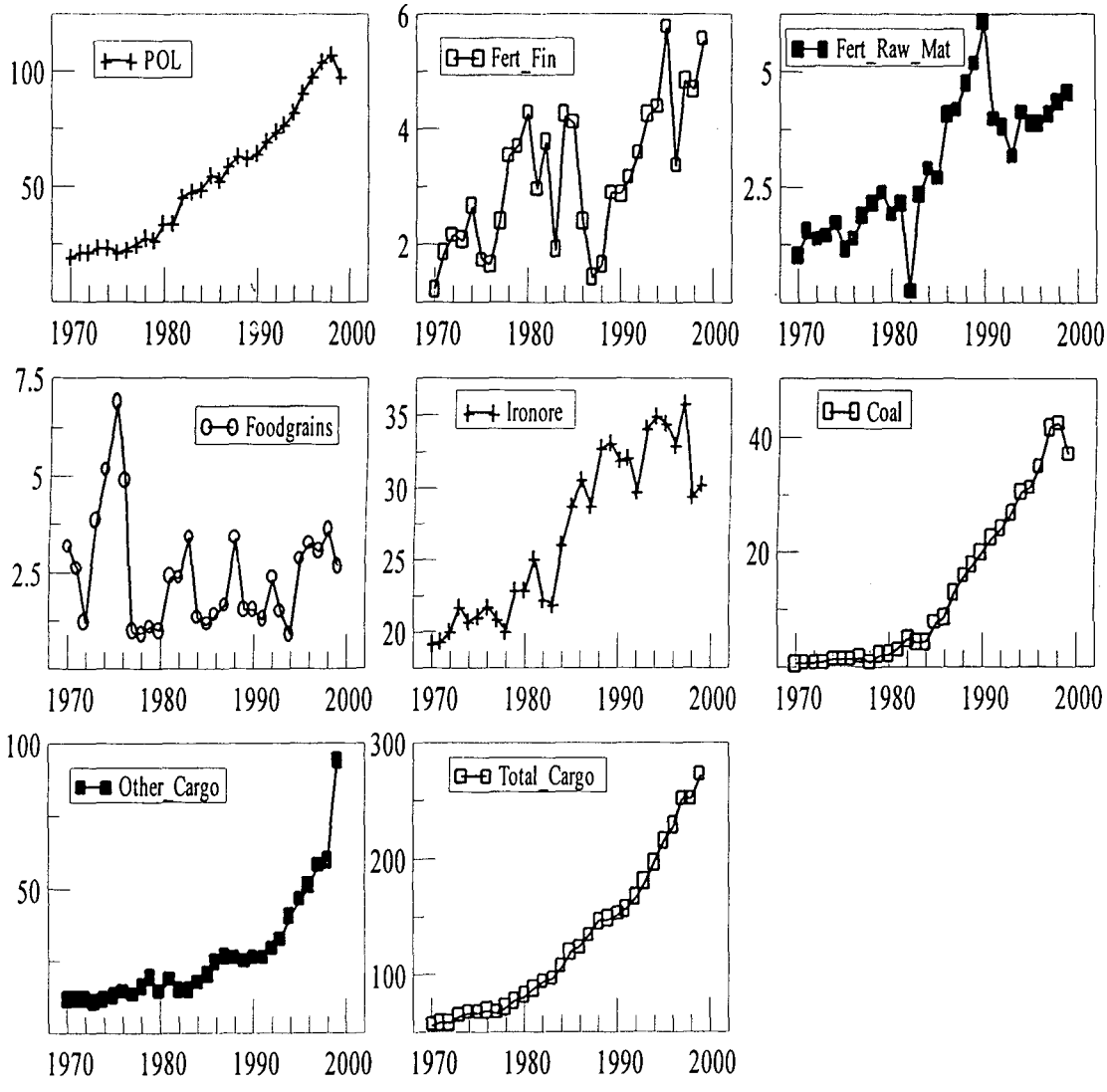


Fig 2.1.1 Petroleum, Oil and Lubricants (POL)
Fig 2.1.2 Fertiliser Finished (Fert_Fin)
Fig 2.1.3 Fertiliser Raw Materials (Fert_Raw_Mat)
Fig 2.1.4 Food grains
Fig 2.1.5 Iron ore
Fig 2.1.6 Coal
Fig 2.1.7 Other Cargo
Fig 2.1.8 Total Cargo
Source: CMIE, "Infrastructure", January (2001)

Figure A 2.2: *Share of Principal Commodities Handled at All Major Ports in India During 1970-71 to 1999-00*

(In Percentages)

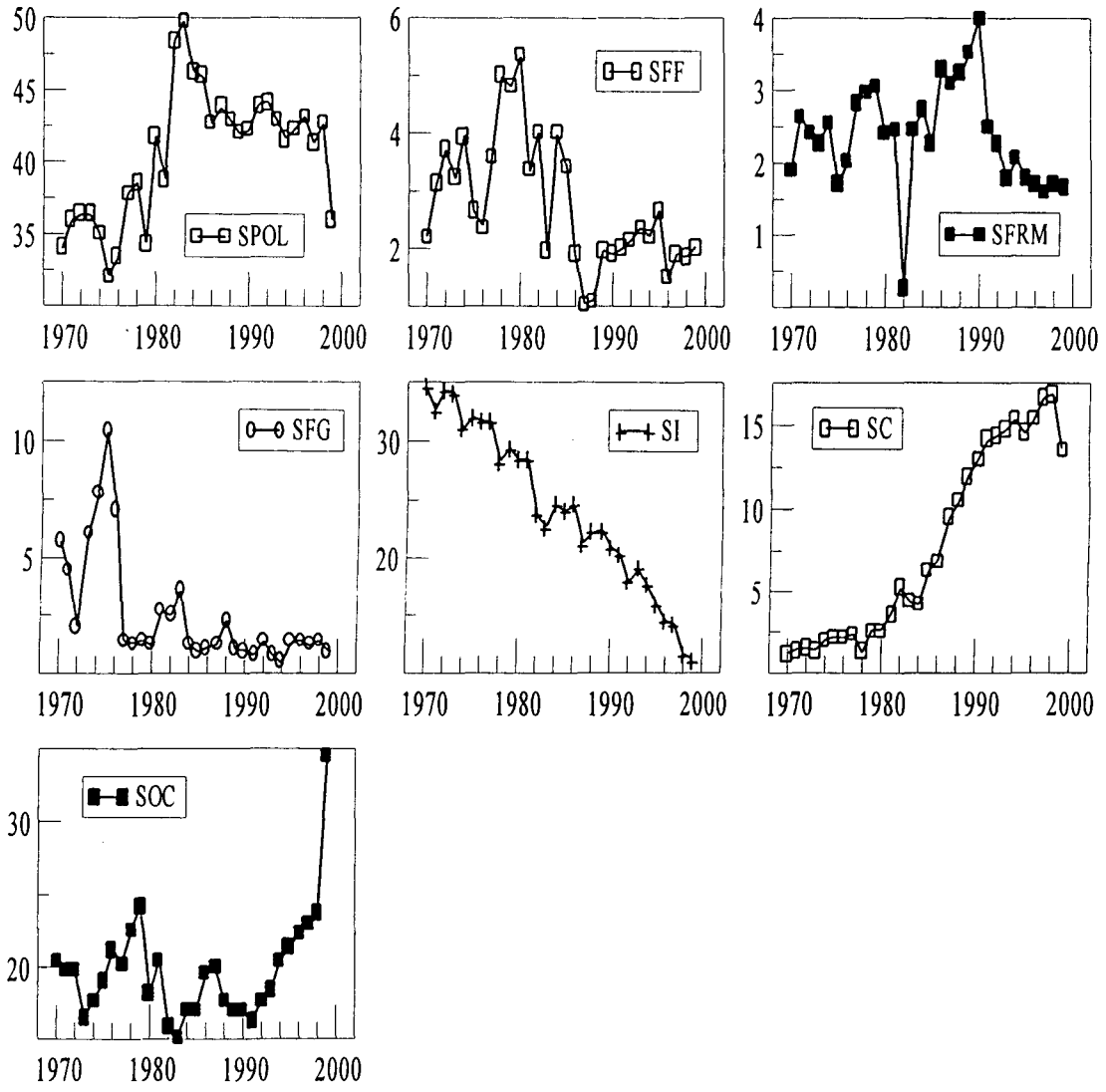


Fig 2.2.1 SPOL - Share of POL in total cargo-handled
Fig 2.2.2 SFF - Share of Fertiliser finished in total cargo-handled
Fig 2.2.3 SFRM - Share of Fertiliser Raw materials in total cargo-handled
Fig 2.2.4 SFG - Share of Food grains in total cargo-handled
Fig 2.2.5 SI - Share of Iron ore in total cargo-handled
Fig 2.2.6 SC - Share of Coal in total cargo-handled
Fig 2.2.7 SOC - Share of Other Cargo in total cargo-handled
Source: CMIE "Infrastructure", January (2001)

Figure 3.1: *Map of Tamil Nadu*

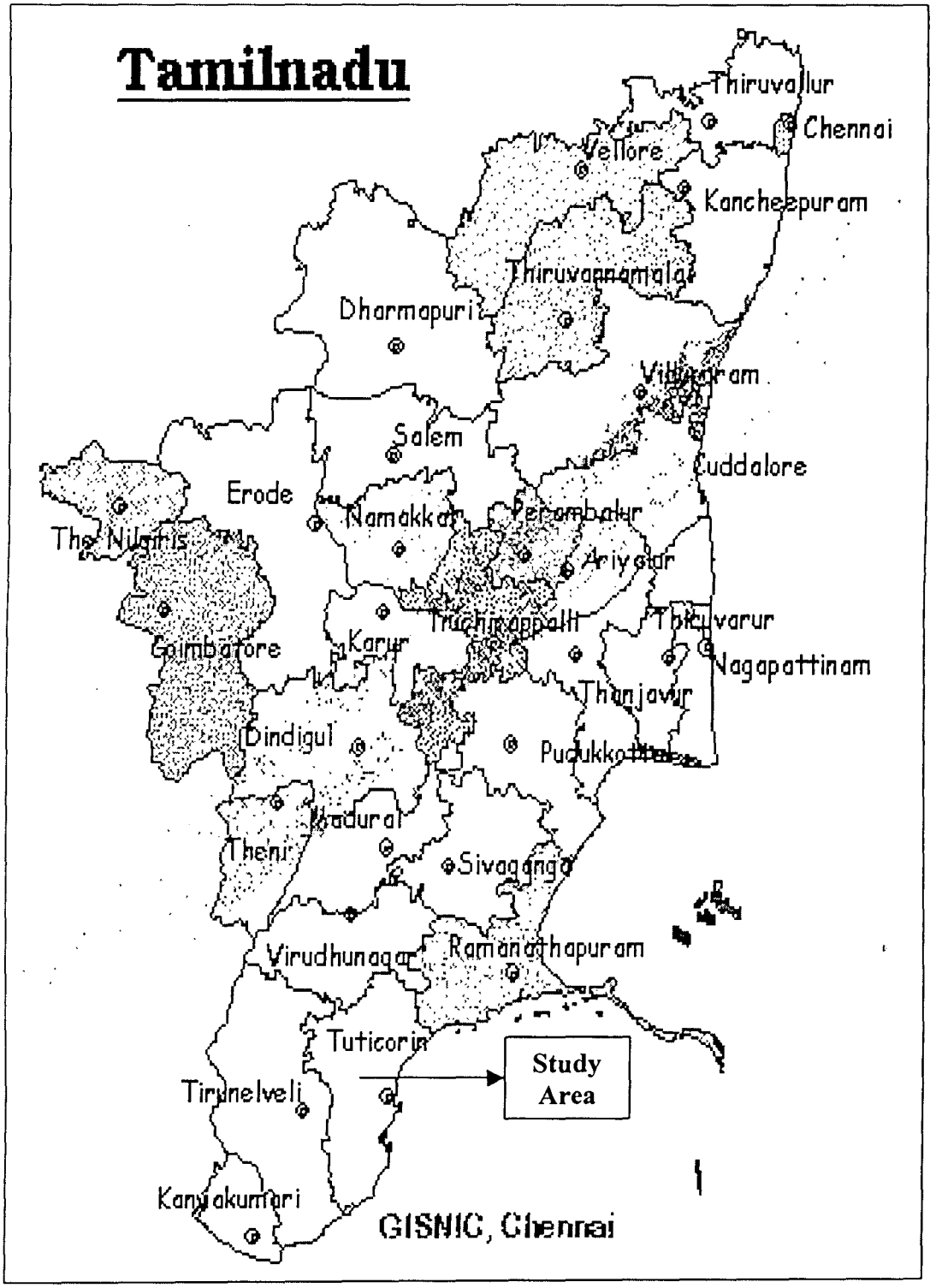
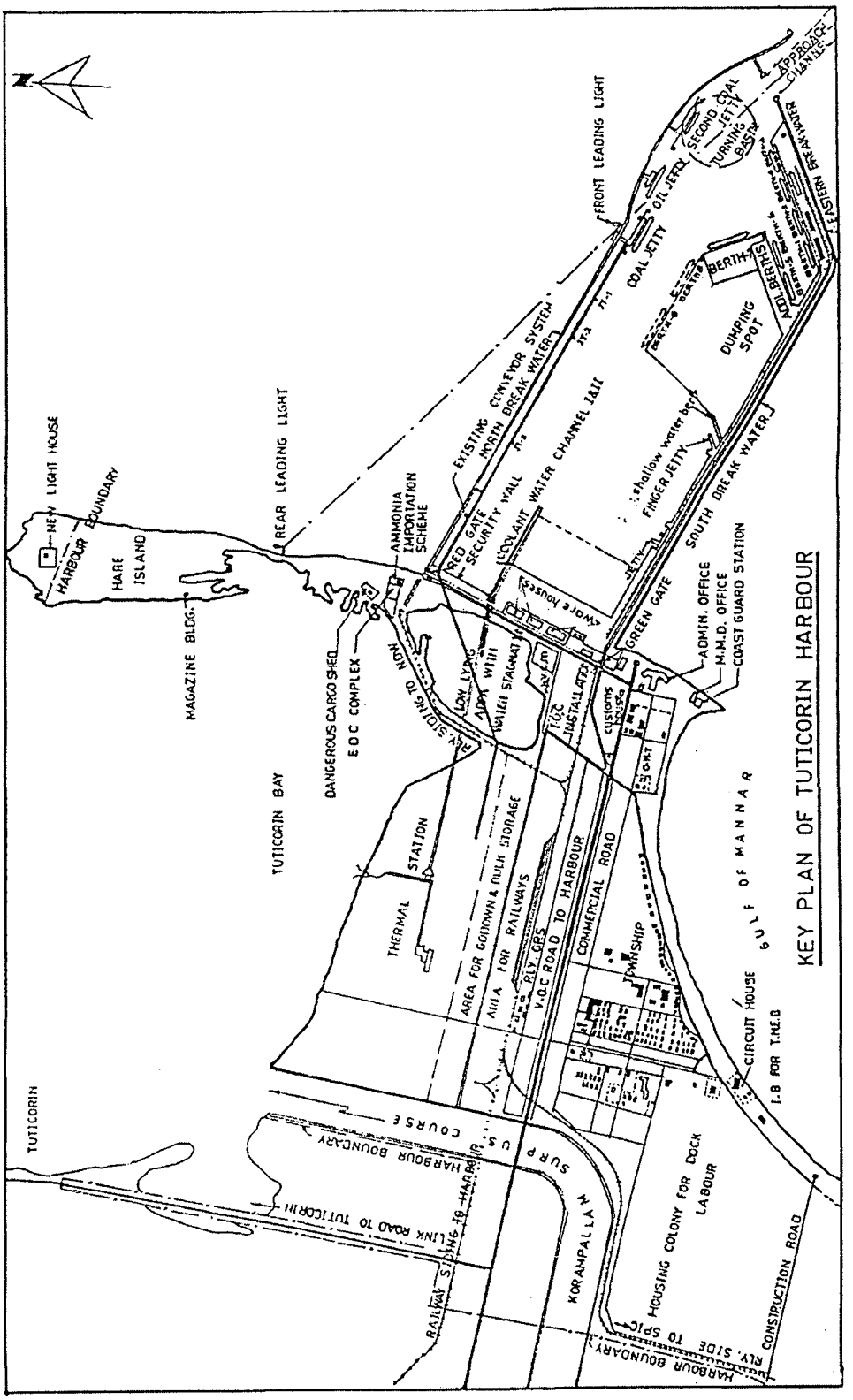


Figure 3.2 : *Map of Tuticorin Port*



Chapter III

Trends and Patterns of Traffic Handled at Tuticorin Port

Introduction: In this chapter and the following one we have discussed extensively about Tuticorin port. The reasons for having selected Tuticorin port are: it is a port located at the southern tip of India[1] with access to both its coasts as well as to the international trade route passing through Colombo and Singapore. It has got a tremendous potential to emerge as a major hub for Asia itself (Techno Economic Project Study For Tuticorin Port 1995). It is a major port developed by Government of India after Independence. Tamil Nadu is the only state where there are two major ports separated by a distance of more than 700 nautical miles (distance between Tuticorin and Chennai is 769 nautical miles). And lastly to the best of our knowledge there exists no study about the performance of this port. This chapter has been organised into three sections. First section provides a brief overview of the evolution and development of Tuticorin port. The second section contains a discussion about the trends and patterns of traffic handled at Tuticorin port. The last section presents the summary and conclusion of this chapter. The data source used in this chapter has been obtained through a primary survey of Tuticorin port.

3.1.1 Evolution of the New Port of Tuticorin: Every port has a maritime history of its own to narrate and Tuticorin is no exception for that. Although, the sources providing historical information about the glorious past of Tuticorin port have been destroyed by the ravages of time; from the sketchy information provided by some travellers one can get a considerable authentic historical picture of the past. The earliest reference about Tuticorin dates back to 123 AD by Ptolemy[2] a Greek philosopher who describes that he visited the "...country of the Kareoi, in the Kolkhic gulf where there is pearl fishery, Sosikourai and Kolkhoi an emporium at the mouth of the river Solen." Although, it has not been possible yet to identify the town Sosikourai, which Ptolemy describes in his narration there remains little doubt as to whether he describes Tuticorin only as Sosikourai because, judging from Ptolemy's narration Tuticorin

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[1] Refer to the map of Tamil Nadu in pp.32.

[2] One can also find Tuticorin being mentioned in the Greek work titled "*Periplus of the Erythrean Sea*", 88 AD by an unknown Greek author.

was then a trading centre from where pearl fishery flourished. James Hornebb also discusses about this point in, "*Report to the Government of Madras on the Indian pearl fisheries of the Gulf of Mannar*". According to him, "the present name Tuticorin is but a corruption of Sosikourai, as the Tamil 'S' is commonly corrupted into 'CH' as 'sippi' into 'chippi' and Chochikourai would readily pass into Totikurai from which the present rendering Tuticorin is easily derivable.

From 2 century AD to 7 century AD no records pertaining to Tuticorin have been located so far. Although, one can find description about the use of pearls during the Sangam age in classical Tamil literature works like *Tevaram*, *Seevahachintamani* and *Periapuranam* they do not provide the exact location as to where it came from. One can safely summarise that the pearls could have come from Tuticorin rather than from Korkai or Puhar, as they were also pearl fishery centres because, the historical records preceding the literature age and after that period talk about the prosperous pearl fishery and trade carried on from here. During the period 7th century AD to 9th century AD Tuticorin was ruled by the Pandya Dynasty and later it passed on into the hands of the Chola Dynasty who ruled it from 10th century AD till 12th century AD. The mighty Cholas had a good naval power. It was highly possible for the great Chola king Raja Raja Cholan, to have led his naval expedition to Ceylon in circa 1020 AD from Tuticorin. As Tuticorin possessed a natural harbour and was also a major trading centre under the Chola dynasty. Moreover, Tuticorin is located at a close proximity to Ceylon.

All throughout these ages i.e. up to 14th century AD Tuticorin remained as a major center for maritime trade and pearl fishery. It did not emerge as a port. During these periods Korkai first and Kayal later served as ports but because of siltation caused by river Tamparabarni both these places lost their importance. The advantage of being a well-guarded port coupled with the presence of natural harbour brought Tuticorin to the fore. The riches and splendour of Tamil Nadu began to reach as far as the west through travellers and traders. Westerners started showing interest in colonising this resource rich region. The Portuguese who had already reached Cochin were the first to reach Tuticorin in the year 1532. Soon after their arrival they got themselves involved in native politics. Before the arrival of Portuguese; Tuticorin received traders from Arabia. After the fall of the great Vijayanagar Empire these Arabs became more powerful and they began to torture the native population the Paravans - the local fisher folk to assert their supremacy. The local fisher folk made many attempts to overthrow the harassing

Arabs but all their efforts ended in vain. The helpless Paravans approached the Portuguese for help. The Portuguese agreed to help them and arranged for a fleet to be sent from Cochin. The Arabs were overthrown and the local fisher folk got back their freedom. The local fisher folks returned their gratefulness by willingly embracing Christianity and became the citizens of Portuguese sovereign. Thus, Portuguese power was established on the fishery coast and a Portuguese governor was stationed there to safeguard their interest. The Portuguese then did not have any rivals in Europe at that time because of the Papal bull[3] issued by the pope which divided the globe into two halves and gave the trading rights in the eastern side to Portugal and the western side to Spain. But by middle of the 16th century the authority of the Pope was questioned which led to the break down of the Papal bull. After this breakdown the other European countries also started to colonise Asian countries. The Dutch made their first appearance in Ceylon in 1602. The peaceful and lucrative trade that Portuguese had in Tuticorin evoked jealousiness in the eyes of Dutch. In 1649 they made their first attempt to capture Tuticorin. For this purpose they dispatched a fleet of 10 vessels with Dutch and Sinhalese infantry under the command of J.M. Suycher, the Governor of Galle. They sailed along the coast and captured Tuticorin and Tiruchendur temple. The inhabitant of Tuticorin protested against this invasion. As their struggle intensified the Dutch sailed back after indulging in arson and plunder and took all the belonging and the fishing boats of the inhabitants along with them. Again, the Dutch people invaded Tuticorin in 1668 with a more powerful force and captured Tuticorin harbour. They made Tuticorin their head quarters. Their control extended from Nagapattinam to Tuticorin. They built a small factory and also stationed a fleet to protect the industry as well as the coast extending from Pamban to Cape Commorin.

The scenario in Tamil Nadu at that time was also not uneventful. Major political changes took place when the Nayak Kings who ruled Madurai then and who also remained as vassals to the Vijayanagar rulers asserted their independence. The European missionaries that came to South India were carrying out their conversion activities. Although, the Nayak kings remained tolerant of these activities they were very careful in not letting the foreigners have any

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[3] During the months of May and September in 1493 the Pope Alexander VI issued bulls assigning spheres of exploration west of Azores or Cape Verde islands to Spaniards and east of the islands to Portuguese. Spain and Portugal concluded the treaty of Tordesillas in June 1494 by which they recognised the Papal bull.

political right over the Tuticorin port. But the Western colonialists were even prepared to undertake a war to bring Tuticorin under their possession.

In 1662 John Nieuhoff an English traveller, visited Tuticorin and stayed there for six months. He in his work titled "*Voyages and Travels into Brazil and the East Indies*" described that, "the sea was calm during the month of October and the harbour was 5 fathoms deep, pearl fishing was carried out at a depth of about 12 to 15 fathoms". Father Martin who visited Tuticorin in 1700 traces how the Dutch expanded their trade links gradually and went to the extent of demanding passports for the commodities that were exported from Tirunelveli coast, as it was not under their control then. The Dutch were not content with the trade advantage and wanted to annexe Tirunelveli. But their attempt failed to yield result as Yusuf Khan the able lieutenant of the Nawab of Carnatic, led a large force and stormed Alwartirunagari, which was then a Dutch trading center. The Dutch never expected such a grave move from the Nawab and his men and so gave up their effort to capture Tirunelveli.

Towards the end of the 18th century the hostilities between the English and the Dutch grew bitter as war broke out in Europe because of the American War of Independence. This hostility spread into Indian Sub continent also. When the news of the war reached India in 1782 the English commander at Palayamkottai sent an army to dislodge the Dutch from Tuticorin. The English army accomplished this task with ease and the Dutch garrison was taken as prisoners. After the end of hostilities in Europe a treaty was signed in 1785 and based on the treaty Tuticorin was restored back to the Dutch. During the last decade of the 18th century the English East India Company acquired the administrative control of Tirunelveli, Madurai and Ramanad from the Nawab, and once again the old hostilities surfaced. Colonel Donald Campbell, the military adviser of the company and Powney the Collector of Tirunelveli demanded the submission of Dutch possessions in Tuticorin. The Dutch handed over all their possessions in Tuticorin to the British. Tuticorin remained in the hands of English for a while. Meanwhile, the Dutch entered in to an alliance with Panchalankurichi Poligar Virapandiya Kattabomman, who was fighting against British atrocities and was not ready to pay taxes to them and they both successfully captured Tuticorin from the English. But their victory was only short lived after these wars were over the English sent Captain Welsh to Tuticorin to wrest it back from the Dutch. Captain Welsh accomplished the task with ease and

all the Dutch were put on pension list. The English could not tolerate even the remains of the Dutch rule in Tuticorin and so they destroyed all the fortifications built by the Dutch.

In 1818 once again the English decided to give the Dutch back their possession in accordance with a treaty concluded in the congress of Aix La Chapelle. The Dutch got back all their settlements in Tirunelveli including Tuticorin and Kayalpattinam and two of the seven islands off the coast. The Dutch erected an Obelisk as a landmark for the ships. Though the Dutch got back the lands the English retained with them the rights to tax certain commodities and also impose levies. The Dutch with their nominal rights were not in a position to run the administration smoothly. Hence, the English East India Company took over the administration of Tuticorin, Kayalpattinam, Alwartirunagari, Punnaikayal and Manapad on the 1st of June 1825.

The beginning of the 19th century marked the rise of Tuticorin to a position of considerable importance in the world of trade and commerce. The populous and resource rich hinterland surrounding Tuticorin was always ready to export goods either for consumption or as raw materials. The advantageous position enjoyed by Tuticorin compared with other ports in the Coramandel coast was possessing a natural harbour, as well as a resource rich hinterland. These factors favoured the development of a harbour by the East India Company. A lighthouse was built after demolishing the Dutch obelisk in 1842 this marked the beginning of the development of a harbour in Tuticorin. The break up of American civil war was a boon in disguise for Tuticorin because, the supply of cotton from America to the international markets stopped. Hence the demand for Indian raw cotton went up. Cotton was one of the principal crops cultivated in the hinterland of Tuticorin and so export of cotton at Tuticorin port increased. The price of cotton, which had seldom gone above Rs. 45/- a bale, rose to Rs. 60/- a bale in 1851. As the demand for cotton increased new roads were laid to connect Tuticorin with the cotton rich hinterland. This boosted the export of cotton. The growth of the town around Tuticorin necessitated its upgradation into a municipality. On 1st of November 1866 Tuticorin became a municipality. In course of time water supply facility was made available, dispensaries and educational institutions were opened. In 1876 a railway line connecting Tuticorin with Maniyachi was constructed. This also helped to increase the export of raw cotton and so during the years 1889-1890 the value of cotton exported amounted to Rs. 145 lakhs.

The planned development of the harbour began in 1886. It was then the first pier a primitive wooden jetty a hundred feet in length constructed at a cost of Rs. 1200/-. It was further strengthened and extended in 1873. The Duke of Birmingham visited the town in 1877, during his visit the business heads of Tuticorin met him, convinced him on the necessity of improving the pier, and succeeded in getting a promise from him. As per his promise in 1881 the jetty was considerably strengthened and in 1887 its width was doubled. Trolley rails were laid in the next year in order to connect the port with the Railways. In 1894, the construction of a new pier supported on iron-screw piles was started. To cope up with the increased demand for space considerable reclamation was done in the foreshore to provide approaches to the new jetty at a cost of nearly Rs. 2 lakhs and the pier was opened in July 13, 1895. The main line of the South Indian Railway was extended up to the quay in 1899. In course of time ginning of cotton and steam spinning techniques were introduced by manufacturing firms in the hinterland.

A systematic effort towards the development of Tuticorin harbour into a major port began from 1920 onwards[4]. Various committees and experts examined the prospects of developing Tuticorin harbour at the instance of the Government of Madras and evolved schemes. Among them the most notable ones were M/s Sir John Wolfe, Barry, and Lyster consulting engineers UK framed the first proposal in 1930. This was followed by the Bristow's Scheme Mr. Robert Bristow was instructed to prepare detailed plans and estimates for the scheme of harbour development at Tuticorin based on the ideas suggested by M/s Sir John Wolfe, Barry, and Lyster. Mr. Bristow did a lot of fieldwork and in 1922 he formulated a new proposal after carrying out a detailed investigation of the area. The erstwhile Government of Madras decided to leave the scheme to a team of independent committee of harbour engineers for a thorough examination and report on the proposal suggested by Robert Bristow. Then another committee called the Palmer committee was asked to prepare a plan. But the Government of Madras shelved all the committee's schemes mainly due to lack of funds. The task of developing the harbour was once again taken up in 1949 and 1950 but was dropped due to paucity of funds. The Sethusamudram canal project committee constituted under the chairmanship of Sir A.

[4] The proposal to construct a deep-sea harbour at Tuticorin was first thought of in the year 1914 but it could not be pursued due to the outbreak of First World War.

Ramaswamy Mudaliar in 1955 also recommended the development of a harbour at Tuticorin. In 1960 The Intermediate Ports Development Committee was formed and the committee put forward a scheme by considering the past developments of Tuticorin into a deep-sea harbour. Further it also examined therein the comparative cost as prepared by the Ministry of Surface Transport.

The study conducted by National Council of Applied Economics Research (NCAER) based on traffic assessment also strongly recommended the development of a harbour at Tuticorin. After under going much hurdles and ordeals, the Government of India finally sanctioned the project during the financial year 1962-63 and Rs. 21.76 crores was sanctioned for this purpose. After this the New Port of Tuticorin took shape, finally the new port started its operation from 11th of July 1974, the day on which Tuticorin was declared as the 10th major port of India.

3.1.2 Brief Description of the New Port of Tuticorin: The New port of Tuticorin (Major port - Zone A) is located at 8°47'30" east latitude and 78°12'15" north longitude. It is an artificial all weather port - a port in which loading and unloading operations can be carried out during monsoon as well as non-monsoon months. Although ports are prone to cyclones, Tuticorin is located in a fairly sheltered area and is protected from storms, cyclones etc by the presence of Ceylon in the east and Rameswaram Islands in the north. Infact, cyclones that develop in the Bay of Bengal by the time it reaches Tuticorin after crossing Rameswaram Island mostly gets weakened. Hence, Tuticorin port can be termed as a region that lies on the shadow of the cyclone zone[5]. The present construction of the harbour consists of two long artificial breakwaters viz. northern and southern including an eastern arm. The length of the northern breakwater is about 4,086 meters and southern breakwater is about 3,876 meters. It also includes an eastern arm with 1,275 meters apart projecting into the sea with an entrance channel of 2,400 meters length, 10.8 meters depth, 152.4 meters width, and enclosing a water area of about 960 acres. The number of turning circles is one, enabling only a single ship to pass through at a time. The old port or extension port (Zone B) covers water spread of about 36.31 acres or 14.7 hectares. It also has a land area of about 20.75 acres or 8.4 hectares. The artificial breakwater construction is one of the longest in India. The major port zone A and minor port zone B were merged and Tuticorin Port Trust was formed on the 1st of April 1979.

[5] It doesn't mean that the Port of New Tuticorin has always been free from cyclones. Infact a major cyclone hit the coast of Tuticorin in 1992 and caused severe cyclonic damage to the coastal areas as well as to the port.

3.1.3 Details of the Alongside Berth at Zone A: Tuticorin port has got seven along side berths, one shallow water berth and one finger jetty (see map of the port given in page No.33) on the southern breakwater. Two more berths have been proposed out of which one berth (number eight) is under construction and berth number nine is being planned for future expansion. Among these berths first four berths are located along the eastern breakwater (VOC wharf) which is an extension of southern breakwater. The berth number five and six are called as additional berths and are suitable to handle general purpose cargo which means that the berth can handle any type cargo except liquid bulk[6]. The northern break water houses two coal jetties, one oil jetty, and one SEPC jetty. A detailed description of storage facilities and capacities, berth particulars, cargo handling equipment and floating crafts have been provided in the appendix tables refer to A 3.1, A 3.2, A 3.3, and A 3.4.

3.2 Trends and Patterns of Traffic Handled at Tuticorin Port: Having discussed about the evolution of Tuticorin port in the previous section in this section we have discussed about the trends and pattern of traffic handled at New Port of Tuticorin. We have presented a detailed analysis of traffic handled at Tuticorin port. The period of analysis is from 1979-80 to 1999-00 for most of the series but subject to data availability. The reason for having selected this period for analysis is because Tuticorin was declared as a major port only in 1979-80. In the following subsections we have covered the trends in export, import, coastal and overseas cargo handled at Tuticorin port, the number of vessels that visited the port and the trends in the value of trade handled at the port.

3.2.1 Trends in Principal Commodity Traffic Handled at Tuticorin Port: In this section we have discussed about the trends in principal commodities handled at Tuticorin port. We have followed the same principal commodity classification as presented in chapter two. The period of analysis is from 1974-75 to 1999-00. The trends in principal commodities handled reveals that all commodities except food grains show an upward trend (refer to appendix Figure A 3.1). The principal commodities handled at a port depend on the traffic potentialities of the hinterland. Tuticorin port serves as a major facility for marketing of POL and related products to southern districts, for the major oil companies like Indian Oil Corporation (IOC), Bharat Petroleum (BP) and Hindustan Petroleum (HP). The Southern Petrochemical Industries

[6] Dry bulk, (conventional and mechanical) Break bulk and Containers

Corporation (SPIC) located at a close proximity to the port, generates demand for fertiliser transport as well as for liquid bulk products. Coal has been another main item in the commodity basket handled at the port. This is meant for Tuticorin Thermal Power Station (TTPS), located opposite outside the port. The other major commodities handled at Tuticorin port are logs, granite stones, salt, cashews etc. The total cargo handled at the port showed an upward trend and it recorded a growth rate of 9.49 per cent during the period 1974-75 to 1999-00. Table 3.1 presents the growth rate and shares of the principal commodities handled at the port.

Table 3.1: *Growth Rates and Shares of Principal Commodities Handled at Tuticorin Port During 1974-75 to 1999-00*

	POL	*Fertiliser Finished*	*Fertiliser Raw Material*	*Food grains*	*Coal*	*Other Cargo*	*Total Cargo*
1974-75 to 1979-80							
CGR (%)	34.6	19.34	69.07	4.48	11.82	7.16	15.13
Avg Share (%)	17.05	12.59	5.24	11.36	18.62	36.01	100
1980-81 to 1989-90							
CGR (%)	0.70	-0.09	4.62	--	14.78	4.40	7.6
Avg Share (%)	11.91	7.54	8.93	3.94	51.70	17.17	100
1990-91 to 1999-00							
CGR (%)	-0.19	3.92	3.15	--	3.11	14.65	7.01
Avg Share (%)	6.01	4.34	3.77	1.56	52.05	32.42	100
1974-75 to 1999-00							
CGR (%)	7.29	3.57	14.24	0.49	11.76	10.61	9.49
Avg Share (%)	10.83	7.47	6.13	4.99	44.20	27.38	100

Source: CMIE, "Infrastructure", January (2001)

Sub period level analysis revealed that the growth rate of total cargo-handled was 15.13 per cent during the first sub period, 7.60 per cent during the second sub period and 7.01 per cent during the third sub period. The share POL in the total cargo-handled was 10.83 per cent and it recorded a growth rate of 7.29 per cent during the period 1974-75 to 1999-00. The sub period level analysis revealed that the share of POL was declining from one period to another. Coal registered a growth rate of 11.76 per cent its share was 44.2 per cent of the total. The share of coal in the total cargo basket handled has been increasing from one sub period to the next. Other cargo registered a growth rate 10.61 per cent during the whole period. Its share was about 27.38 per cent of the total and on an average 1.4 million tonne of other cargo was handled in a year. (Detailed results of this analysis and a plot of the shares have been given in the appendix Table: A 3.5 and appendix Figure A 3.2)

3.2.2 Trends in Import and Export Cargo-handled at Tuticorin Port: In this section we have discussed about the trends and pattern of export and import traffic handled at Tuticorin

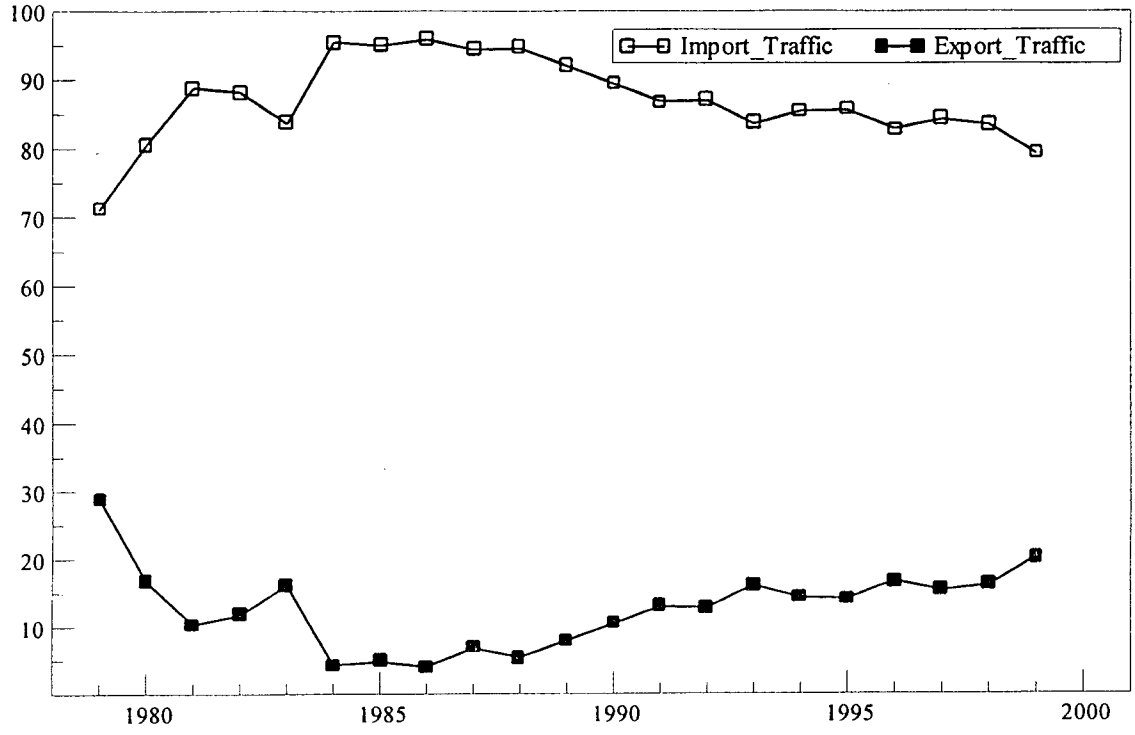
port. Table 3.2 presents the growth rates and shares of import and export cargo-handled at Tuticorin port during the whole period as well as during the two sub periods.

Table 3.2: *Growth Rates and Shares of Export and Import Traffic Handled at Tuticorin Port During 1979-80 to 1999-00*

	Import Traffic (mt)	*Export Traffic (mt)*	*Total Traffic (mt)*
1979-80 to 1989-90			
CGR (%)	10.02	-4.43	7.47
Avg Share (%)	89.15	10.72	33.94
1990-91 to 1999-00			
CGR (%)	5.75	14.43	7.01
Avg Share (%)	84.85	15.14	66.76
1979-80 to 1999-2000			
CGR (%)	7.57	5.29	7.01
Avg Share (%)	87.05	12.83	100.00

Source: CMIE, "Infrastructure", January (2001)

Figure 3.1: *Share of Export and Import Traffic Handled at Tuticorin Port During 1979-80 to 1999-00*



Source: Compiled from Various Administrative Reports of Tuticorin Port

The analysis of exports and imports traffic revealed that growth rate of import traffic was 7.57 per cent and that of export traffic was 5.29 per cent during the whole period, indicating that import traffic grew at a faster rate than export traffic. Figure 3.1 describes the trends in the shares of imports and exports traffic handled at Tuticorin port during the period 1979-80 to

1999-00. The figure reveals that after 1986-87 the share of exports traffic has been increasing and that of the imports has been declining. This rise in the share of export traffic may be due to industrial development in the hinterland that is more export oriented rather than the import oriented.

The shift in the share towards export cargo has also been reflected in the decadal growth rates. Decade wise growth rates revealed that during the first decade the growth of import traffic was higher and export traffic was showing a decline. But in the second decade i.e., during the nineties, export traffic grew at a faster rate than import traffic. Further, from the results one can see that the share of import traffic handled has always remained higher than the export traffic handled. Imports share has been remaining around 85 per cent in both periods. The variation in import traffic handled was also less when compared with the export traffic handled.

3.2.3 Trends in Overseas and Coastal Traffic Handled at Tuticorin Port: In this section we have analysed the trends in overseas and coastal traffic handled at Tuticorin Port. Overseas traffic refers to commodities handled at Tuticorin port that are bound for some other countries (overseas export traffic-OET) or cargo bound from some other countries to Tuticorin (Overseas Import Traffic-OIT). Similarly, coastal traffic can also be classified in to cargo handled from Tuticorin port bound for some other ports within India (Coastal Export traffic-CET) and cargo received from some port within India (Coastal Import Traffic-CIT). By summing up overseas import and overseas export traffic we have derived Total Overseas Traffic (TOT). Similarly we can also derive Total Coastal Traffic (TCT).

Table 3.3: *Growth Rates and Shares of Overseas and Coastal Cargo-handled at Tuticorin Port*

	Overseas Traffic	*Coastal Traffic*
Decade wise summaries 1979-80 to 1989-90		
CGR (%)	4.89	9.36
Avg Share (%)	42.2	57.80
1990-91 to 1999-00		
CGR (%)	11.34	3.14
Avg Share (%)	42.22	57.78
Overall Summaries 1979-80 to 1999-2000		
CGR (%)	8	5.91
Avg Share (%)	39.55	60.46

Source: Compiled from Various Administrative Reports of Tuticorin port.

Table 3.3 presents the growth rate and shares of overseas and coastal traffic handled at Tuticorin port during the period 1979-80 to 1999-00. The overall growth rate revealed that total overseas traffic (TOT) registered a growth rate of 8 per cent and total coastal traffic (TCT) registered a growth rate of 5.91 per cent. Overseas export traffic registered a higher growth rate compared to overseas import traffic. In case of coastal traffic the data revealed that coastal export traffic has been declining over the period registering a negative growth rate of -11.57 per cent. Although, coastal import traffic was showing an increasing trend during the last four years it has also started showing a declining trend[7].

From the above analysis we have found that in case of Tuticorin Port overseas traffic handled has gone up over the period under review and coastal traffic handled has declined. In case of coastal traffic, coastal import traffic registered a higher growth rate than coastal export traffic except during the second sub period. The decline in the shares of coastal traffic can be due to competition from other modes of surface transport.

3.2.4 Category-wise Cargo-handled at Tuticorin Port: The nature of commodities handled at a port assumes significance because of two reasons: firstly it is determined by the composition of industry and other economic activities in the hinterland. Secondly, the port has to design its berth capacities in such a way as to handle specific types of cargo. So, while designing and constructing a new berth the port authorities have to take in to consideration the present composition of the cargo basket handled at the port and the expected changes in it. Therefore, in this section we have analysed the trends and composition of total cargo-handled at Tuticorin port. Commodities handled at a port can be broadly classified into four namely, containers, break bulk, liquid bulk and dry bulk. Table 3.4 gives the growth rate and composition of cargo-handled at Tuticorin port during 1985-86 to 1999-00.

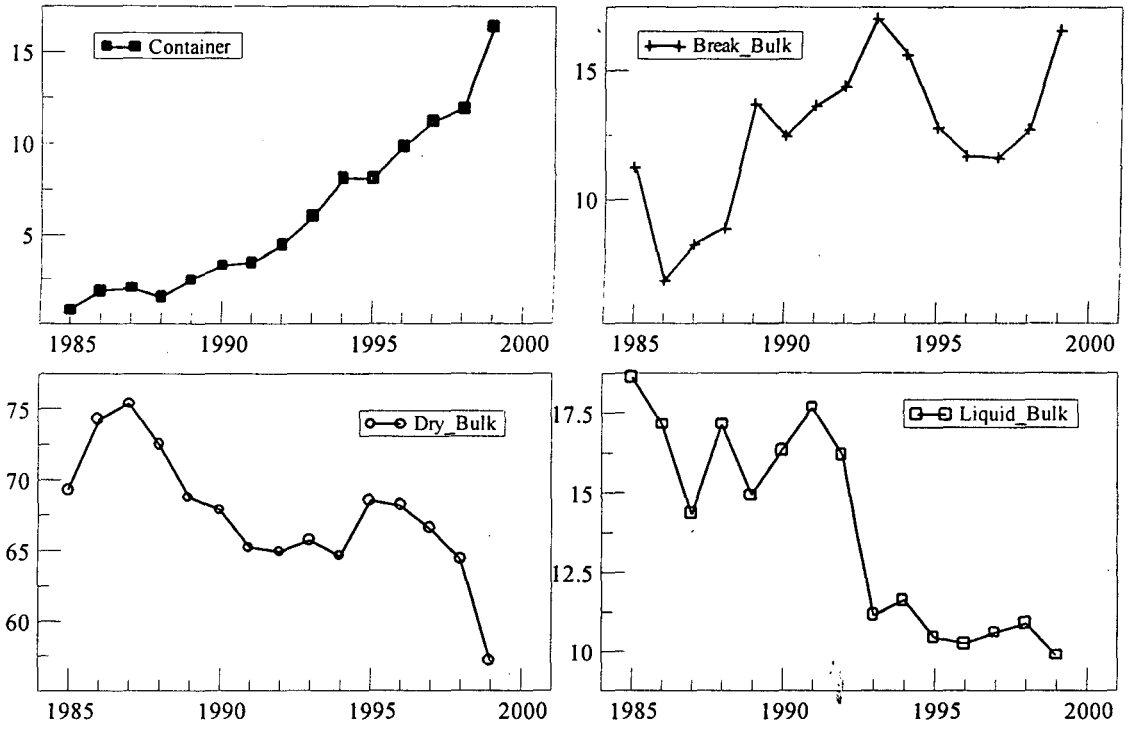
[7] A detailed table containing the period wise analysis of growth rates of coastal import and export traffic and overseas import and export traffic has been given in the Appendix (refer to Table A 3.6).

Table 3.4: *Growth Rates and Composition of Cargo-handled at Tuticorin Port During 1985-86 to 1999-00*

	Containers	*Break Bulk*	*Dry Bulk*	*Liquid Bulk*	*Total cargo*
CGR (%)	29.71	8.69	4.55	1.51	5.91
Avg Share (%)	6.09	12.52	67.57	13.82	100.00

Source: Compiled from Various Administrative Reports of Tuticorin Port

Figure 3.2: *Share of Category-wise Traffic Handled at Tuticorin Port During 1985-86 to 1999-00*



Source: Compiled from Various Administrative Reports of Tuticorin Port

The total cargo-handled during the period 1985-86 to 1999-00 grew at a rate of 5.91 per cent. A break up of the cargo basket revealed that container traffic recorded the highest growth rate during the period under observation 29.71 per cent. In average tonnage term's container traffic handled per year was about 0.52 million tonnes and its share in the total cargo-handled was 6.09 per cent. Container traffic also exhibited a high degree of variability in it. Break bulk cargo recorded the next highest growth rate and its share has also increased over the period. Liquid bulk registered the lowest growth rate among the different types of cargo-handled (1.51 per cent) but the variation in this series was less. Figure 3.4 depicts the shares of these commodities in the total cargo-handled.

From the figure 3.2 one can infer that the shares of liquid bulk and dry bulk in the total cargo-handled has been showing a decline. The decline in the liquid bulk traffic handled can be mainly attributed to the reduction in intake by SPIC (Southern Petrochemical Industrial Corporation). However, Hindusthan Petroleum Limited (HPL), Bharat Petroleum Limited (BPL) and Indian Oil Corporation (IOC) have predicted a high consumption level for their products in the coming years and so they have augmented their storage capacities and other facilities used for handling oil at the port. Therefore, in the coming years one can expect a rise in the liquid bulk traffic at the port. Another reason for the relative decline in the share of POL products handled at the port can be due to the competition faced from other modes of surface transport. With dredging process being completed one can expect a rise in the liquid bulk traffic at the port in the coming days.

3.2.5 Details of Container Traffic Handled at Tuticorin Port: In this section we have analysed the container traffic handled at Tuticorin port. Containers have standard international specifications to facilitate their handling for instances refer to UNCTAD (1985). Throughout the world two different specifications of containers are handled. They are Twenty Feet Equivalent Units (TEUs) and Forty Feet Equivalent Units (FEUs). The total container traffic handled at Tuticorin port has been obtained by multiplying the 40' containers handled by 2 and then adding the result with 20' containers.[8] Table 3.5 presents the growth rate and shares of 20' and 40' containers handled at Tuticorin port. The total TEUs handled registered a growth rate of 14.36 per cent during the period 1980-81 to 1999-00. A plot of the shares revealed that over the years the share of 20' containers has been coming down drastically and 40' containers has been going up (refer to Figure 3.3). The share of forty feet equivalent containers handled has been growing at a faster pace compared to twenty feet equivalent containers during the period under observation. This can be due to a worldwide increase in the usage of 40' containers coupled with the economies of scale enjoyed by manufacturing firms, shipping companies and multi-modal transport operators in handling these bigger boxes.

8 The reason behind this is one forty feet equivalent container is equivalent to two twenty feet equivalent containers.

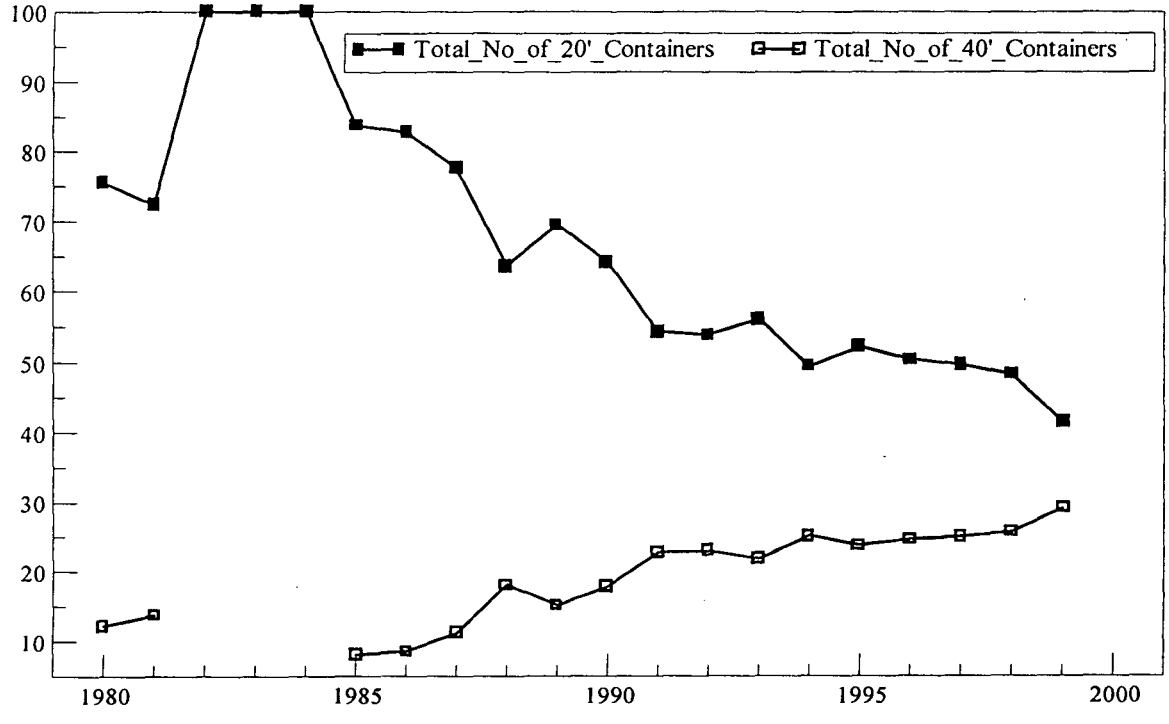
Table 3.5: *Growth Rates and Shares of20' and 40' Container Traffic Handled at Tuticorin Port During 1980-81 to 1999-00*

(In Numbers)

	Total No of 20' Containers Handled	*Total No of 40' Containers Handled*	*Total TEUs Handled*
Decade wise Summaries			
	1980/81 to 1989/90		
Avg Share (%)	82.50	8.75	
CGR (%)	3.37	6.56	4.23
	1990/91 to 1999/2000		
Avg Share (%)	51.98	24.01	
CGR (%)	15.90	27.13	21.06
Overall Summaries			
	1980/81 to 1999/2000		
Avg Share (%)	67.24	16.38	
CGR (%)	10.99	19.46	14.36

Source: Compiled from Various Administrative Reports of Tuticorin port.

Figure 3.3: *Share of 20' and 40' Containers Handled at Tuticorin Port During 1980-81 to 1999-00*



Note: data on 40' containers was not available for 1982-83 to 1984-85
Source: Compiled from Various Administrative Reports of Tuticorin Port

3.2.6 Details of Container Import and Export Traffic Handled at Tuticorin Port: In this section we have analysed the trends in container imports and exports traffic handled at Tuticorin Port.

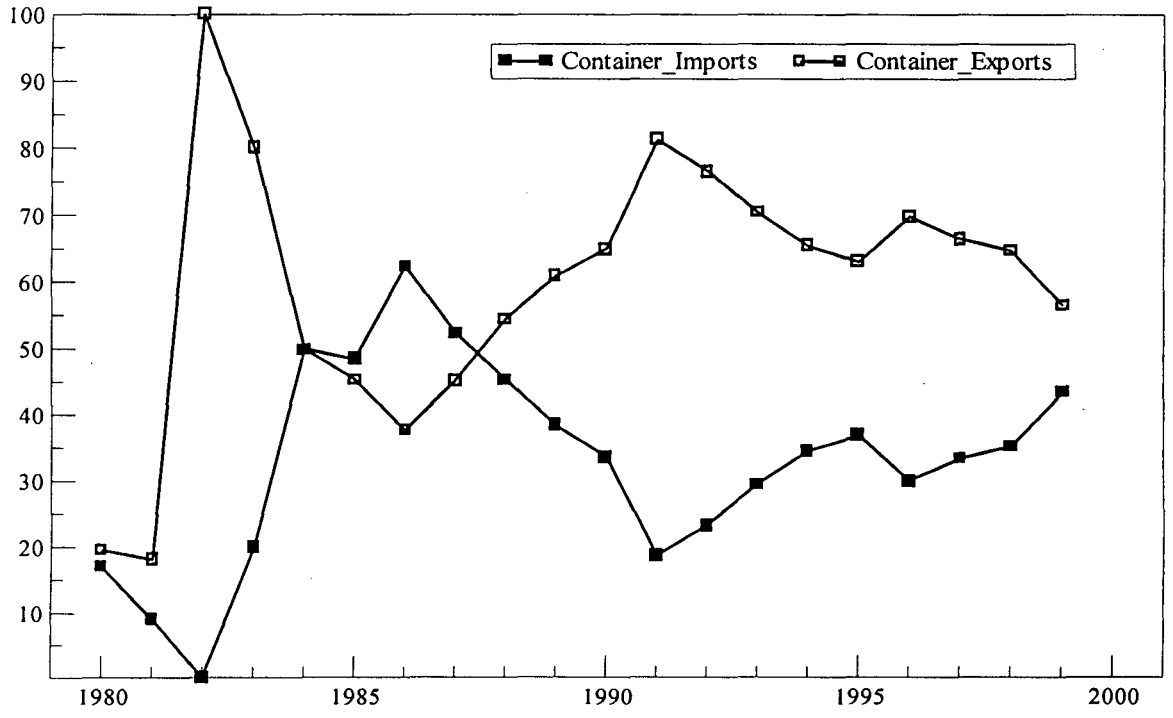
Table 3.6: *Summary Results of Container Export and Import Traffic Handled at Tuticorin Port During 1980-81 to 1999-00*

(Million Tonnes)

	Container Imports Handled	*Container Exports Handled*	*Total Containers Handled*
Decade wise Summaries			
	1980-81 to 1989-90		
Avg Share (%)	34.32	51.15	
CGR (%)	21.97	26.05	12.49
	1990-91 to 1999-00		
Avg Share (%)	31.95	67.93	
CGR (%)	28.88	23.96	25.69
Overall Growth Rate			
	1980-81 to 1999-2000		
Avg Share (%)	33.13	59.54	
CGR (%)	25.96	26.81	20.23

Note: total container traffic handled is inclusive of exports, imports and transhipment traffic.
Source: Compiled from Various Administrative Reports of Tuticorin port

Figure 3.4: *Share of Container Import and Export Traffic Handled at Tuticorin Port During 1980-81 to 1999-00*



Source: Compiled from Various Administrative Reports of Tuticorin Port

Total container traffic handled registered a growth rate of 20.23 per cent during the period 1980-81 to 1999-00 (refer to Table 3.6). The share of container export traffic handled has always been higher than the container imports traffic handled. A plot of the shares data revealed that the shares of both container imports as well as exports had a fluctuating tendency

(refer to Figure 3.4). Container export traffic handled registered a lower growth rate during nineties than compared with eighties.

3.2.7 Details of Various Categories of Vessels Handled at Tuticorin Port: In this section we have analysed the different category of vessels that have visited Tuticorin port during the period 1980-81 to 1999-00. Based on the nature of the cargo carried vessels can be broadly classified in to the following heads namely containers, break bulk, dry bulk (conventional and mechanical), and liquid bulk. The total number of ships that visited Tuticorin port during the financial year 1999-00 was 1,071 in number.

Table 3.7: *Summary Results of Various Category of Vessels Handled at Tuticorin Port During 1980-81 to 1999-00*

	Container	*Break Bulk*	*Dry Bulk*		*Liquid Bulk*	*All Vessels*
			Conventional	Mechanical		
Max	298	393	136	196	146	1073
Min	15	92	39	80	91	203
Stdev	87.36	110.16	31.66	39.74	17.08	288.77
Avg	126.75	242.27	89.40	121.47	121.93	607.67
CV (%)	68.92	45.47	35.41	32.72	14.01	47.52
CGR (%)	9.56	8.79	6.65	-0.18	1.58	8.24
Vessels Handled (in GRT terms)						
Avg	695624.42	--	--	--	--	6974688.95
CGR (%)	5.90	--	--	--	--	5.99

Note: GRT-Gross Registered Tonnage
Source: Compiled from Various Administrative Reports of Tuticorin Port

The total number of vessels handled at the port increased from a minimum of 203 ships in 1979-80 to above 1,000 ships registering a growth rate of 8.24 per cent during the period 1980-81 to 1999-00 (refer to Table 3.7). In gross registered tonnage (GRT) terms the average GRT for all categories of vessels handled was 6974688.95 tonnes and the growth rate registered in GRT terms was 5.99 per cent. A break up of the various categories of vessels handled at the port revealed an interesting picture. Container ships handled recorded the highest growth rate compared to all other vessels. But maximum number of vessels handled was in break bulk category 393 in number and it registered a growth rate of 8.79 per cent. Ships carrying liquid bulk registered a growth rate of 1.5 per cent. The growth rate registered by dry bulk vessel in mechanical category was negative. The high growth rate registered in the case of container vessels handled could probably be due to the following reasons. (i) Increase in the number of feeder vessels visiting the port (ii) Due to the introduction of a regular railway service that links the port with the internal container deports (ICDs) in Coimbatore

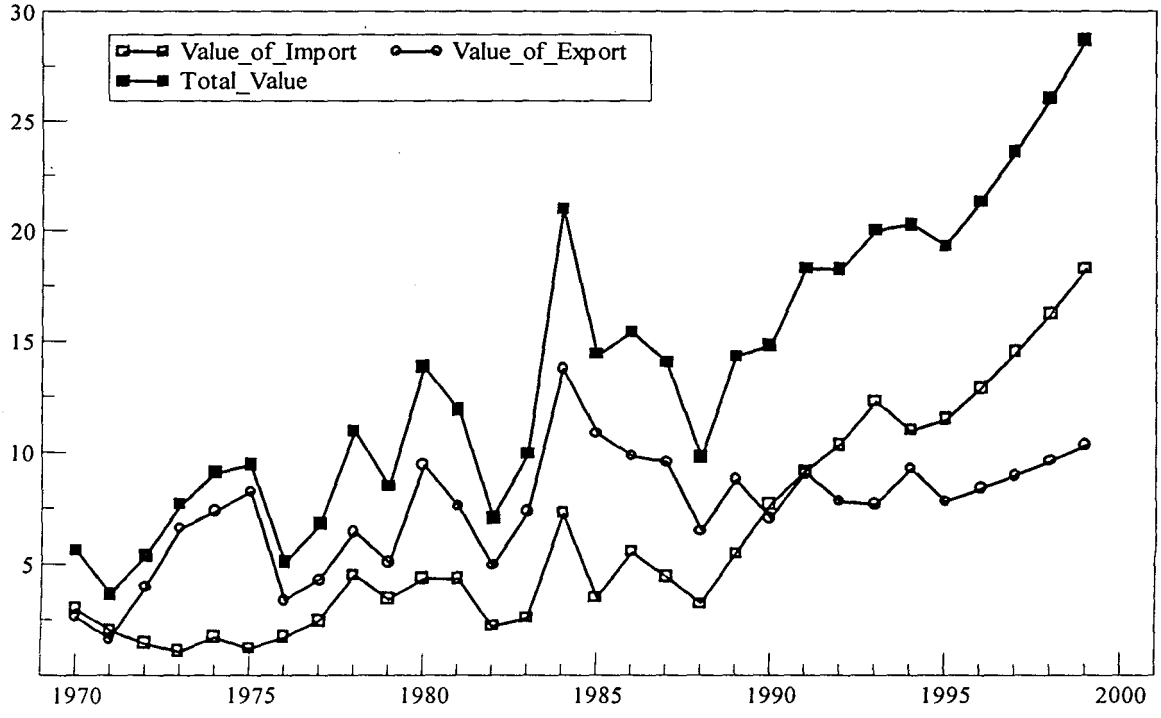
and Banglore. (iii) Tuticorin could have attracted a certain percentage of the container traffic from neighbouring ports such as Cochin and Madras. Moreover, the distance between Tuticorin and other major container ports in Asia i.e. Colombo and Singapore is less (Colombo is 40 nautical miles away and Singapore is 1820 nautical miles away). This might also be a cause for the increase in the container traffic handled at the port as well as in the number of container vessels visiting this port.

3.2.8 Value of Trade Handled at Tuticorin Port: In this section we have analysed the value of trade handled at Tuticorin Port. We have analysed export, import and aggregate traffic (export traffic + import traffic) handled at Tuticorin Port. The period of analysis is from 1970-71 to 1999-00[9]. The plot of the shares revealed that import, export and total trade handled at Tuticorin port has been growing over time with some fluctuation in certain years and after nineties the share of imports in value terms has been higher than the share of exports (refer to figure 3.5).

The value of export trade handled at Tuticorin port was Rs 1,266 lakhs in 1970-71 and it increased to about Rs 9,69,533 lakhs in 1999-00. The value of import trade handled at Tuticorin Port was Rs 1,113 lakhs and it increased to about Rs 5,49,690 lakhs in 1999-00. The total value of trade handled at Tuticorin port grew at a rate of 24.02 per cent during the period 1970-71 to 1999-00 (refer to Table 3.8). The share of export trade handled at Tuticorin port in value terms (Where share has been obtained as percentage of total value of trade handled at all ports in Tamil Nadu) was 7.5 per cent and import trade share was 6.32 per cent during the whole period. Total value of trade handled at Tuticorin port registered a higher growth rate compared to the total value of trade handled at all ports in Tamil Nadu. The share of total value of trade handled at Tuticorin port in the total value of trade handled at all ports in Tamil Nadu was 13.82 per cent during the whole period. This may probably be due to a substantial volume of traffic handled at Chennai port, which is an older port and is well known in port circles compared to Tuticorin. The volume of traffic handled at Chennai could also have been higher because of greater industrial concentration in and around Chennai. Detailed summary results pertaining to value of trade handled at Tuticorin port have been given in the appendix table A 3.7.

[9] Due to non-availability of value statistics, we have predicted the values for the last four years (1996 to 1999) using simple growth rate.

Figure 3.5: *Trends in Value of Import, Export and Total Trade Handled at Tuticorin Port During 1970-71 to 1999-00*



Source: Compiled from Various Reports of Tamil Nadu An Economic Appraisal, Government of Tamil Nadu

Table 3.8: *Growth Rates and Shares of Value of Export, Import and Total Trade Handled at Tuticorin Port During 1970-71 to 1999-00*

	Tuticorin Imports Value	Tuticorin Exports Value	Tuticorin Total Value
Decade Wise Summaries			
	1970-71 to 1979-80		
CGR (%)	15.04	21.20	18.28
Avg Share (%)	2.24	4.97	7.21
	1980-81 to 1989-90		
CGR (%)	16.65	13.09	14.32
Avg Share (%)	4.30	8.88	13.18
	1990-91 to 1999-00		
CGR (%)	32.05	25.78	29.38
Avg Share (%)	12.42	8.65	21.07
Over all Summaries			
	1970-71 to 1999-2000		
CGR (%)	24.78	22.97	24.02
Avg Share (%)	6.32	7.50	13.82

Source: Compiled from various issues of Tamil Nadu An Economic Appraisal, Government of Tamil Nadu.

3.3 Conclusion: In this chapter we have discussed about the historical and economic factors that lead to the evolution of Tuticorin port and the development of the port to its present stage. In the subsequent section we had discussed about the volume of traffic handled and value of trade handled at Port of New Tuticorin. The analysis of the trends and patterns in traffic handled included trends in major commodities handled, export and import traffic, coastal and

overseas, category-wise cargo handled, number of ships handled and their GRT. We have consistently followed the same pattern of analysis for all the series. The trends and pattern of traffic handled indicated that import traffic registered a higher growth rate compared to export traffic similarly overseas traffic recorded a higher growth rate than coastal traffic. The growth in export traffic during 1990's was quite high. The port also handled a considerable amount of container cargo. We have found from our discussions that Tuticorin port has done well in handling certain type of traffic like exports. This can be due to certain port-specific factors or advantages and disadvantage involved in handling different type of cargo. It is towards these aspects that we turn our attention to in the following chapter.

Appendix Tables

Table A 3.1: *Storage Facilities and Its Capacity Available at Tuticorin Port*

Type		*Dry Storage Accommodation*			*Liquid Storage Tanks*			*Container*			
		No.	Area (Sq. mtrs)	Location Inside Port/ Outside Port	No.	Location Inside port/ Outside Port	Capacity (Kls/ Tonnes)	Type of Cargo	No.	Location Inside Port/ Outside Port	Capacity (TEUs)
A.	PORT OWNED										
a.	Covered:										
i	Transit Shed/ Overflow Sheds	2	10,800	Inside	--	--	--	--	--	--	--
ii	Warehouse	3	15,500	Inside	--	--	--	--	--	--	--
iii	Container Freight Station	--	--	--		--	--	--	--	--	--
b.	Open	--	72,000	Inside	--	--	--	--	--	--	--
B.	OTHERS										
a.	Covered:										
i	Transit Shed/	--	--	--	3	Inside	15,000M^3	Ph. Acid	--	--	--
	Overflow Sheds				1	Outside	10,000MT	Liq. Amo	--	--	--
	Warehouse (TNWHC)	14	14*3,000MT	Outside	10	Outside	2,000M^3	V.C.M	--	--	--
ii	Container	--	--	--	1	Outside	5,000M^3	V.C.M	--	--	--
iii	Freight				3	Outside	3*8,500MT	F.Oil	--	--	--
	Station				2	Outside	2*70KL	LSHF/HSD	--	--	--
b	Open	--	--	--	3	Outside	1*13,700KL	Naptha	--	--	--
							1*13,800KL	Naptha	--	--	--
							1*14,100KL	Naptha	--	--	--
					2	Outside	1*600MT	L.D.O.	--	--	--
							1*938MT	L.D.O.	--	--	--
					2	Outside	7,790KL	E.D.C.	--	--	--
					1	Outside	10,000KL	L.P.G.	--	--	--

Source: Tuticorin Port Trust Twenty First Administrative Report 1999-2000.

Table A 3.2: *Details of Berth Particulars in Zone - A of Tuticorin Port*

Sl No.	*Name of Berth*	*Type of Berth*	*Designed/ Actual Depth*	*Quay Length*	*Maximum Size of Vessel That can be Accommodated*		*Remarks*
					Length	DWT	
			(Mtrs)	(Mtrs)	(Mtrs)		
1.	Berth No. I	Alongside	8.24	168	168	20,000	Transit shed provided (Break bulk)
2.	Berth No. II	Alongside	8.24	168	168	20,000	Transit shed provided (Break bulk)
3.	Berth No. III	Alongside	10.7	192	192	25,000-35,000	Open (Break bulk / dry bulk)
4.	Berth No. IV	Alongside	10.7	192	192	25,000-35,000	Open (Break bulk / dry bulk)
Additional Berth or Finger Pier							
5.	Berth (2 Nos)	Alongside	8.24	168each	168each	20,000	Open (Break bulk / Containers)
6.	Berth No. VII	Alongside	10.7	240	190	25,000-35,000	Berth handed over to M/s PSA SICAL Corporation for container handling on BOT basis From 15-7-98
7.	Shallow Draught Berth	Alongside	6	140	110	5,000 - 6,000	--
8.	Passenger Jetty	Alongside	4.5	121	90	4,000 - 4,500	Passenger terminal building is provided
9.	Oil Jetty	Jetty type	10.7	228	150-228	40,000	--
10.	I Coal Jetty	Jetty type	10.7	185	235	50,000	Shore reception hoppers provided
11.	II Coal Jetty	Jetty type	10.7	210	235	50,000	Shore reception hoppers provided

Source: Tuticorin Port Trust Twenty First Administrative Report 1999-2000.

Table A 3.3: *Details of Cargo Handling Equipment Owned by Tuticorin Port*

Sl No.	*Description*	*Owned by The Port*	
		Number	Rated Capacity (Tonnes)
1.	Mobile Cranes	2 Nos.	75T @ 3.5m
		1 No.	12T @ 3.5m
2.	Wharf Cranes	3 Nos.	3T @ 23m
		2 Nos.	6T @ 23m
		1 No.	10T @ 23m
		4 (Grab)	4T @ 23m
3.	Fork Lift Trucks	3 Nos.	3T
4.	Electric Fork Lift Trucks	--	--
5.	Pay Loaders	1 No.	2.3 cum
		1 No.	3.1 cum
6.	Tractors	--	--
7.	Transfer Cranes	--	--
8.	Container Quay Cranes	--	--
9.	Top Lift Trucks	5 Nos.	40T
10.	Gantry Cranes	1 No.	25T
11.	Loco	1 No.	1500 MT

Source: Tuticorin Port Trust Twenty First Administrative Report 1999-2000.

Table A 3.4: *Details of Floating Crafts Owned by Tuticorin Port*

Sl No.	*Description*	*Owned by The Port*	
		Number	Capacity
1.	Dredgers	--	--
2.	Tugs	1	32 TBP
		2	30 TBP
		1	26 TBP
		1	10 TBP
		1	8 TBP
		1	4 TBP
3.	Launches (Pilot)	2	2*336 BHP
4.	Water Barges	2	150 tonnes each
5.	Launch (Survey)	--	--
6.	Dumb Barges	2	100 tonnes each
7.	Others		
	i. Mooring Boat	2	2*54 BHP each
	ii F.C. Kayal	1	10 tonnes
	M.L. Veera Cheran	1	165 BHP

Note: TBP - Tug Bollard Power, BHP- Break Horse Power.
Source: Tuticorin Port Trust Twenty First Administrative Report 1999-2000.

Table A 3.5: *Summary Results of Principal Commodities Handled at Tuticorin Port During 1974-75 to 1999-00*

(Million Tonnes)

	POL	*Fertiliser Finished*	*Fertiliser Raw Materials*	*Food grains*	*Iron ore*	*Coal*	*Total Cargo*
Decade wise Summaries							
			1974-75 to 1979-80				
Max	0.44	0.49	0.22	0.29	0.43	0.83	2.41
Min	0.07	0.01	0.02	0.04	0.22	0.39	1.04
Stdev	0.13	0.17	0.09	0.09	0.08	0.15	0.46
Avg	0.28	0.21	0.10	0.17	0.29	0.55	1.59
Avg Share (%)	17.05	12.59	5.24	11.36	18.62	36.01	--
CV (%)	0.45	0.78	0.88	0.52	0.28	0.27	0.29
CGR (%)	34.60	19.34	69.07	4.48	11.82	7.16	15.13
			1980-81 to 1989-90				
Max	0.52	0.51	0.53		2.98	1.10	5.32
Min	0.33	0.11	0.15		0.74	0.37	2.56
Stdev	0.07	0.16	0.14		0.83	0.23	0.93
Avg	0.43	0.27	0.35		2.08	0.64	3.88
Avg Share (%)	11.91	7.54	8.93	3.94	51.70	17.17	--
CV (%)	16.01	59.42	40.93		39.96	35.91	23.85
CGR (%)	0.70	-0.09	4.62		14.78	4.40	7.60
			1990-91 to 1999-00				
Max	0.51	0.51	0.45		5.58	4.89	10.15
Min	0.39	0.21	0.14		2.64	1.25	5.08
Stdev	0.04	0.10	0.08		1.16	1.04	1.93
Avg	0.45	0.34	0.29		4.19	2.67	8.05
Avg Share (%)	6.01	4.34	3.77	1.56	52.05	32.42	--
CV (%)	8.39	29.54	28.68		27.69	39.02	23.97
CGR (%)	-0.19	3.92	3.15		3.11	14.65	7.01
Over all Summaries							
			1974-75 to 1999-00				
Max	0.52	0.51	0.53	0.41	5.58	4.89	10.15
Min	0.07	0.01	0.02	0.02	0.22	0.37	1.04
Stdev	0.10	0.15	0.14	0.09	1.76	1.21	2.95
Avg	0.40	0.29	0.27	0.15	2.48	1.40	4.96
Avg Share (%)	10.83	7.47	6.13	4.99	44.20	27.38	--
CV (%)	25.00	51.18	51.93	63.15	71.16	86.47	59.48
CGR (%)	7.29	3.57	14.24	0.49	11.76	10.61	9.49

Source: CMIE, "Infrastructure", January (2001).

Table A 3.6: *Summary Results of Overseas and Coastal Traffic Handled at Tuticorin Port During 1979-80 to 1999-00*

(Million Tonnes)

Decade Wise Summaries						
			1979-80 to 1989-90			
	Total Overseas Traffic	*Overseas Exp Traffic*	*Overseas Imp Traffic*	*Total Coastal Traffic*	*Coastal Exp Traffic*	*Coastal Imp Traffic*
Max	1.94	0.50	1.52	3.39	0.40	3.38
Min	0.96	0.13	0.74	1.27	0.01	0.87
Stdev	0.32	0.12	0.30	0.81	0.13	0.91
Avg	1.35	0.25	1.10	2.41	0.11	2.30
CV	23.51	46.96	27.40	33.84	118.13	39.43
CGR	4.89	2.89	5.52	9.36	-27.25	13.12
			1990-91 to 1999-2000			
Max	5.76	2.03	3.73	5.90	0.04	5.88
Min	1.97	0.52	1.26	3.11	0.001	3.09
Stdev	1.28	0.46	0.87	0.92	0.01	0.92
Avg	3.47	1.24	2.23	4.58	0.02	4.56
CV	36.83	0.37	0.39	20.15	0.76	0.20
CGR	11.34	14.54	9.95	3.14	7.92	3.11
Overall Summaries						
			1979-80 to 1999-2000			
Max	5.76	2.03	3.73	5.90	0.40	5.88
Min	0.96	0.13	0.74	1.27	0.001	0.87
Stdev	1.40	0.60	0.85	1.40	0.10	1.46
Avg	2.36	0.72	1.64	3.44	0.06	3.38
CV	0.59	0.83	0.52	0.41	1.60	43.25
CGR	8.00	9.51	7.34	5.91	-11.57	7.79

Note CV and CGR are in percentages

Source: Compiled from various Administrative Reports of Tuticorin port

Table A 3.7: *Summary Measures of Value of Trade Handled at Tuticorin Port During 1970-71 to 1999-00*

(Rs. Lakhs)

	Tuticorin Import	*Tuticorin Export*	*Tuticorin Total Value*	*Tuticorin Import*	*Tuticorin Export*	*Tuticorin TotalValue*
Decade Wise Summaries						
1970-71 to 1979-80	(Level)			(Shares %)		
Max	5578	7997	13575	4.50	8.24	10.96
Min	689	744	1660	1.05	1.64	3.66
Stdev	1810.98	2654.98	4114.97	1.10	2.16	2.30
Avg	2010.50	4301.30	6311.80	2.24	4.97	7.21
CV	90.08	61.73	65.19	49.21	43.45	31.92
CGR	15.04	21.20	18.28	1.41	6.83	4.26
1980-81 to 1989-90	(Level)			(Shares %)		
Max	35808	57037	92845	7.28	13.75	21.02
Min	4849	12049	17416	2.19	4.92	7.12
Stdev	9133.50	13807.12	22671.20	1.53	2.46	3.81
Avg	14252.60	28340.50	42593.10	4.30	8.88	13.18
CV	64.08	48.72	53.23	35.67	27.69	28.90
CGR	16.65	13.09	14.32	2.44	-0.69	0.39
1990-91 to 1999-00	(Level)			(Shares %)		
Max	969533	549690	1519223	18.31	10.38	28.69
Min	60154	55460	115614	7.70	7.10	14.80
Stdev	304389.93	166289.76	470191.19	3.23	1.03	4.05
Avg	366112.80	235118.40	601231.20	12.42	8.65	21.07
CV	83.14	70.73	78.20	26.02	11.87	19.24
CGR	32.05	25.78	29.38	9.05	3.87	6.85
Over all Summaries						
1970-71 to 1999-00	(Level)			(Shares %)		
Max	969533	549690	1519223	18.31	13.75	28.69
Min	689	744	1660	1.05	1.64	3.66
Stdev	241385.79	140527.10	381417.62	4.93	2.64	6.67
Avg	127458.63	89253.40	216712.03	6.32	7.50	13.82
CV	1.89	1.57	1.76	0.78	0.35	0.48
CGR	24.78	22.97	24.02	6.24	4.70	5.60

Source: Compiled from Various Reports of Tamil Nadu An Economic Appraisal, Government of Tamil Nadu

Appendix Figures

Figure A 3.1: *Trends in Principal Commodities Handled at Tuticorin Port During 1974-75 to 1999-00*

(In Million Tonnes)

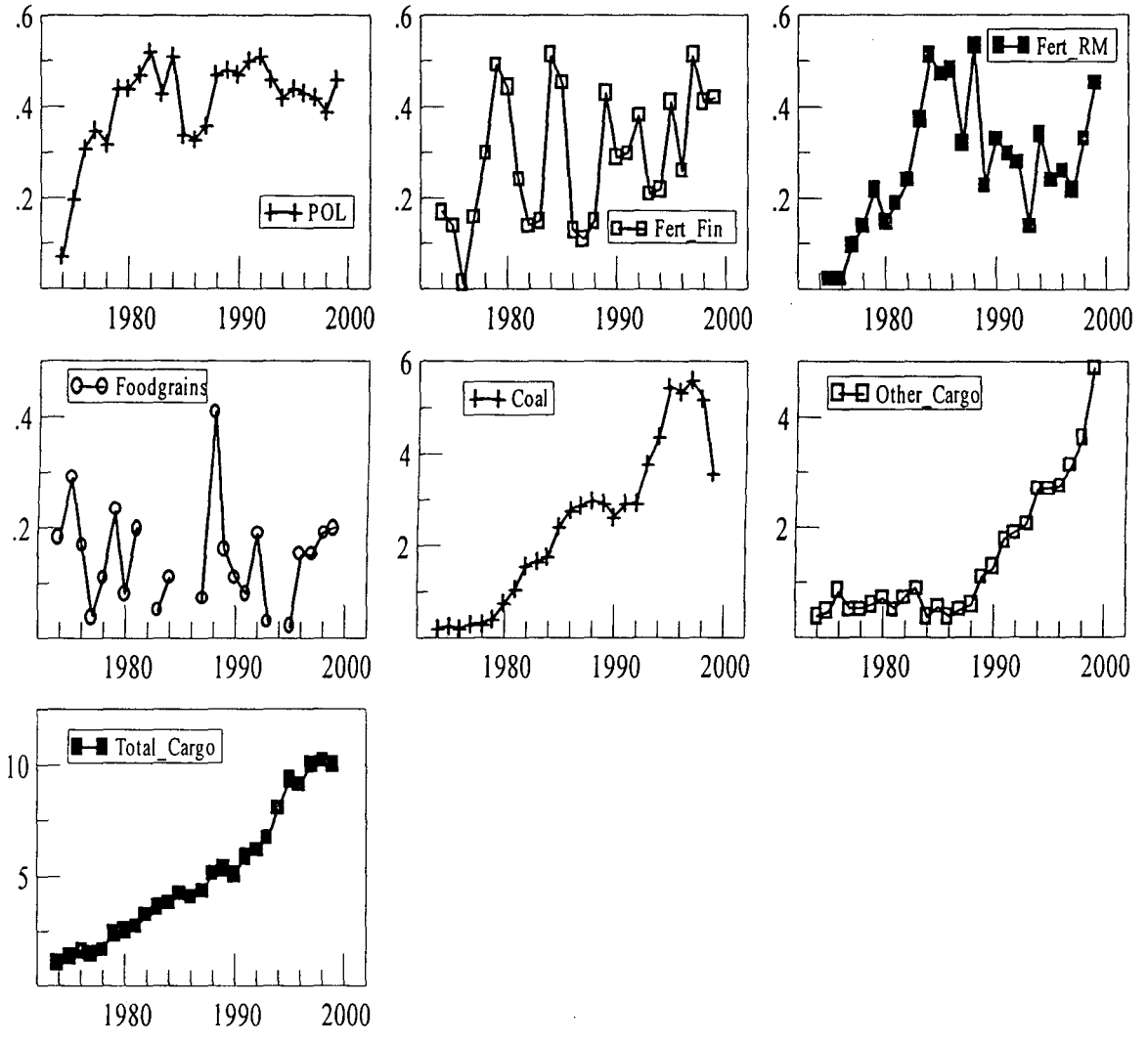
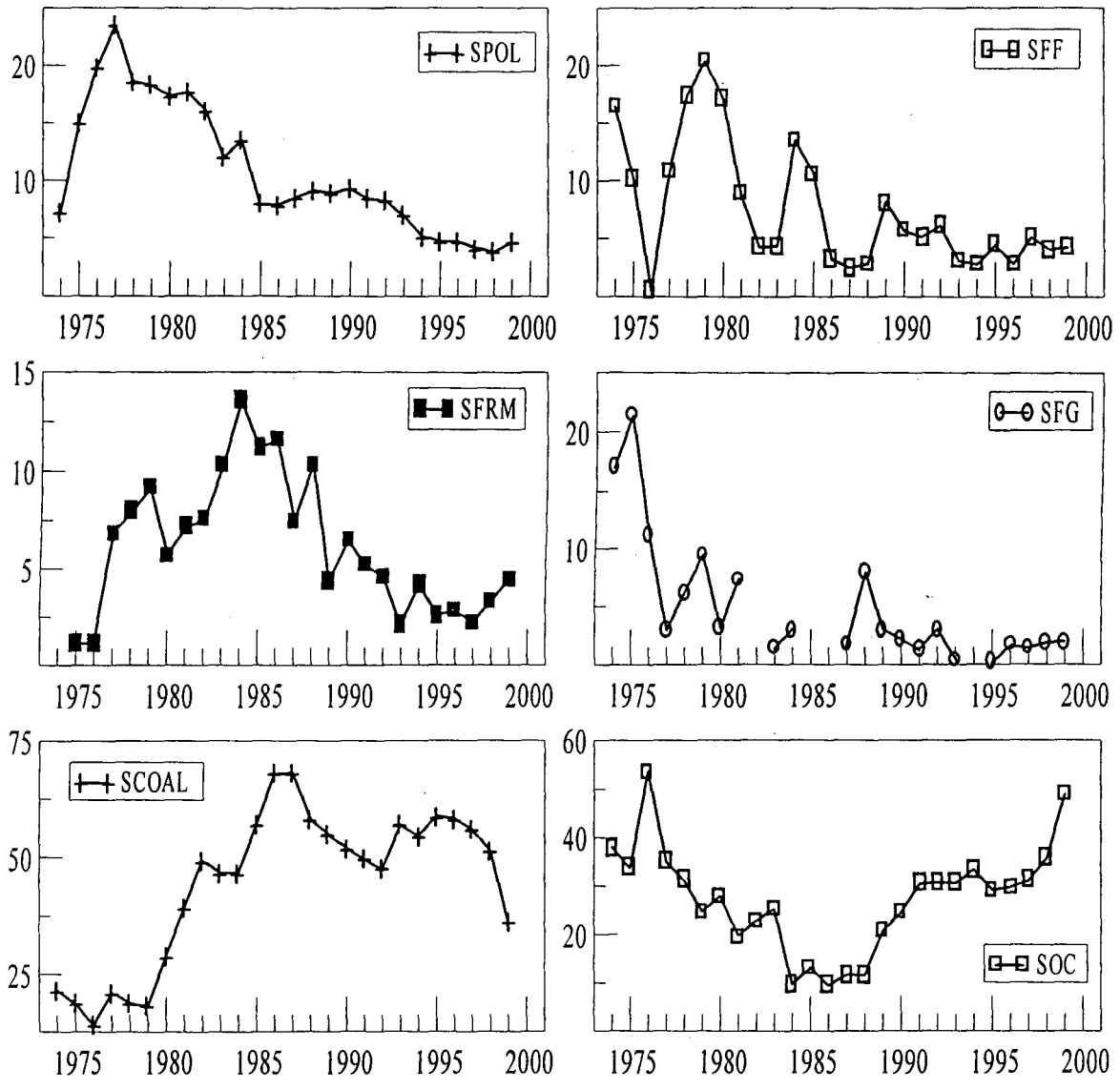


Fig 3.1.1 Petroleum Oil Lubricants (POL)
Fig 3.1.2 Fertiliser Finished (Fert_Fin)
Fig 3.1.3 Fertiliser Raw Materials (Fert_RM)
Fig 3.1.4 Food grains
Fig 3.1.5 Coal
Fig 3.1.6 Other Cargo
Fig 3.1.7 Total Cargo
Source: CMIE, "Infrastructure", January (2001)

Figure A 3.2: *Share of Principal Commodities Handled at Tuticorin Port During 1974-75 to 1999-00*

(In Percentages)



Note: Fig 3.2.1 SPOL - Share of POL in total cargo-handled
Fig 3.2.2 SFF - Share of Fertiliser Finished in total cargo-handled
Fig 3.2.3 SFRM - Share of Fertiliser Raw Materials in total cargo-handled
Fig 3.2.4 SFG - Share of Food grains in total cargo-handled
Fig 3.2.5 SCOAL - Share of Coal in total cargo-handled
Fig 3.2.6 SOC - Share of Other Cargo in total cargo-handled
Source: CMIE, "Infrastructure", January (2001)

Chapter IV

Economics of Port Operation at Tuticorin

Introduction: In this chapter we have examined the factors affecting the cargo handling operation at the port level. The cargo handling operations in a port are affected by various factors. These factors can be broadly classified into two viz. factors internal to the port and factors external to the port[1]. Our discussion is confined only to internal factors. As discussed in Chapter 2, the factors affecting cargo handling operations at the port level are productivity, operational constraints[2], inadequate facilities[3] inefficient and non-optimal deployment of port equipment, labour problems and lack of co-ordination in the entire logistic chain. We would not be looking into all these factors in this chapter. However, we would be looking into certain selected factors such as productivity and other port efficiency measures as discussed by Nair and Anil (1992). This chapter has been organised into five sections. Section one contains a discussion about the trends and pattern of traffic handled at all major ports in India with special emphasis on Tuticorin port. Section two analyses the trends and pattern of output, employment and capital assets of Tuticorin port over the years. Section three analyses the physical performance of the port. Section four examines the financial performance of the port and the last section presents the summary and conclusion of this chapter.

4.1 Trends and Patterns of Output Handled at All Major Ports in India: This section contains a discussion about the trends and pattern of output handled at all major ports in India. Output can generally be defined as the end product of the production process. It can generally be measured in two different ways one in value and another in quantum. Both these measures have their own advantages and disadvantages. We have discussed this issue in the context of output of a port. The former one i.e., value helps us to overcome the problem of aggregation but at the same time masks off the heterogeneity among the various commodities handled at a port. This has serious implication on productivity measurement because; productivity varies between the various categories of commodities handled due to differences in the mode of

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[1] By internal factors we mean factors, which are within the control of the port, and by external factors we mean factors, which are beyond the ports control.

[2] Operational constraints refer to frequent breakdown of cargo handling equipment, poor maintenance of equipment, use of obsolete equipment etc.

[3] By inadequate facilities we mean lack of container terminals or inadequacy of container handling facilities, equipment for dredging etc with the port.

cargo handling[4]. The latter one i.e., quantum, is measured in terms of the amount of cargo-handled at a port during a particular period of time. For instance Jansson and Shneerson (1982) define the output of a port as follows "The output of a port is most simply defined in terms of tons per unit of time passing through, that is throughput"(p.9). In this study, we follow the quantum approach for measuring output. We take the amount of cargo-handled at a port during a financial year as the output of the port in that year. Further, the database does not divulge statistics pertaining to the value added in the process of handling cargo at the ports. It only gives the amount of cargo-handled. Therefore, following Nair and Anil (1992) we have also used the amount of cargo-handled at a port as its output. We have converted all commodities handled into million tonnes for convenience. The period of analysis is from 1970-71 to 1999-00. The data has been collected from Centre for Monitoring Indian Economy's (CMIE) publication on *Infrastructure* and *Various Administrative Reports of Tuticorin Port.*

Geographical location of a port and its proximity with, the trading partners of India affect the amount of cargo-handled by it. This indicates that, any change in India's direction of trade relocates the cargo-handled at all the major ports in India. To examine this fact we have classified all the major ports in India into two groups; namely port situated on the west coast and ports situated on the east coast[5]. Then we have looked in to the share of cargo-handled at the ports situated in these two groups.

For this purpose we have constructed simple index of output following Barger (1951) and National Account Statistics (1999). National Account Statistics provides a simple index for cargo-handled at all major ports put together only. But we have constructed the same for all major ports in India with 1993-94 as base year. A plot of these indices over 1970-71 to 1999-00[6] has been given in the appendix to this chapter. Figure A 4.1 in the appendix revcals that the cargo-handled at all the major ports has been increasing over the period under consideration. Figure A 4.2 in the appendix depicts the share of each major port in the total cargo-handled at all major ports in India put together. It reveals that the proportion of cargo-

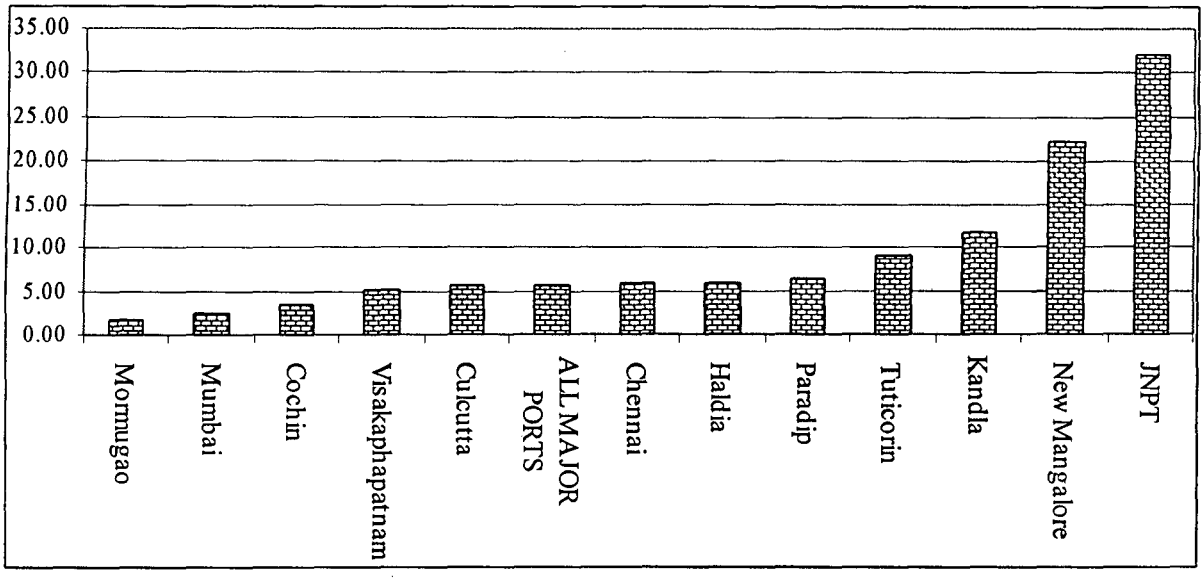
[4] The various commodities handled at a port can be broadly classified into four different categories namely break bulk, liquid bulk, dry bulk and containers.

[5] This group of classification has been obtained by aggregating the total cargo-handled (measured in million tonnes) at each major port situated along the two coasts of India separately.

[6] Although, the period of analysis is from 1970-71 to 1999-00 it varies from port to port because, some ports were established after 1970 at various time points. While some of them were established prior to 1970. Based on the number of years for which data has been available the analysis has been carried out (Refer to Table 4.1 for the number of years)

handled at the ports of Calcutta, Chennai in the east coast, and Cochin, Murmagao, Mumbai in the west coast has been declining. At the same time Kandla, New Mangalore, and JNPT (Jawaharlal Nehru Port Trust) in the west coast and Tuticorin in the east coast have recorded an increase in their shares. The share of cargo-handled at Visakhapatnam port alone exhibited a fluctuating trend. We have also computed growth rates of cargo-handled at each individual port depending on the availability of data for the period 1970-71 to 1999-00. These growth rates have been sorted in ascending order and have been presented in figure 4.1.

Figure 4.1: *Growth Rate of Cargo-handled at All Major Ports in India During 1970-71 to 1999-00*



Source: Compiled from CMIE, "Infrastructure", January (2001)

The figure reveals that Mormugao port located in the west coast registered the lowest growth rate of output (1.7 per cent) during the period under examination, while JNPT also located in west coast recorded the highest growth rate (32.13 per cent). The figure also revealed that five ports namely Mormugao, Mumbai, Cochin, Vishakapatanam and Culcutta have recorded growth rates of output less than the all India average of 5.69 per cent. Seven ports namely, Chennai, Haldia, Paradip, Tuticorin, Kandla, New Manglore and JNPT, have recorded growth rates of output above all India average. Tuticorin port registered a growth rate of 9.11 per cent, which was the highest among the east coast ports. We have also analysed the growth rate of output for the three sub-periods namely 1970-71 to 1979-80, 1980-81 to 1989-90 and 1990-91 to 1999-00. Table 4.1 presents the overall and sub-period growth rates of output, for all major ports in India. Growth rate of total cargo-handled at all major ports put together shows that it

was high during the second period (6.28 per cent) compared to the first period (3.39 per cent) and it was still higher in the third period (6.79 per cent). The period wise analysis of cargo-handled at all major ports revealed an interesting picture. In all the three sub-periods the growth rates recorded by the ports of Mumbai, Mormugao and Cochin were below all India average. Moreover, Mumbai port handled the maximum share of cargo (20.65 per cent) and the variation in cargo-handled at Mumbai port over the period was also low (coefficient of variation was 27.32 per cent). On the other hand New Mangalore and Kandla registered growth rates higher than the combined growth rate of all major ports, during the whole period and also during the sub-periods. The output growth rate of Tuticorin was also higher than all India average in all the three sub-periods.

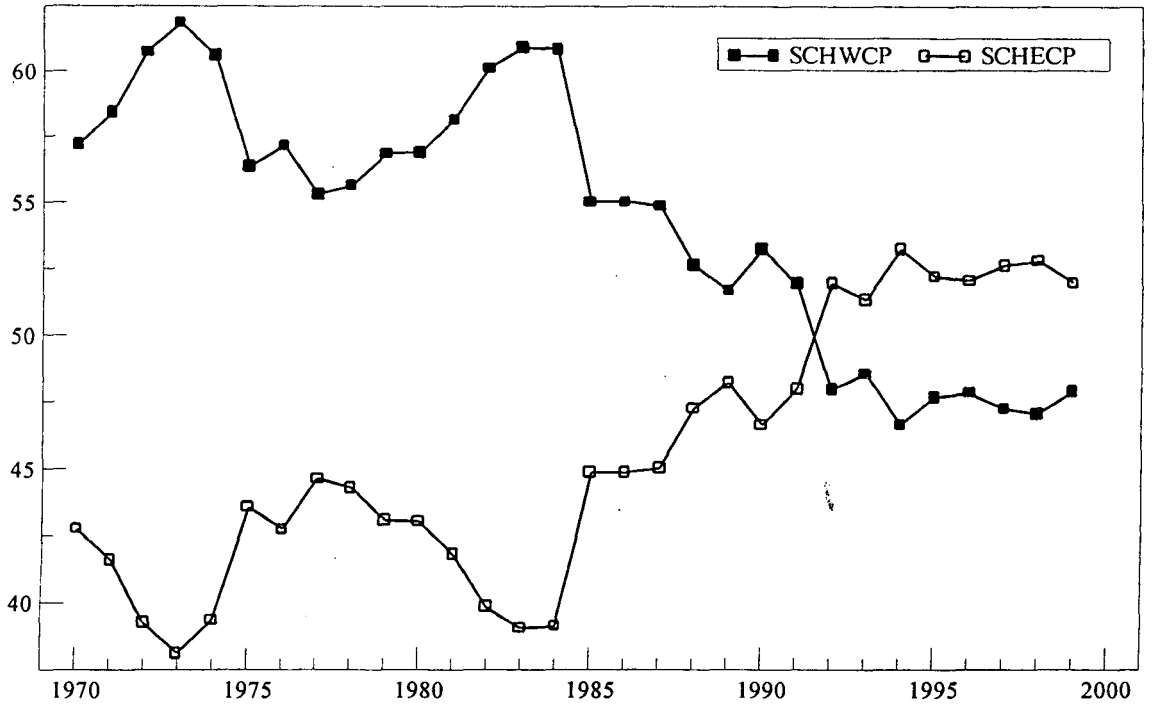
Table 4.1: *Summary Results of Cargo-handled at All Major Ports in India During 1970-71 to 1999-00*

(In Percentages)

	Decade wise Summaries									*Overall Summaries*		
Ports	1970-71 To 1979-80			1980-81 To 1989-90			1990-91 To 1999-00			1970-71 To 1999-2000		
	Avg Share	CV	CGR	Avg Share	CV	CGR	Avg Share	CV	CGR	Avg Share	CV	CGR
Culcutta (30)	11.24	11.07	3.63	10.25	17.11	4.71	10.00	25.57	7.57	10.50	52.50	5.65
Chennai (30)	12.16	13.60	3.73	14.59	31.92	8.72	13.89	15.84	4.33	13.55	55.19	5.79
Cochin (30)	7.28	11.80	1.27	5.30	19.61	3.13	4.53	23.81	5.81	5.71	39.82	3.31
Haldia (8)	0.00	0.00	0.00	0.00	0.00	0.00	7.09	18.88	5.81	1.89	18.88	5.81
JNPT (11)	0.00	0.00	0.00	0.00	0.00	0.00	2.79	64.22	22.17	0.94	72.54	32.13
Kandla (30)	5.38	47.93	16.29	13.02	23.83	8.01	13.63	29.98	8.93	10.67	76.56	11.84
Mormugao (30)	19.51	11.25	2.80	13.01	7.71	0.29	8.30	10.78	2.03	13.61	17.51	1.70
Mumbai (30)	25.44	6.68	1.07	21.94	16.59	5.03	14.57	6.99	0.51	20.65	27.32	2.53
New Mangalore (26)	0.71	63.82	46.27	3.34	57.37	23.05	4.85	34.33	8.17	2.87	85.54	22.39
Paradip (30)	3.82	20.43	0.67	2.93	53.36	10.68	4.65	25.54	7.07	3.80	73.07	6.34
Tuticorin (26)	2.27	28.87	15.13	3.40	23.85	7.60	3.64	23.97	7.01	2.80	59.48	9.11
Vizag (30)	13.39	11.98	1.59	12.17	30.25	7.63	13.47	23.52	7.36	13.01	58.27	5.16
All Major Ports (30)		9.97	3.39		21.51	6.28		22.61	6.79	100.00	54.79	5.69

Note: figures in the bracket indicate number of years. CV, CGR and Avg Share are in percentages.
Source: Compiled from CMIE, "Infrastructure", January (2001).

Figure 4.2: *Share of Traffic Handled at West Coast and East Coast Ports During 1970-71 to 1999-00*



Note: SCHECP - Share of Cargo-handled at East Coast Ports, SCHWCP - Share of Cargo-handled at West Coast Ports
Source: Compiled from CMIE, "Infrastructure", January (2001)

Figure 4.2 depicts the trends in the share of cargo-handled at east coast and west coast ports in the total cargo handled at all major ports put together from 1970-71 to 1999-00. It reveals that till 1991 the share of cargo-handled at the west coast ports was higher than that at east coast ports (see also appendix table A 4.1). One reason for this can be the higher berth capacity of the west coast ports. Table 4.2 presents the distribution of berth capacity across all major ports in India.

However, in the post-liberalisation period, the share of cargo-handled at the east coast ports was higher than the total cargo-handled at all major ports put together. Besides, the higher berth capacity, there are some other reasons also which favour the west coast ports. Among these one can be the geographical proximity of the west coast ports to the countries, India has trading relationship with. In other words, the west coast ports are at an advantageous trading location with regard to countries in Europe, Gulf, North America and Africa. As against this, countries like Japan, China, Australia and those in South East Asia are the only ones close to the east coast ports. Therefore, the west coast ports stand to gain greater in comparison with

the east coast ports. Another possible reason for the difference in the quantum of cargo-handled by the ports in these two groups could be the disparity in the levels of development among the various states in India.

Table 4.2: *Distribution of Berth Capacities across All Major Ports in Eastern and Western Coasts of India*

(As at January 2001)

East Coast Ports			*West Coast Ports*		
	Capacity (MT)	No of Berth		Capacity (MT)	No of Berth
Calcutta	8.3	33	Cochin	13.45	14
Chennai	27.62	20	JNPT	14.6	15
Haldia	28.7	12	Kandla	39	15
Paradip	12.85	9	Mormugao	19.48	4
Tuticorin	12.5	10	Mumbai	30.5	46
Visakhapatnam	30.8	19	New Mangalore	20.25	9
Total	120.77	103	Total	137.28	103
Share (%)	46.8	50	Share (%)	53.2	50

Source: Compiled from CMIE, "Infrastructure", January (2001).

The states of Gujarat and Maharashtra are industrially advanced compared to other states in India. These states are located on the west of India. Therefore, the west coast ports have the capacity to handle a larger amount of cargo. In case of the states situated on the eastern coast, only Tamil Nadu is industrially advanced, the others being predominantly agricultural. So the ports on this side have a lower advantage than west coast ports in terms of cargo handling capability. These could be the possible reasons why the west coast ports have an edge over their east coast counterparts. As we have already mentioned above, the share of the east coast ports in the total cargo-handled has been higher than that of the west coast ports since 1991-92. One possible reason for this shift can be the change in the direction of India's foreign trade towards South-East-Asian countries. Table 4.3 presents the shares of these countries in the imports and exports of India. The table clearly shows an increase in both over the period under consideration.

During the period 1990-91 to 1999-2000, India's exports in US dollar terms with the Other Asian Developing Countries[7] grew by 12.62 per cent and imports grew by 10.95 per cent. Since these countries are closer to the east coast ports, increased trade with these countries might have led to more cargo handling at these ports in the nineties.

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[7] OADC (Other Asian Developing Countries) include Hongkong, South Korea, Malaysia, Singapore and Thailand. Refer to RBI, Handbook of statistics on Indian Economy, 1999-2000.

Table 4.3: *Trends in Direction of India's Foreign Trade to Other Asian Developing Countries*

Years	*EXPORTS*	*IMPORTS*	*SOEOADC**	*SOIOADC**
	(US $ Million)	(US $ Million)	(%)	(%)
1990-91 to 1999-00				
1990-91	2076.6	3240.5	11.44	13.46
1991-92	2394.9	2740.2	13.41	14.12
1992-93	2745.1	3026.5	14.81	13.83
1993-94	3993.7	3460.2	17.96	14.85
1994-95	4492.5	4914.9	17.06	17.15
1995-96	5587.2	6169.4	17.57	16.82
1996-97	6432.3	6331.8	19.22	16.18
1997-98	6361.5	7024.6	18.17	16.93
1998-99	5165.3	8069.6	15.55	19.04
1999-2000	6813.9	9159.6	18.12	19.40
CGR (%)	12.62	10.95		
CV (%)	38.09	42.09		

Note: OADC (Other Asian Developing Countries) includes Hong Kong, South Korea, Malaysia, Singapore and Thailand. * Indicates that in the last two columns, the shares of exports and imports in the total exports and imports of India have been given.
Source: RBI, Handbook of statistics on Indian Economy, 1999-2000.

4.2.1 Trend in Output of Tuticorin Port: In this section we have discussed briefly about the trends in output of Tuticorin port, as we have already discussed about output elaborately in the previous chapter. The output trend of Tuticorin port has been growing over the period under consideration, i.e. 1979-80 to 1999-00. The cargo-handled rose from 2.41 million tonnes in 1979-80 to about 9.99 million tonnes in 1999-00, registering a continuous growth rate of 7.66 per cent which is also statistically significant (refer to Table 4.5). An analysis of sub-period growth rates revealed that during 1980-81 to 1989-90 the growth rate was 7.6 per cent and in the next sub-period, 1990-91 to 1999-00, it was 7.01 per cent (refer to Table 4.4). Further, the data also reveals that the share of Tuticorin port in the combined cargo-handled at all major ports was 3.40 per cent in the first period and it marginally increased to 3.64 per cent in the second sub-period.

Table 4.4: *Summary Measures of Output, Capital and its Components and Employment of Tuticorin Port During 1979-80 to 1997-98*

	Output	*Employment*	*Components of Capital stock*		*Capital Stock*	*Capital Stock*
			Construction	Equipment & Machinery		
			At Curr Prices (Rs. Lakhs)	At Curr Prices (Rs. Lakhs)	At Curr Prices (Rs. Lakhs)	At 81-82 Prices (Rs. Lakhs)
1979-80 to 1989- 90						
CV (%)	25.90	4.98	5.55	15.64	7.89	16.65
CGR (%)	7.47	1.67	23.60	43.98	28.45	5.00
1990-91 to 1997-98						
CV (%)	24.15	5.73	3.95	11.76	7.07	13.99
CGR (%)	8.81	-1.82	12.69	39.85	23.89	5.10
1979-80 to 1997-98						
CV (%)	43.77	5.57	4.89	14.07	7.58	29.78
CGR (%)	7.76	0.17	26.16	68.67	40.62	5.34

Note: employment includes only official staff and is not inclusive of cargo handling labourers. Output and employment are unweighted indices constructed with base 1979-80 = 100.
Source: Compiled from Various Administrative Reports of Tuticorin Port

Table 4.5: *Growth Rate of the Indices of Output, Capital and Employment of Tuticorin Port in Semi-log Form During 1979-80 to 1997-98*

(1979-80 = 100)

Variable	*GR (%)*	*T-Value*	*R-SQR*	*Adj R-SQR*	*DW*
Output	7.66	32.03*	0.98	0.98	1.34
Employment	-0.25	-1.07	0.06	0.01	0.39**
Capital	5.28	82.84*	0.998	0.997	0.49**

Note: * denotes significance at 5% level. ** Denotes the presence of positive first order serial correlation among the residuals. Growth rate of employment pertains only to official staff of the port. Growth rate of employment for cargo handling labourers has not been calculated due to non-availability of data about them.
Source: Compiled from Various Administrative Reports of Tuticorin Port

4.2.2 Trends in Employment of Tuticorin Port: In this section we have discussed briefly about, the trends and pattern of employment in Tuticorin port. The data collected from the various Administrative Reports of the port permits us only for a discussion about the non-cargo-handling workers. Even though a primary survey has been conducted, the data on cargo handling labour force could not be gathered. Because, cargo-handling operations were undertaken by contract shore labour under the supervision of private stevedoring firms[8].

[8] Private firms that own shore labour and undertake loading and unloading of cargo at the port are called 'Stevedoring firms'. From 1981-1999 cargo handling operations were carried out by private stevedoring firms, with the help of port equipment and shore labour they owned. But from 1.1.2000 onwards, subcontracting of cargo-handling operations given to private firms at Tuticorin port has been terminated. The cargo handling shore labourers have been brought under the direct control of the port i.e. they have been extended the Dock Labour Board status (refer to Tuticorin Port Trust Administration Report 1999-2000).

The data from these private firms are not readily available[9]. Hence, we have considered only the non-cargo-handling labourer's i.e., official staff of the port. To quote from Goldar (1986) "Total employees as a measure of labour input includes both workers and persons other than workers. The latter category of workers includes supervisors, technicians, managers, clerks and other similar types of employees. It has been argued that such employees are as much important for getting the work done as workers who operate machines and, therefore, their services should be taken into account in the measurement of labour input" (p.49). As per the administrative reports the official staffs are classified into four classes viz. class 1, 2, 3 and 4. We have aggregated these employees into two groups. The first group comprises of class one and two employees. The second group consists of class three and four employees. The former group includes skilled administrative officials, heads of departments, civil engineers, electrical engineers, medical officers, harbour master, captain, pilots, accounts officers, traffic managers, software specialists etc. The latter group of employees consists of clerks, stenographers, accountants, office assistance, junior technicians, supervisor's etc. Figure 4.3 depicts the trends in the various categories of employees at the port. In the figure we have indexed the various categories of employees by taking 1986-87 as base year (i.e. = 100). The index of employment of official staffs revealed that there was a decline over time in the total official staff of the port. A disaggregated level analysis indicated that, this decline was mainly due to a fall in the number of employees belonging to the second group. The number of employees in the first group increased tremendously after 1992-93. This was mainly due to a restructuring of official staff within the engineering department at the port. In that year many class3 posts were converted in to class1 and 2. The growth rate of employment of official staff during the period 1986-87 to 1999-00 was -1.15 per cent.

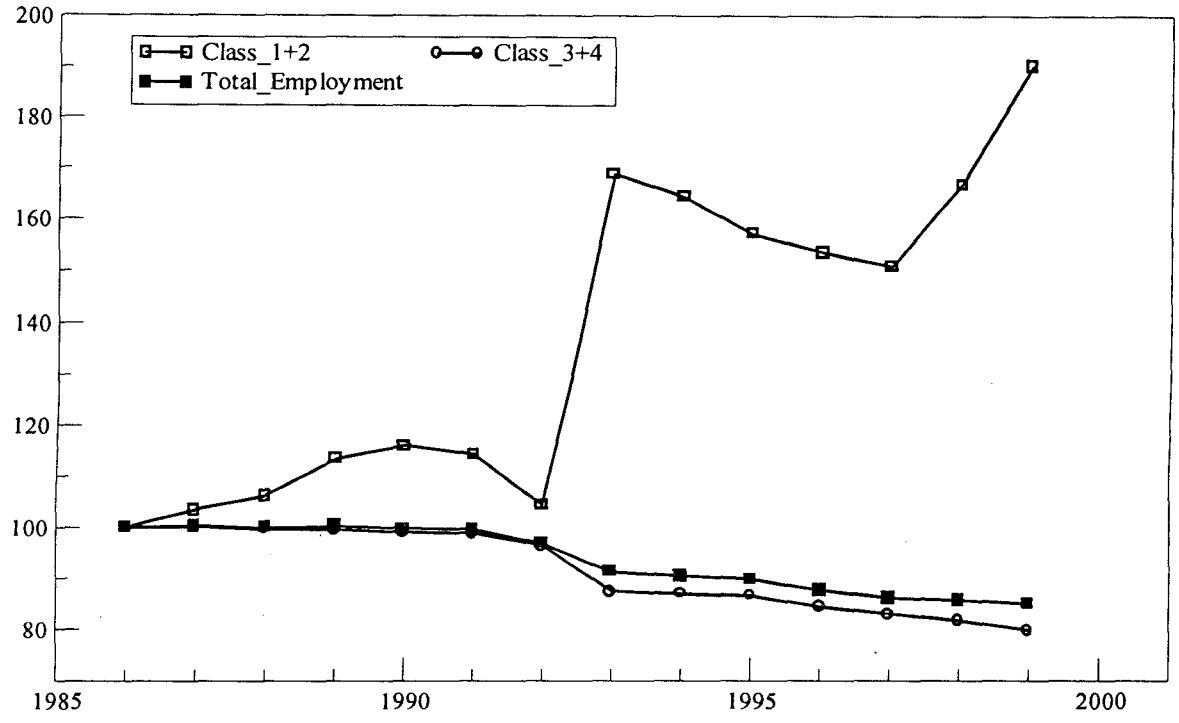
Further, the shares of employment indicated that 93.25 percent of the employees belonged to the second group, and the rest belonged to the first group of our classification refer to Table 4.7. We have also looked in to the overall growth rate of employment during 1979-80 to 1997-98. Employment at Tuticorin Port registered a continuous negative growth rate of -1.37 per

[9] An attempt was made to collect relevant information pertaining to cargo-handling labour force (shore labourers) from Tuticorin Port Trust Cargo Handling Labour Pool (TPTCHLP), which was earlier known as Tuticorin Stevedores Association (TSA). But TSA did not maintain any continuous records pertaining to shore labourers and their operations due to absence of official obligation. But, from 1-1-2000 onwards attempt is being made to compile all relevant information pertaining to cargo handling labour operations at the port.

cent during this period and it was statistically significant (refer to Table 4.6). Thus, during the period under consideration the overall employment at the port declined[10] notably.

Figure 4.3: *Trends in Various Categories of Employment at Tuticorin Port During 1986-87 to 1999-00*

(1986-87 = 100)



Source: Compiled from Various Administrative Reports of Tuticorin Port

Table 4.6: *Results of Cochrane-Orcutt Regression for Capital and Employment at Tuticorin Port During 1979-80 to 1997-98*

Variable	*GR (%)*	*T-Value*	*R-SQR*	*Adj R-SQR*	*DW*
Employment	-1.37	-5.39*	0.64	0.62	1.37
Capital	5.17	39.72*	0.99	0.98	0.57

Note: * denotes significance at 5% level.
Source: Compiled from Various Administrative Reports of Tuticorin Port

[10] The growth rates of employment computed based on regression analysis in semi-log form indicated the existence of first order serial correlation among the residuals (Refer to table 4.5). We have attempted to correct this using Cochrane-Orcutt iterative procedure. The results so obtained have been reported in this chapter.

Table 4.7: *Summary Measures of the Indices of Employment and Wages of Employees of Tuticorin Port During 1986-87 to 1999-00*

(1986-87 = 100)

Employment			
	Class 1+2	*Class 3+4*	*Total Employees*
CV (%)	22.59	8.69	6.67
CGR (%)	4.70	-1.59	-1.15
Avg Share (%)	6.75	93.25	
Nominal Wages			
	Class 1+2	Class 3+4	Total Pay
CV (%)	69.05	46.66	48.88
CGR (%)	15.47	11.84	12.19
Avg Share (%)	9.54	90.46	
Real Wages			
CV (%)	35.69	13.37	14.48
CGR (%)	7.13	3.76	4.09
Avg Share (%)	9.54	90.46	

Note: employees refer to only official staff employed in the port, and does not include cargo- handling labourers. Money Wages or Nominal Wages have been deflated using consumer Price index (CPI) for industrial workers in selected centers with base as 1982 = 100. The center selected for the purpose was Madurai.
Source: Compiled from Various Administrative Reports of Tuticorin Port

We have also examined the trends in the wages received by these two categories of official staff. The total wage bill has been obtained by adding the pay and allowances. The nominal wages received by the employees have been deflated by using the consumer price index for industrial workers (CPI) in Madurai with base 1982 = 100. We have used the CPI in Madurai, as it is located at a close proximity to Tuticorin. The trends in the wages indicated that total wage bill in real and nominal terms have been growing over the period under consideration. The wages of employees in class 1+2 has been growing at a higher rate in both real and nominal terms (refer to Table 4.7). Class 3+4 employees who constitute a large share of the total employment have been receiving a major share of the wage bill. The difference between the growth rates of income in these two categories of employees may be probably due to the differences in their skills and also due to the type of jobs they perform. The employees belonging to class 1+2 cadre have been instrumental in the operations of the port. They act as critical inputs for the day today operations, and have also been co-ordinating with the projects related to the development of the port.

4.2.3 Trends in Capital Stock of Tuticorin Port: Besides a productive labour force a port also needs different kinds of machinery, equipment and storage facilities for its efficient functioning. In this section we have discussed about the construction of a consistent capital stock series for Tuticorin port. The data on capital stock and its components have been obtained from the various Administrative Reports of Tuticorin port. For convenience we have

divided the total capital stock into two components, namely construction and equipment and machinery. The construction group is inclusive of land, buildings sheds and other structures, wharves, roads and boundaries, docks, sea walls, piers and navigational aids. The equipment and machinery group is inclusive of capital dredging, floating crafts, railway and rolling stocks, cranes and vehicles, plant and machinery, installation of water supply, electricity and communication and oil pipelines and installations. Table 4.8 presents the trends in the total capital stock and its two components from 1979-80 to 1997-98 in current as well as in constant prices (at 1981-82 Prices). As per the book value, the total capital assets in current prices registered a growth rate of 7.58 per cent (refer to Table 4.4). Regarding the growth rate of its components, Table 4.8 reveals that capital stock classified under the group of construction increased from Rs.3,117.65 lakhs in 1979-80 to Rs. 7,729.42 lakhs in 1997-98, recording a growth rate of 4.89 per cent (refer to Table 4.4). Similarly the components of capital stock included under the second group, namely equipment and machinery grew from Rs. 581.12 lakhs in 1979-80 to Rs.7,093.16 lakhs in 1997-98, registering a growth rate of 14.07 per cent. The higher growth rate of the equipment and machinery group compared to the construction group has resulted in an increase in the share of the equipment and machinery group in the total capital stock. The share of the equipment and machinery group in the total capital stock increased from 15.71 per cent in 1979-80 to 47.86 per cent in 1997-98. This increase in the share of equipment and machinery group in total capital stock indicates the increased mechanisation of the port over time. However, from 1996-97 onwards the share of construction component expressed in current prices in the total capital stock of the port has been increasing. This can be mainly attributed to the expansion of berth facilities under taken at the port.

From the behaviour of the trends in the two components of capital stock namely construction, and equipment and machinery presented in Table 4.8 one can infer the following. There exists a basic difference between the investment made by a port on construction, and equipment and machinery. This difference can be explained as follows. The investment incurred on construction activity can be attributed to a long-term phenomenon i.e. it refers to the expansionary activity undertaken by the port in the form of increasing the number of berths. On the other hand the investment made on equipment and machinery can be attributed to capacity improvements i.e. investment made in the short-run by the port on the purchase of new cargo handling equipment. While the first type of investment is made after a careful

evaluation of the hinterland in terms of its potential to generate traffic say for a period of ten years. The investment incurred on equipment and machinery is made after the augmentations of the port capacity i.e. new cargo handling equipment are purchased only after constructing new berths.

Table 4.8: *Trends in Capital Stock and its Components of Tuticorin Port During 1979-80 to 1997-98*

Years	*Construction*	*Equipment & Machinery*	*Capital Stock*	*Capital Stock*
	Curr Prices	Curr Prices	Curr Prices	(At 81-82 Prices)
	(Rs. Lakhs)	(Rs. Lakhs)	(Rs. Lakhs)	(Rs. Lakhs)
1979-80	3117.65	581.12	3698.77	11934.54
1980-81	3342.55	911.37	4253.92	12954.62
1981-82	3360.19	903.30	4263.50	13856.07
1982-83	3614.90	1597.55	5212.45	14738.64
1983-84	4058.18	1621.20	5679.38	15470.91
1984-85	5289.51	1705.05	6994.56	16035.58
1985-86	5376.35	1807.15	7183.49	16789.62
1986-87	5537.76	1998.66	7536.42	17600.04
1987-88	5621.82	2662.79	8284.60	18507.67
1988-89	5656.65	2775.50	8432.16	19369.99
1989-90	5650.15	2874.88	8525.03	20412.22
1990-91	5668.88	2914.26	8583.14	21531.89
1991-92	5714.77	3065.34	8780.11	22914.66
1992-93	5796.33	3088.31	8884.64	24123.02
1993-94	6887.53	3719.21	10606.75	25494.68
1994-95	7022.74	6223.07	13245.81	27275.79
1995-96	7063.02	7122.80	14185.82	28828.21
1996-97	7628.87	7126.42	14755.29	30487.72
1997-98	7729.42	7093.16	14822.59	32050.72

Source: Compiled from Various Administrative Reports of Tuticorin Port.

The above analysis on the trends in the capital stock has been carried out in current prices; an analysis of the same in constant prices would provide a better insight. Hence, we have also measured the value of the total capital stock at constant prices. We have constructed a consistent capital stock series based on the cost approach, from the book value of the total capital assets at original cost as reported in the balance sheet of the port. The reason behind selecting this method for measuring the capital stock series is because it is a backward looking concept of capital. The capital stock of a particular year has been measured by the amount of resources that would have been required in the base year to produce these capital goods. The methodology we have adopted for measuring the capital stock at constant prices is perpetual inventory method following Goldar (1986). In this method the capital stock for a given year is traced to the stream of past investments at constant prices. The formula used for estimation of capital stock is as follows.

$$K_t = K_0 + \sum_{t=1}^{n} \left\{ \frac{[(B_t - B_{t-1}) + D_t]}{P_t} \right\}$$

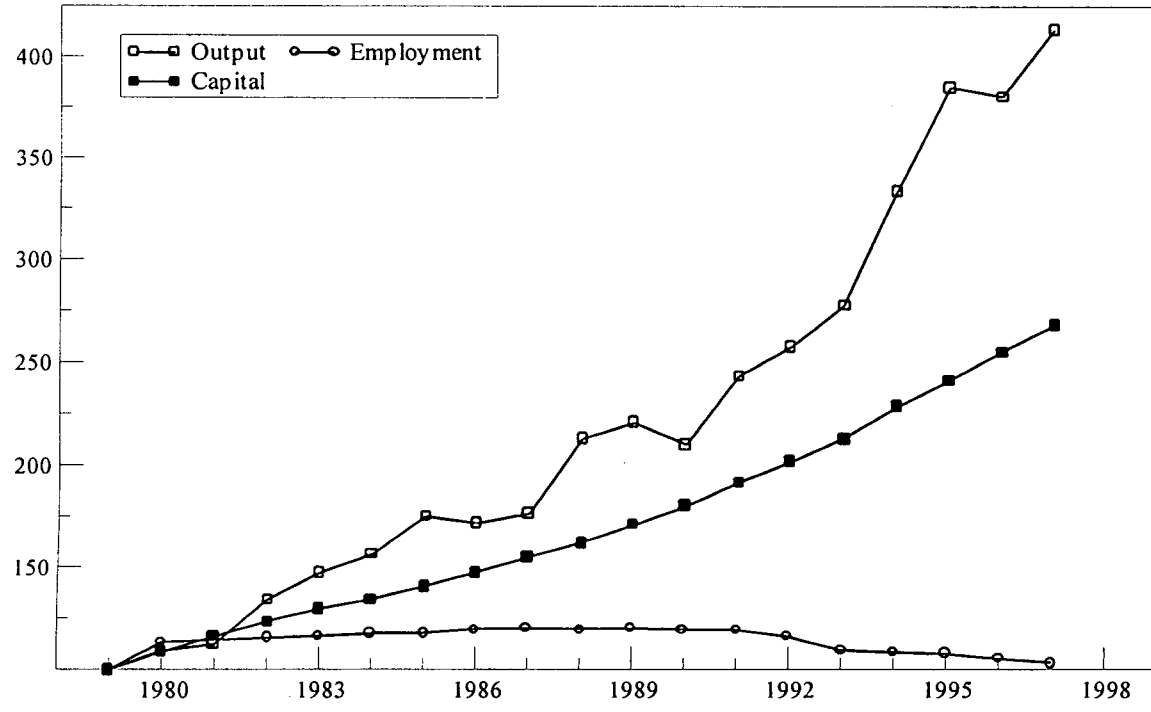
In the above equation K_0 denotes the benchmark year capital stock. K_t denotes the gross capital stock at time t. B_t the book value of capital stock at time t, and (B_t-B_{t-1}) denotes the investment at time t. D_t denotes the amount of capital depreciated, and P_t denotes the price index. We have taken 1979-80's capital stock as the benchmark year capital stock. The reason behind selecting this year was due to the fact that the port being declared as a major port and all the assets of the port were revalued in this year. The depreciation amount, D_t is as given in the balance sheet of the port. For deflating the investment series, we used weighted price index, with weights equal to the average share of construction and equipment and machinery in the total capital stock in the benchmark year.

The price indices of construction and equipment and machinery with base 1981-82 have been taken from the various issues of RBI's Report on Currency and Finance and Chandok Series. The investment figure for each year has been added with the depreciation figure for that year. The sum so obtained has been deflated by using the composite price index, after which the resultant value has been added cumulatively to the benchmark year capital stock. The capital stock trend at constant prices has been depicted in the figure 4.4. Further, the figure also presents the movement in output and employment of the port during the period 1979-80 to 1997-98.

Table 4.8 also presents the total capital stock series in 1981-82 prices. The table reveals that the total capital stock series of the port at constant prices in the benchmark year was Rs. 11,934.54 lakhs and it increased to Rs. 32,050.72 lakhs in 1997-98 registering a growth rate of 5.34 per cent. The trend in the capital stock revealed that it has been constantly growing during the period under consideration. In semi-log form the growth rate registered was 5.17 per cent and it was also statistically significant (refer to Table 4.6).

Figure 4.4: *Trends in the Indices of Output, Capital and Employment of Tuticorin Port During 1979-80 to 1997-98*

(1979-80 = 100)



Note: output and employment are in terms of simple indices. Employment refers to only official staff.
Source: Compiled from Various Administrative Reports of Tuticorin Port

4.3 Physical Performance of Tuticorin Port: Having discussed about the trends in output and inputs in the previous sections, in this section we have discussed about selected indicators of physical performance. In other words we have discussed about the role of port-specific factors in influencing cargo-handling operations at the port. Since productivity is one of the main factor that influences the cargo handling operations at the port we have began the section with a discussion on port productivity. By productivity we mean partial productivity i.e., ratios of output to particular inputs. According to Kendrick (1961), Partial productivity ratios are, "useful for measuring the saving in particular inputs achieved over time, do not measure overall changes in productive efficiency, since they are affected by changes in composition of input, i.e., by factor substitutions." As we have discussed in the beginning of this chapter since, output measurement has serious problems. Therefore, we have used operating revenue of the port as a proxy for output. Another reason for having used operating revenue was due to the non-availability of data on value added during the process of cargo handling at the port. To compute the changes in productivity overtime, following Kendrick (1961) we have chosen to work in terms of productivity ratios as these ratios provide greater flexibility for the analysis

of movements and of relationship with other variables. We have computed the following crude measures of port productivity viz. (i) Capital Productivity: this has been calculated by dividing the deflated operating revenue by the capital stock series measured at constant prices. This measure can otherwise be called as the revenue to the port per unit of capital input[11]. (ii) Labour Productivity: this has been calculated by dividing the deflated operating revenue by the real wages received by the official staff of the port. This measure can otherwise be called as the revenue to the port per unit of real wages. The movements of these two crude measures of productivity reveals that they have been slowly raising over time with capital productivity showing slight fluctuations (refer to Figure 4.5). However, note that these results are to be considered only as indicative ones as they are not based on a consistent output series. Therefore, they might not be revealing the true picture; rather they have to be considered as crude. The non-availability of reliable data on output in value terms has forced us to rely on operating revenue as a proxy. Also we do not have data on cargo handling labourers.

Figure 4.5 depicts the trends in capital and labour productivity and capital intensity- where capital intensity is defined as capital per unit of labour. The ratio of deflated operating revenue to total capital stock at constant prices reveals that it has been increasing over the period registering a continuous growth rate of 1.75 per cent per annum during the period 1979-80 to 1997-98[12] (refer to Table 4.10). Sub-period analysis revealed that the growth rate of capital productivity was 5.04 per cent during the first period and in the second period it was 2.81 per cent (refer to Table 4.9). Compared to the first period, the second period growth rate of capital productivity was lower. This can be due to the increased capital intensity during the second period as is evident from the trend. The trend in labour productivity revealed that it has been slowly growing during the period under observation[13]. Period-wise analysis revealed that labour productivity was higher in the second period 1990-91 to 1997-98 compared to the previous period (refer to Table 4.9).

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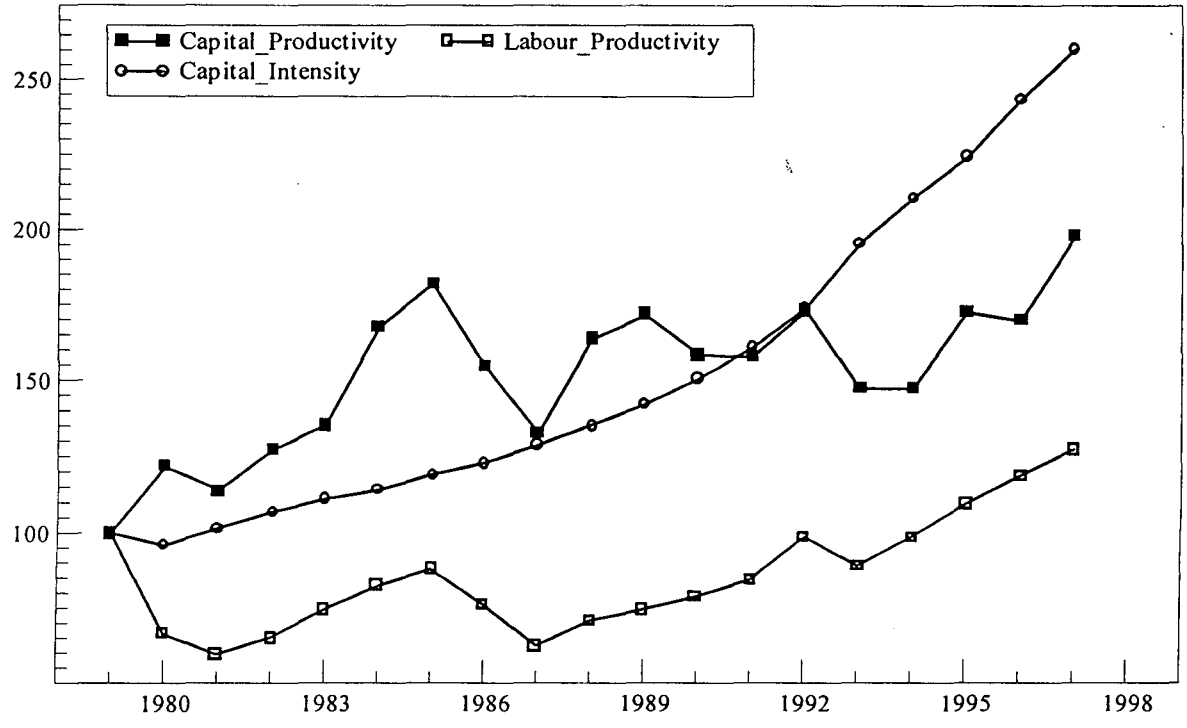
[11] We have deflated the operating revenue because the denominator figures are in real terms. Operating revenue was deflated by using Wholesale Price Index (WPI) with base 1981-82. We have used WPI for all commodities to deflate the operating revenue because different types of cargo are handled at the port and the tariff rates levied for handling each commodity varies, according to its market value.

[12] Regression equations fitted to productivity ratios in semi-log form over time to compute growth rates revealed the presence of positive first order serial correlation among the residuals. To remove the effect of serial correlation Cochrane-Orcutt iterative procedure has been used and the results so obtained have been reported. The original results have been presented in appendix refer to Table A 4.2.

[13] As already mentioned above we have deflated the operating revenue of the port by the whole price index with base 1981-82. The total remuneration given to the employees have been deflated by using CPI for industrial workers in Madurai with base 1982.

Figure 4.5: *Trends in Indices of Capital Productivity, Labour Productivity and Capital Intensity of Tuticorin Port During 1979-80 to 1997-98*

(1979-80 = 100)



Note: labour productivity has been computed only for official staff. Cargo handling labourer's productivity has not been computed due to non-availability of data.
Source: Compiled from Various Administrative Reports of Tuticorin Port

Table 4.9: *Summary Measures of Capital Intensity, Labour and Capital Productivity of Tuticorin Port During 1979-80 to 1997-98*

	Labour Productivity	*Capital Productivity*	*Capital Intensity*
1979-80 to 1989- 90			
CV (%)	16.06	18.6	13.02
CGR (%)	-2.63	5.04	3.27
1990-91 to 1997-98			
CV (%)	16.95	10.04	19.36
CGR (%)	6.22	2.81	7.04
1979-80 to 1997-98			
CV (%)	22.56	16.53	33.64
CGR (%)	1.31	3.66	5.16

Note: labour productivity has been computed only for official staff, as data on cargo handling labourers were not available.
Source: Compiled from Various Administrative Reports of Tuticorin Port.

Table 4.10: *Results of Cochrane-Orcutt Regression for Capital Intensity, Capital and Labour Productivity of Tuticorin Port During 1979-80 to 1997-98*

(1979-80 = 100)

Variable	*GR (%)*	*T-Value*	*R-SQR*	*Adj R-SQR*	*DW*
Labour Productivity	4.3	5.77*	0.68	0.65	1.15
Capital Productivity	1.74	2.36*	0.26	0.21	1.79
Capital Intensity	7.6	14.83*	0.93	0.92	1.49

Note: * denotes 5% level of significance.
Source: Compiled from Various Administrative reports of Tuticorin Port.

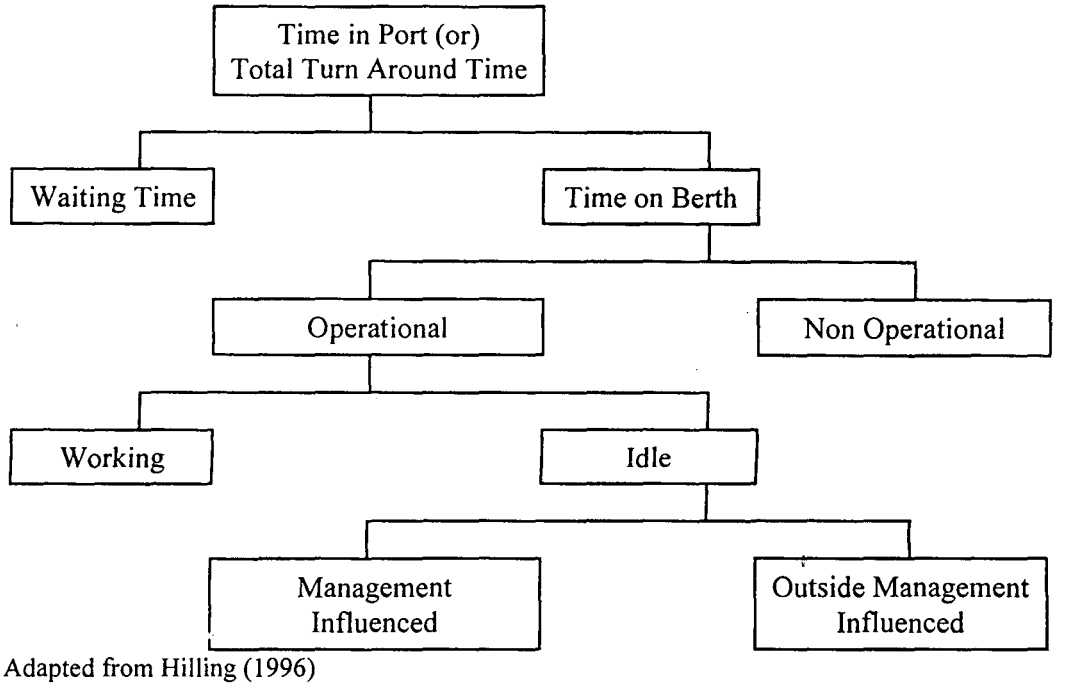
The above measures of productivity give us an overview of the performance of the port during the period of analysis. As far as a port is concerned the factors that determine its competitiveness is its ability to handle the cargo at low cost, quickly, safely, and efficiently. The speed at which a port handles the cargo at its disposal can be evaluated by the amount of time taken by a ship to load or unload the cargo at the port. In other words to quote from Hilling (1996) "it is the rate at which the cargo is handled between ship and shore (the ship cargo-handling system) and the rate at which the cargo arrives at or can be delivered away from the immediate berth area (the shore handling system)" (P.262). In case of Tuticorin the shore handling system i.e. movement of cargo within port unto the wharves is done by various modes of transport like trucks, railway wagons, pipelines, and conveyer belts. Loading and unloading operations are also carried out with the help of ship's cranes that come to the port. Private cranes are also involved in handling of cargo within the port premises. Therefore, it is very difficult to quantify the role of port's efficiency in handling the cargo.

However, in this section we look into certain important port efficiency indicators like average ship turn-around time, average ship berth output etc. Average ship turn-around time refers to the total time taken by a ship from the time it enters the approach channel of the port till the ship leaves the port after loading or unloading the cargo. The time spent by a ship at a port can be divided into different categories. The following chart describes this division of time.

As shown in the figure 4.6 this total turn around time is divided into waiting time or pre berthing time and time at berth. Waiting time or pre berthing time is the time, which a ship has to wait for getting a berth at the port. The time on berth can be further classified into working time at berth or operational time and idle time at berth or non-operational time. Working time at berth is the time during which loading or unloading operations take place. Idle time at berth is the time during which no operations (loading/ unloading) are taking place

at the berth. This idle time at berth is further classified in to two, (1) idle time caused by reasons that are within the control of the ports management and (2) idle time that is caused by the factors beyond the control of the ports management.

Figure 4.6: *Ship Time at Port*



Source: Adapted from Hilling (1996)

We have computed some measures to get an idea about the performance of the port with respect to its fastness, and efficiency in cargo handling. These measures have been computed for total cargo-handled as well as for container and non-container cargo-handled. The rationale for distinguishing between container and non-container cargo is that the methods used for handling these two types of cargo are different.

Table 4. 11: *Trends in Turn Around Time and Efficiency in Cargo Handling for All Categories of Vessels Handled at Tuticorin Port During 1985-86 to 1999-00*

Years	*Total No of Vessels Handled*	*Avg Tonnage Per Ship-Parcel Size*	*Pre Berthing Time Per Ship (in days)*	*Working Time Per Ship at Berth (in days)*	*Non-Working Time Per Ship Time at Berth (in days)*	*Total Time Spent Per Ship at Berth (in days)*	*T.A.T Per Ship (in days)*	*Avg Output Rate Per Berth hr*
1985-86	422	9737	1.05	2.566	1.710	4.276	5.53	94.88
1986-87	407	10102	0.63	2.119	0.880	2.998	3.84	140.38
1987-88	413	10137	0.63	2.181	1.137	3.318	4.15	127.30
1988-89	465	10657	0.47	2.916	0.954	3.870	4.38	114.73
1989-90	578	9085	0.76	2.890	0.813	3.703	4.67	102.22
1990-91	643	7594	0.52	2.442	0.989	3.431	4.11	92.22
1991-92	695	8142	1.03	2.643	0.996	3.638	4.93	93.25
1992-93	748	7973	1.17	2.600	1.089	3.689	5.07	90.06
1993-94	806	8012	1.99	2.087	1.493	3.580	5.78	93.24
1994-95	878	8832	1.93	1.887	1.354	3.241	5.34	113.54
1995-96	939	9633	2.29	2.017	1.378	3.395	5.93	118.22
1996-97	905	10025	1.57	1.987	1.326	3.313	5.09	126.07
1997-98	984	9815	1.70	1.980	1.320	3.300	5.04	123.92
1998-99	1073	9242	1.60	1.840	1.260	3.100	4.74	124.23
1999-00	1071	9165	2.98	1.940	1.230	3.170	6.19	120.47

Source: Compiled from Various Administrative Reports of Tuticorin Port Trust

Table 4.11 presents the trends in the average total turn around time (TAT) for all category of Vessels (container ships and non-container ships) handled during each financial year from 1985-86 to 1999-00 at Tuticorin port. The average turn around time has been computed by dividing, the total time taken by all the ships that left the port after loading or unloading the cargo in a financial year by the total number of vessels that left the port during the same year[14]. The table shows that the average turn around time for all categories of vessels during 1985-86 was 5.53 days. It showed a marginal decline till 1990-91 and there after it has been increasing. During 1999-00 it was 6.19 days, which was the highest during the period under examination[15]. This increase in the turn around time can be due to increase in the pre-berthing or waiting time, increase in the non-working time and decrease in the working time over the period under observation. For instance the pre berthing time increased from 1.05 days in 1985-86 to 2.98 days in 1999-00. Non-working time increased from less than one day in the pre 1991 period to 1.230 days in 1999-00. Working time, which was about more than two

[14] The total time or total turn around time as shown in the figure 4.6 has been obtained as follows ([Total no of vessels handled / 24] + Total Pre-berthing detention + Total time spent at berth + Ship idle time at port)

[15] From 1997-98 the Ministry of Surface Transport has changed the methodology adopted for calculating Turn Around Time (T.A.T) per Ship. Therefore, the data for these three years are not comparable with others. The rise in T.A.T per ship in Tuticorin port has been mainly due to this reason.

days in the second half of the eighties declined to 1.94 days in 1999-00. We have also compared Tuticorin ports position with all other major ports in India during the period 1997-98 to 1999-00 in case of two main port efficiency indicators namely average turn around time and average output per ship berth day (refer to appendix Table A 4.3). The data for this has been taken from CMIE's publication on infrastructure. The following procedure has been adopted for this first we have ranked the average turn round time for all the major port in ascending order and then compared the ranks across the ports. From the ranking it can be inferred that the average turn around time has improved in case of Mumbai, Mormugao and Kandla i.e., reduced over the period 1997-98 to 1999-00. On the other hand in the case of Chennai and Tuticorin the average turn around time had increased. In other words the increase in average turn around time in case of Tuticorin port indicates that its position has been deteriorating over the period under consideration. The average turn around time at Tuticorin Port increased from 5.05 days in 1997-98 to 6.39 days in 1999-00. An attempt has also been made to look into the average output per ship berth day, another main indicator of port performance. First we computed simple growth rates for the average output per ship berth day for all major ports in India for three consecutive years from 1997-2000. Then we took average of the simple growth rates and sorted the result in ascending order. The results so obtained have been reported in appendix Table A 4.4. Culcutta port registered the highest growth rate followed by Mumbai. Tuticorin ranked tenth indicating that compared to other major ports, average output rate per ship berth day was also lower for Tuticorin.

Tables 4.12 present the trends in turn around time and efficiency in cargo handling for container vessels that were handled by the port. Although, the average turn around time taken by container vessels has been less than compared to all categories of vessels, it has been increasing over the years. It was around one day in the second half of the eighties and it has increased to more than two days in the nineties. This increase in the turn around time can be due to the increase in pre berthing time as well as due to non-working time at berth.

Table 4.12: *Trends in Turn Around Time and Efficiency in Handling Container Cargo Vessels at Tuticorin Port During 1985-86 to 1999-00*

Years	*Total No of Vessels Handled*	*Avg Tonnage Per Ship-Parcel Size*	*Avg Pre - berthing Time*	*Working Time Per Ship*	*Avg Non-Working Time at Berth (in days)*	*Avg Berth Time Per ship*	*Avg T.A.T of The Vessel*	*Avg Output Rate Per Berth hr*
1985-86	34	927.68	0.069	0.436	0.612	1.047	1.158	36.91
1986-87	55	1373.25	0.076	0.553	0.418	0.971	1.088	58.92
1987-88	85	1006.41	0.062	0.489	0.426	0.914	1.018	45.86
1988-89	81	943.63	0.055	0.636	0.526	1.162	1.259	33.84
1989-90	138	963.35	0.199	0.573	0.263	0.837	1.079	47.98
1990-91	193	851.20	0.231	0.592	0.385	0.977	1.249	36.30
1991-92	167	1201.84	0.340	0.786	0.394	1.180	1.596	42.43
1992-93	145	1916.14	0.542	1.072	0.438	1.510	2.103	52.86
1993-94	171	2381.79	0.819	1.123	0.688	1.812	2.736	54.78
1994-95	165	3922.39	0.663	0.960	0.700	1.660	2.378	98.48
1995-96	181	4234.10	0.801	1.141	0.863	2.003	2.869	88.07
1996-97	182	4928.18	0.636	1.397	0.990	2.386	3.132	86.06
1997-98	238	4678.37	0.700	1.340	0.950	2.290	3.032	85.12
1998-99	266	4552.77	0.550	1.110	0.810	1.920	2.512	98.80
1999-00	298	5506.51	0.960	1.040	0.580	1.620	2.622	141.62

Source: Compiled from Various Administrative Reports of Tuticorin Port Trust

Table 4.13 presents the trend in turn around time and efficiency in cargo handling for the non-container vessels that were handled by the port during various years. The data on these indicators have been available only from 1990-91 onwards. The table reveals that turn around time for the non-containerised cargo vessels increased from five days in the beginning of nineties to above 6.5 days in 1995-96. But from 1997-98 onwards there has been a tremendous rise in turn around time of non-containerised cargo vessels handled at the port. This is mainly due to change in the computation of turn around time. The increase in turn around time in both periods has been due to the increase in the waiting time and increase in the time at berth. Although, the working time at berth has gone up, this has also been accompanied with an increase in the non-working time, which has resulted in an increase in the time at berth. The above analysis presents an unsatisfactory picture of increasing turn around time of non-containerised cargo vessels at Tuticorin port. It has the effect of increasing the rental cost and port dues for the ships. This reduces the competitiveness of the port in relation to other national and international ports.

Table 4.13: *Trends in Turn around Time and Efficiency in Handling Non-Containerised Cargo Vessels at Tuticorin Port During 1990-91 to 1999-00*

Years	*Total No of Vessels Handled*	*Avg Tonnage Per Ship-Parcel Size*	*Pre Detention Time Per Ship (in days)*	*Working Time Per Ship (in days)*	*Non- Working Time Per Ship (in days)*	*Total Time Spent Per Ship at Berth (in days)*	*T.A.T Per Ship (in days)*	*Avg Output Rate Per Berth hr*
1990-91	450	10485.94	0.638	3.235	1.248	4.484	5.163	97.448
1991-92	528	10337.59	1.248	3.230	1.186	4.416	5.982	97.545
1992-93	603	9429.11	1.324	2.967	1.245	4.212	5.781	93.269
1993-94	635	9527.79	2.306	2.347	1.710	4.056	6.603	97.866
1994-95	713	9968.05	2.220	2.102	1.505	3.607	6.022	115.143
1995-96	758	10922.02	2.648	2.227	1.501	3.728	6.667	122.086
1996-97	723	11307.81	1.809	2.136	1.410	3.547	5.583	132.852
1997-98	746	11453.11	7.520	9.080	5.920	15.000	22.562	31.814
1998-99	807	10788.26	7.120	8.760	5.400	14.160	21.322	31.745
1999-00	773	10575.82	13.590	9.920	5.320	15.240	28.872	28.915

Source: Compiled from Various Administrative Reports of Tuticorin Port Trust

Another indicator used for measuring the efficiency of a port is the average output rate per berth hour. This can be defined as the amount of cargo-handled during one hour of berth operation. Table 4.11 presents the trends in average output rate per berth hour for all category vessels as well as for container and non-container cargo vessels. It can be seen from the table that average output rate per berth hour has increased from 94.88 tonnes in 1985-86 to 118.22 tonnes in 1995-96. But, in the last three years it has been hovering around 122 tonnes. Average output rate per berth hour for container cargo reveals that it has also been increasing over time (refer to Table 4.12). This increase in the average output rate per berth hour despite an increase in the turn around time can be due to increase in the average tonnage per ship, which is more than proportionate, to the increase in the turn around time (refer to column three in Table 4.12). The average output per berth hour for non-containerised cargo has been showing a declining trend.

4.3.1 Reasons for the Increase in the Turn around Time of Vessels at Tuticorin Port: Our analysis of the trends in turn around time at Tuticorin port revealed an increase in the same over the period 1985-86 to 1999-00. An attempt has been made here to investigate in to the causes behind the increase in turn around time. As given in Figure 4.12 the reasons for the increase in turn around time can be classified into two namely, reasons which are within the control of the ports management (port account) and reasons which are beyond authority of the port management (non-port account). Table 4.14 presents some of the important port related

factors that were causing delay in cargo handling at the port during the period 1986-87 to 1999-00.

Table 4.14: *Reasons for the Non-working of Berths due to Port Related Factors*

(In Percentages)

Years	*PORT ACCOUNT*				
	No of Ships Handled	Non-availability of Berth	Non-availability of Equipment	Equipment Break Down	Total of Port Account
1986-87	222	0.00	0.00	1.44	1.44
1987-88	231	0.00	0.00	0.27	0.27
1988-89	287	0.00	0.00	0.00	0.00
1989-90	399	0.00	0.00	0.00	0.00
1990-91	489	0.00	2.08	0.54	2.62
1991-92	514	0.00	2.88	1.01	3.89
1992-93	582	0.03	3.77	0.29	4.09
1993-94	621	0.18	2.58	0.43	3.19
1994-95	689	0.44	1.93	0.59	2.96
1995-96	685	0.37	1.28	1.33	2.98
1996-97	635	0.29	2.38	1.09	3.75
1997-98	642	0.06	2.55	0.19	2.80
1998-99	772	0.30	0.21	0.20	0.72
1999-00	519	0.00	0.24	0.31	0.55

Source: Compiled from Various Administrative Reports of Tuticorin Port Trust

Some of the major factors, which hampered the cargo handling operations at the port, were (1) non-availability of berths, (2) non-availability of equipment, and (3) equipment break down[16]. From the table one can observe that during the first six years non-availability of berths did not figure as a cause for the delay in the cargo handling. However, from 1992-93 onwards non-availability of berths has been causing delay in the cargo handling operations. The non-availability of berths can be due to the increase in the number of vessels coming to the port. Column two of Table 4.14 supports this argument. The second major reason was the non-availability of equipment. Since 1990-91 this factor has been acting as a major hindrance for the cargo handling operations at the port. In most of the years around two per cent of the total number of the days delayed has been due to the non-availability of equipment. Equipment break down was yet another reason that had delayed the cargo handling process at the port. However, its contribution to the total days lost has been marginal, say less than one percent. Thus, from table 4.14 it is clear that the role-played by port related factors in causing delay in

[16] Besides these factors there were also some other factors, which had caused delay in cargo, handling operations at the port. However, those factors were specific to a particular year(s). A continuous series pertaining to those factors was not available.

cargo handling at the port has been negligible. In most of the years they have accounted only for two to three percent of the total days delayed.

Table 4.15 presents the role of those factors, which falls under the non-port account category involved in causing delay in the cargo handling operations at the port. The important factors were strikes and stoppages, shed congestion, non-availability of cargo containers, weather constraints, power failure, factors that are related to ships, which come to the port etc. The percentage of the number of days lost, due to strikes and stoppages has been showing a declining trend except in the last three years. The role played by shed congestion in causing delay has also been negligible, revealing that warehousing facilities are sufficient at the port. Moreover, currently additional storage facilities and new warehouses are also being constructed within the port premises. The role of non-availability of cargo containers in causing delay has been decreasing over time. This must be having a positive impact on the container traffic at the port. This is mainly due to increase in the number of container cargo ships visiting the port. Although, the port was declared as an all weather port, the table reveals that weather constraints also have caused delay. But its role has also been decreasing over time. From table 4.15 one can see that the most important factors which has been causing delay are the factors related to the ship's account and other miscellaneous factors which are specific to a particular year.

In the above analysis we had considered only those port account and non-port account reasons, which were causing delay in cargo handling operations at Tuticorin port for which recorded data was readily available. The analysis revealed that non-port reasons accounted for a substantial percentage of the delay during the initial years. However, in the later years especially after 1997-98 onwards we observed that the role-played by non-port reasons that we had considered in causing delay has declined. In recent years other reasons such as agent's option, shippers account etc account for a substantial percentage of delay (refer to Twenty-first Administration Report, Tuticorin Port Trust, 1999-2000). The analysis further pointed towards the need for augmenting the available berth capacity in the port in a context of increased ship arrivals.

Table 4.15: *Non-Port Reasons that Accounted for the Non-working of Berths at Tuticorin Port During 1986-87 to 1999-00*

(In Percentages)

Years	*No of Ships Handled*	*Strikes-Stoppages*	*Shed Congestion*	*Non-availability of Cargo-containers*	*Weather Constraints*	*Power Failure*	*Ship's Account*	*Others*	*Share of NPF*
1986-87	222	7.05	0.00	32.82	3.33	1.43	10.49	42.60	97.71
1987-88	231	3.36	0.00	38.62	5.90	0.55	19.80	30.53	98.76
1988-89	287	4.05	0.00	22.57	10.27	1.87	0.00	61.24	100.01
1989-90	399	0.57	0.00	27.60	7.30	0.59	4.91	59.03	100.00
1990-91	489	0.34	0.00	19.69	7.09	1.60	52.07	2.60	83.39
1991-92	514	0.00	0.00	16.25	0.00	0.94	55.93	1.03	74.15
1992-93	582	0.41	0.07	13.14	6.66	2.38	51.88	2.26	76.79
1993-94	621	0.02	0.13	14.22	10.25	1.96	44.77	8.12	79.46
1994-95	689	0.35	0.07	11.79	6.37	2.27	36.26	17.69	74.80
1995-96	685	0.88	0.00	11.53	3.70	0.69	37.99	28.37	83.14
1996-97	635	0.50	0.00	9.85	4.53	0.69	41.32	27.11	83.99
1997-98	642	1.57	0.00	10.55	7.55	1.53	16.65	3.45	41.29
1998-99	772	4.01	0.51	4.49	5.16	0.90	8.89	8.40	32.37
1999-00	519	2.64	0.38	6.13	2.84	0.82	6.28	12.66	31.76

Note: NPF refers to Non Port related Factors
Source: Compiled from Various Administrative Reports of Tuticorin Port Trust

4.11 Financial Performance of Tuticorin Port: A brief discussion on the financial performance of Tuticorin port has been carried out in this section. We have analysed the financial performance of the port by examining the trends in the components of operating expenditure, operating income and net surplus. The operating expenditure of a port is the expenditure incurred for the day-to-day operations in a port. The main components of the operating expenditure are expenditure incurred on cargo handling and storage, port and dock facilities for shipping, railway working, maintenance of rentable land and buildings, and management and general administration.

Table 4.16 presents the trends in the shares of the components of operating expenditure. The share of expenditure on port and dock facilities for shipping in the total expenditure has been declining over time. It had reduced from 44.44 per cent in 1979-80 to 29.86 per cent in 1999-00. On the other hand the share of the expenditure on management and general administration of the port has been increasing over the years. The share of the expenditure on the maintenance of rentable land and buildings has also been increasing during the period under examination. Over all trends in expenditure revealed that the proportion of expenditure on the

creation and maintenance of the capital stock of the port has been declining and the proportion of expenditure on general administration and management of the port has been increasing.

Table 4.16: *Trends in Various Components of Operating Expenditure*

(In Percentages)

Years	*Cargo Handling & Storage*	*Port & Dock Facilities for Shipping*	*Railway Workings*	*Rentable Land & Buildings*	*Management & General Admn*
1979-80	24.29	44.44	2.83	3.09	25.35
1980-81	20.35	41.18	2.10	4.65	31.71
1981-82	26.26	31.40	2.90	5.53	33.92
1982-83	25.49	28.19	2.59	6.28	37.46
1983-84	23.25	30.61	2.98	6.43	36.72
1984-85	24.76	26.48	3.25	7.50	38.01
1985-86	26.82	28.73	2.73	8.04	33.68
1986-87	25.56	29.13	3.75	7.88	33.68
1987-88	24.78	30.13	3.61	7.73	33.75
1988-89	25.51	29.60	4.83	8.00	32.06
1989-90	26.31	30.58	3.81	7.56	31.74
1990-91	25.59	30.49	3.57	7.39	32.96
1991-92	26.63	30.13	4.06	7.31	31.88
1992-93	27.25	29.69	3.53	7.34	32.19
1993-94	31.18	28.72	2.29	6.12	31.69
1994-95	39.36	22.67	2.36	6.71	28.90
1995-96	26.14	31.04	1.78	8.21	32.83
1996-97	25.30	29.80	1.87	7.90	35.13
1997-98	24.65	32.14	3.47	6.98	32.75
1998-99	22.37	29.30	4.60	9.00	34.72
1999-00	22.12	29.86	2.63	8.81	36.58

Source: Compiled from Various Administrative Reports of Tuticorin Port.

Table 4.17 presents the trends in the shares of the components of operating income of Tuticorin port. The components of operating income of a port are cargo handling and storage charges, port and dock charges, railway earnings and estate rentals. Cargo handling and storage charges had contributed to a substantial portion of the operating income of the port. In 1979-80 cargo handling and storage charges accounted for 68.78 per cent of the total operating income. However, its share has been declining over time and in 1999-00 it accounted for only 55.26 per cent of the total. The shares of port and dock charges and estate rentals in the total operating income of the port have also been increasing during the period under consideration.

Table 4.17: *Trends in Various Components of Operating Income*

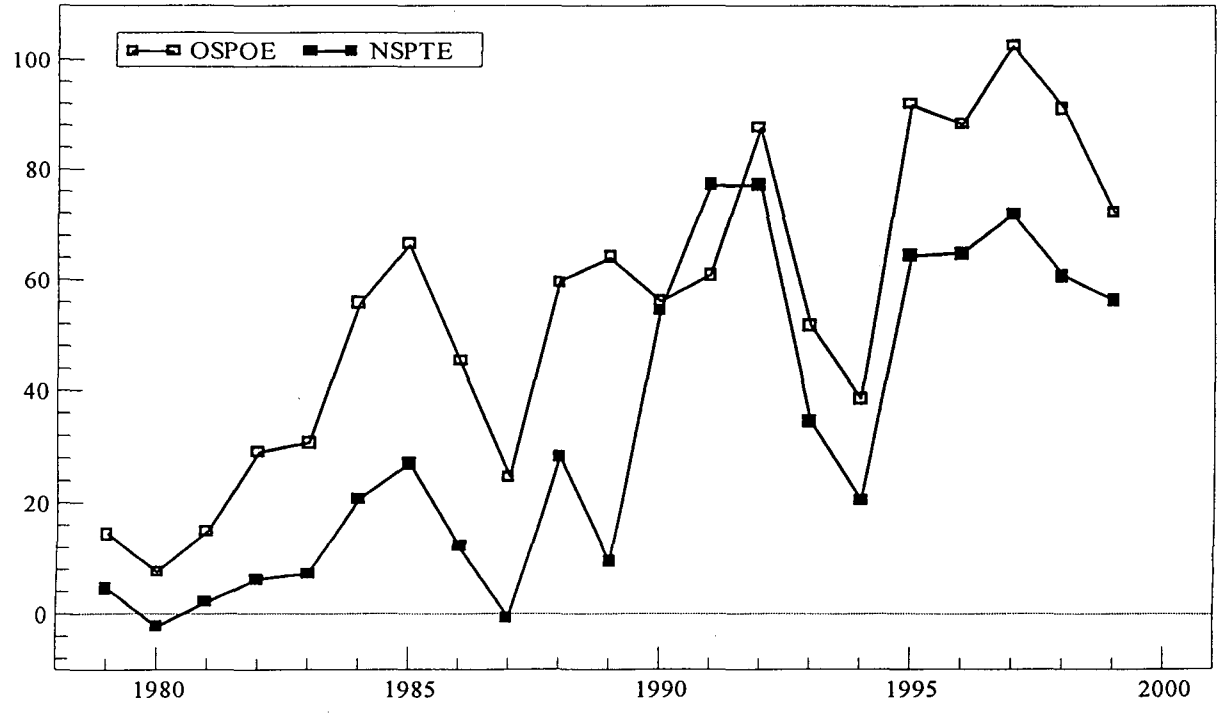
(In Percentages)

Years	*Cargo Handling & Storage Charges*	*Port & Dock Charges*	*Railway Earnings*	*Estate Rentals*
1979-80	68.78	22.17	4.52	4.54
1980-81	73.48	20.45	2.88	3.20
1981-82	73.20	21.14	3.29	2.38
1982-83	72.00	19.54	3.47	4.98
1983-84	76.02	16.61	3.13	4.23
1984-85	73.49	18.09	5.41	3.01
1985-86	75.19	18.59	3.51	2.70
1986-87	76.90	16.95	3.18	2.97
1987-88	75.58	17.87	3.02	3.53
1988-89	75.33	19.15	2.52	3.00
1989-90	72.08	20.98	3.13	3.82
1990-91	69.46	20.82	3.26	6.46
1991-92	71.56	20.33	2.67	5.44
1992-93	66.42	24.99	2.14	6.44
1993-94	65.59	27.52	0.00	6.89
1994-95	67.30	26.93	0.56	5.21
1995-96	65.53	29.85	0.17	4.45
1996-97	63.05	32.03	0.97	3.95
1997-98	62.19	30.20	1.23	6.38
1998-99	60.81	31.72	1.39	6.09
1999-00	55.26	32.40	1.51	10.84

Source: Compiled from Various Administrative Reports of Tuticorin Port.

Having discussed about the trends in operating income, and operating expenditure of the port we have looked into the trends in operating surplus. The difference between operating income and operating expenditure is defined as operating surplus. Figure 4.10 depicts the trends in operating surplus as a percentage of operating expenditure. The figure reveals that this ratio has been increasing over the time period. We have also looked in to the movements in net surplus as a percentage of total expenditure, where net surplus is defined as the difference between total income and total expenditure. Total income is the sum of operating income and other miscellaneous income and total expenditure is the sum of operating expenditure and other miscellaneous expenditure. Net surplus as a percentage of total expenditure also exhibited a trend similar to that of the operating surplus as a percentage of the operating expenditure (refer to Figure 4.7).

Figure 4.7: *Trends in Operating Surplus and Net Surplus of Tuticorin Port During 1979-80 to 1999-00*



Note: OSPOE refers to Operating Surplus as Percentage of Operating Expenditure. NSPTE refers to Net Surplus as Percentage of Total Expenditure
Source: Compiled from Various Administrative Reports of Tuticorin Port

The above analysis about the financial performance of Tuticorin port reveals that the port had a sound financial health during the period 1979-80 to 1999-00. This healthy financial position can help the port to overcome physical shortages such as lack of modern cargo handling equipment, lack of computerised terminals, lack of more general-purpose berths etc.

4.5 Summary and Conclusions: In this chapter we have discussed about the role of port specific factors in influencing cargo-handling operations. As a prelude to it we have made a broad discussion on the trends and pattern of output of all major ports in India. This was followed by a discussion on the trends in output handled at all the port located in west coast in comparison with east coast and also the reasons for the differential in output handled by these two groups. Then we have looked into the trends in output, employment and capital of Tuticorin Port. We have also discussed about some indicators of productivity and other port related efficiency measures. We call these measures as crude due to non-availability of proper data on important variables like value-added for output, cargo-handling labourers' etc. This

has limited the scope of our analysis. Finally a brief discussion on operational and financial performance of the port has also been attempted.

The findings of the chapter can be summed up as follows. Cargo-handled at all the major ports have been increasing over the period 1970-71 to 1999-00. The shares of cargo-handled at Calcutta and Chennai ports in the east coast, and Cochin, Mormagao, and Mumbai ports in the west coast has been declining over the period 1970-71 to 1999-00. One possible reason for the difference in the growth rates of cargo-handled at all major ports situated in the west coast and the east coast could be due to the geographical proximity of west coast ports with the trading partners of India. It can also be due to the difference in the industrial development among the states located in these two coasts. The rise in the shares of cargo-handled at the ports situated along the eastern coast after 1991-92 could mainly be attributed to the change in India's direction of trade with the South East Asian Countries.

The trends in output of Tuticorin port revealed that it has been increasing over the period 1979-80 to 1997-98. The trends in employment, which includes only official staff of the port, indicated that it has been slowly declining over time. At the same time the physical assets of the port were growing. The growth rates computed on the measures of productivity indicated that productivity of official staff was higher when compared with capital productivity. But as the official staffs are not directly involved in the day-to-day operations of cargo handling at the port this result has to be interpreted with caution. Capital intensity showed a substantial rise during the period under consideration.

The analysis of the average turn around time and average output rate per berth hour revealed that in case of container vessel during the period 1985-86 to 1996-97 both average output rate per berth hour and average turn around time were increasing. However, during the last three years i.e.1996-97 to 1999-00 average output rate per berth hour increased and average turn around declined marginally. The rise in average output rate per berth hour observed in case of container ships especially in the last year is due to opening up of an exclusive container berth at the port on a BOT basis. In the case of non-containerised cargo vessels, during the period 1990-91 to 1995-96 both the efficiency indicators were increasing. But, during the last three years average output rate per berth hour had reduced, and average turn around time has been increasing. This rise in average turn around time increases the cost of ships, which eventually

falls on the port users. This high turn around time in case of non-containerised cargo vessels indicate that the delay is cargo specific.

The analysis of factors contributing to the delay in handling of ships due to non-working of berths revealed that port related factors had only a marginal share and non-port related factors had a substantial share. In case of non-port related factors, the factors, which we had taken in to account for analysis has been declining over time. Apart from these observations the capacity of the port i.e., expansion in terms of the number of berths was almost stagnant during the time period 1984 to 1994. From 1995 onwards again expansion of the port has commenced. Already one new berth has been commissioned (Berth no: 7) and one is under construction while yet another is being planned. One of the most essential requirements of any port is the adequate deepness of its approach channel and harbour basin. The non-availability of sufficient deepness prevents the port from handling bigger cargo vessels and larger parcel sizes thereby preventing the port from enjoying scale economies.

Appendix Tables

Table A 4.1: *Summary Results of Cargo-handled at East and West Coast Ports in India*

	Decade wise Summaries						*Overall Summaries*	
	1970-71 to 1979-80		1980-81 to 1989-90		1990-91 to 1999-00		1970-71 to 1999-2000	
	WCP	ECP	WCP	ECP	WCP	ECP	WCP	ECP
Stdev	3.48	3.59	10.74	14.14	21.43	28.69	31.85	41.36
Avg	37.83	27.45	63.85	49.89	106.64	113.94	69.44	63.76
CV (%)	9.19	13.08	16.83	28.34	20.09	25.18	45.87	64.87
CGR (%)	3.33	3.47	5.26	7.50	5.67	7.95	5.07	6.39

Source: Compiled from CMIE, "Infrastructure", January (2001).

Table A 4.2: *Growth Rate of Capital Intensity, Labour and Capital Productivity at Tuticorin Port in Semi-log form during 1979-80 to 1997-98*

(1979-80 = 100)

Variable	*GR (%)*	*T-Value*	*R-SQR*	*Adj R-SQR*	*DW*
Labour Productivity	2.71	4.02*	0.49	0.46	0.85**
Capital Productivity	2.29	4.5*	0.54	0.52	1.08**
Capital Intensity	5.54	21.58*	0.96	0.96	0.26**

Note * denotes significance at 5% level. ** Denotes the presence of positive first order serial correlation among the residuals.
Source: Compiled from Various Administrative Reports of Tuticorin Port

Table A 4.3: *Average Turn Round Time for all Major Ports During 1997-2000*

Ports	*1997-98*	*1998-99*	*1999-00*
Culcutta	7.47 (10)	6.59 (9)	6.59 (11)
Chennai	7.12 (9)	7.5 (11)	6.8 (12)
Cochin	3.99 (1)	3.61 (2)	3.23 (2)
Haldia	5.3 (6)	4.73 (5)	5.21 (7)
JNPT	4.47 (3)	1.96 (1)	1.72 (1)
Kandla	8.98 (12)	8.61 (12)	6.15 (9)
Mormugao	6.32 (8)	4.81 (6)	4.3 (5)
Mumbai	8.37 (11)	7.01 (10)	5.6 (8)
New Mangalore	4.09 (2)	3.72 (3)	3.8 (3)
Paradip	5.12 (5)	4.11 (4)	3.89 (4)
Tuticorin	5.05 (4)	4.87 (7)	6.39 (10)
Visakhapatnam	6.11 (7)	5.28 (8)	4.75 (6)

Note: Figures in the parentheses indicates the rank for average ship turn around time at each port.
Source: Compiled from CMIE, "Infrastructure", January (2001).

Table: A 4.4: *Average Output per Ship Berth day for All Major Ports in India During 1997-2000*

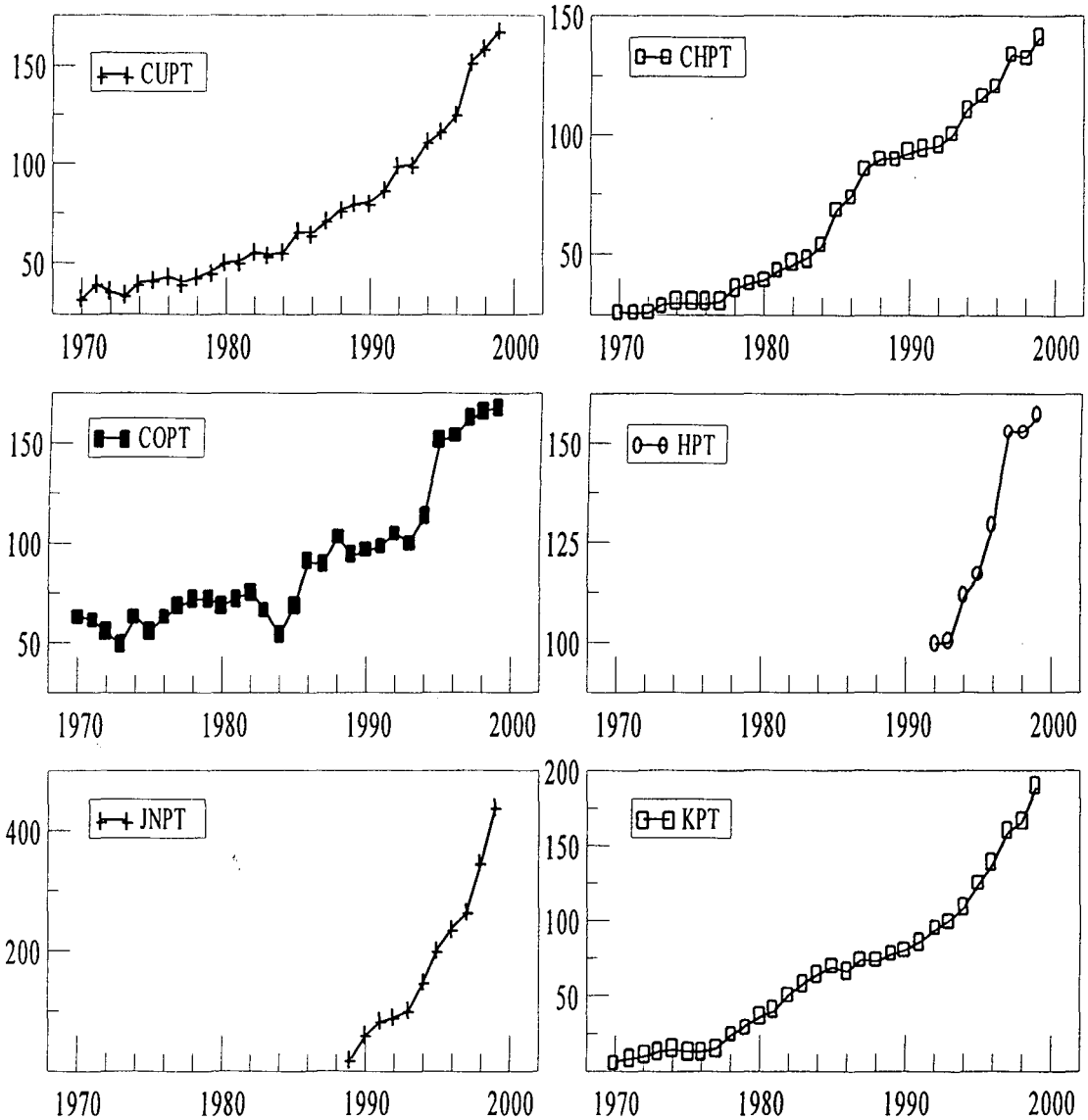
Port	*G1*	*G2*	*Average Growth Rate*	*Rank*
Culcutta	32.06	27.11	29.58	1
Chennai	20.04	2.15	11.10	5
Cochin	-14.82	28.91	7.05	8
Haldia	-10.50	6.00	-2.25	11
JNPT	-1.11	-3.83	-2.47	12
Kandla	33.89	-0.43	16.73	3
Mormugao	8.90	0.78	4.84	9
Mumbai	16.21	31.84	24.02	2
New Mangalore	4.12	19.89	12.00	4
Paradip	14.43	1.34	7.88	7
Tuticorin	1.70	-3.12	-0.71	10
Visakhapatnam	12.27	7.40	9.83	6

Note: G1and G2 refers to simple growth rates in percentages. In column 4 ranks have been given according to average growth rate.
Source: Compiled from CMIE, "Infrastructure", January (2001).

Appendix Figures

Figure A 4.1: *Index of Traffic Handled at All Major Ports in India During 1970-71 to 1999-00*

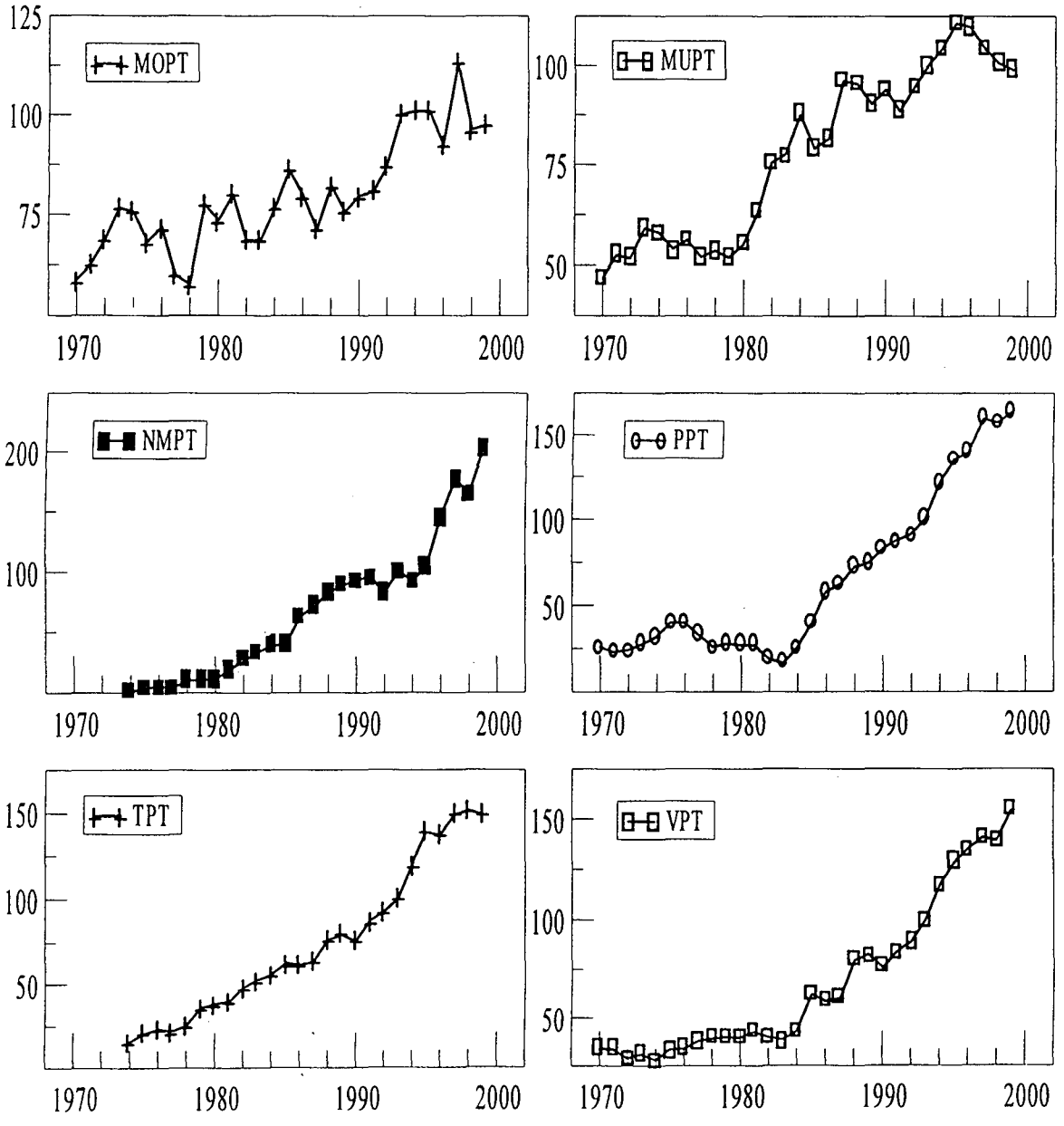
(1993 - 94 = 100)



Note: Traffic handled has been represented in simple index terms
Fig 4.1.1 Traffic handled at Culcutta Port trust (CUPT)
Fig 4.1.2 Traffic handled at Chennai Port trust (CHPT)
Fig 4.1.3 Traffic handled at Cochin Port trust (COPT)
Fig 4.1.4 Traffic handled at Haldia Port trust (HPT)
Fig 4.1.5 Traffic handled at JNPT Port trust (JNPT)
Fig 4.1.6 Traffic handled at Kandla Port trust (KPT)
Source: Compiled from CMIE, "Infrastructure", January (2001).

Figure A 4.1: *Index of Traffic Handled at All Major Ports in India During 1970-71 to 1999-00*

(1993 - 94 = 100)



Note: Traffic handled has been represented in simple index terms
Fig 4.1.7 Traffic handled at Mormugao Port trust (MOPT)
Fig 4.1.8 Traffic handled at Mumbai Port trust (MUPT)
Fig 4.1.9 Traffic handled at New Mangalore Port trust (NMPT)
Fig 4.1.10 Traffic handled at Paradip Port trust (PPT)
Fig 4.1.11 Traffic handled at Tuticorin Port trust (TPT)
Fig 4.1.12 Traffic handled at Visakhapatnam Port trust (VPT)
Source: Compiled from CMIE, "Infrastructure", January (2001).

Figure A 4.2: *Share of Cargo-handled at All Major Ports in India During 1970-71 to 1999-00*
(In Percentages)

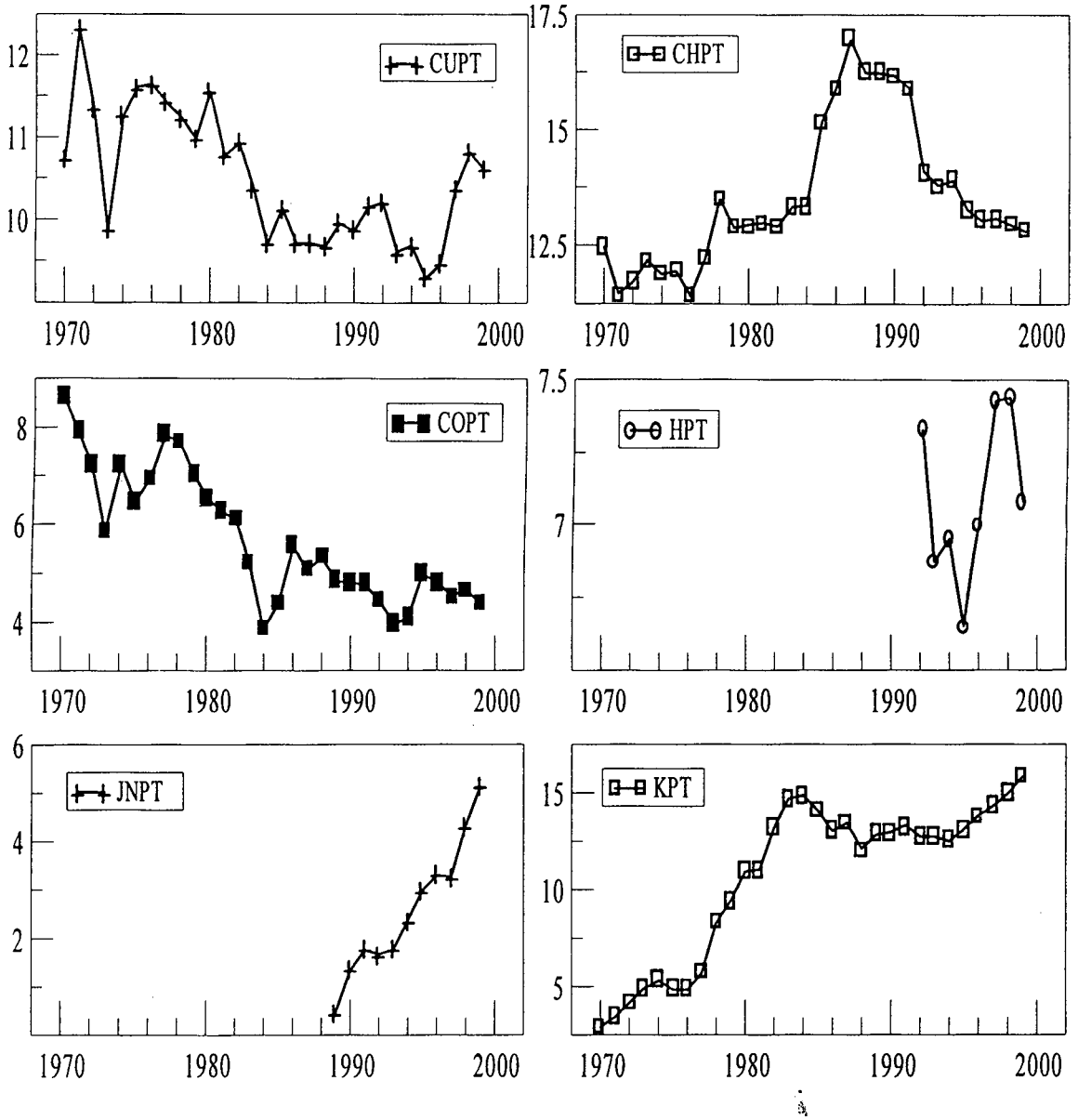


Fig 4.2.1 Share of traffic handled at Culcutta Port in total traffic handled (CUPT)
Fig 4.2.2 Share of traffic handled at Chennai Port in total traffic handled (CHPT)
Fig 4.2.3 Share of traffic handled at Cochin Port in total traffic handled (COPT)
Fig 4.2.4 Share of traffic handled at Haldia Port in total traffic handled (HPT)
Fig 4.2.5 Share of traffic handled at JNPT Port in total traffic handled (JNPT)
Fig 4.2.6 Share of traffic handled at Kandla Port in total traffic handled (KPT)
Source: Compiled from CMIE, "Infrastructure", January (2001).

Figure A 4.2: *Share of Cargo-handled at All Major Ports in India During 1970-71 to 1999-00*
(In Percentages)

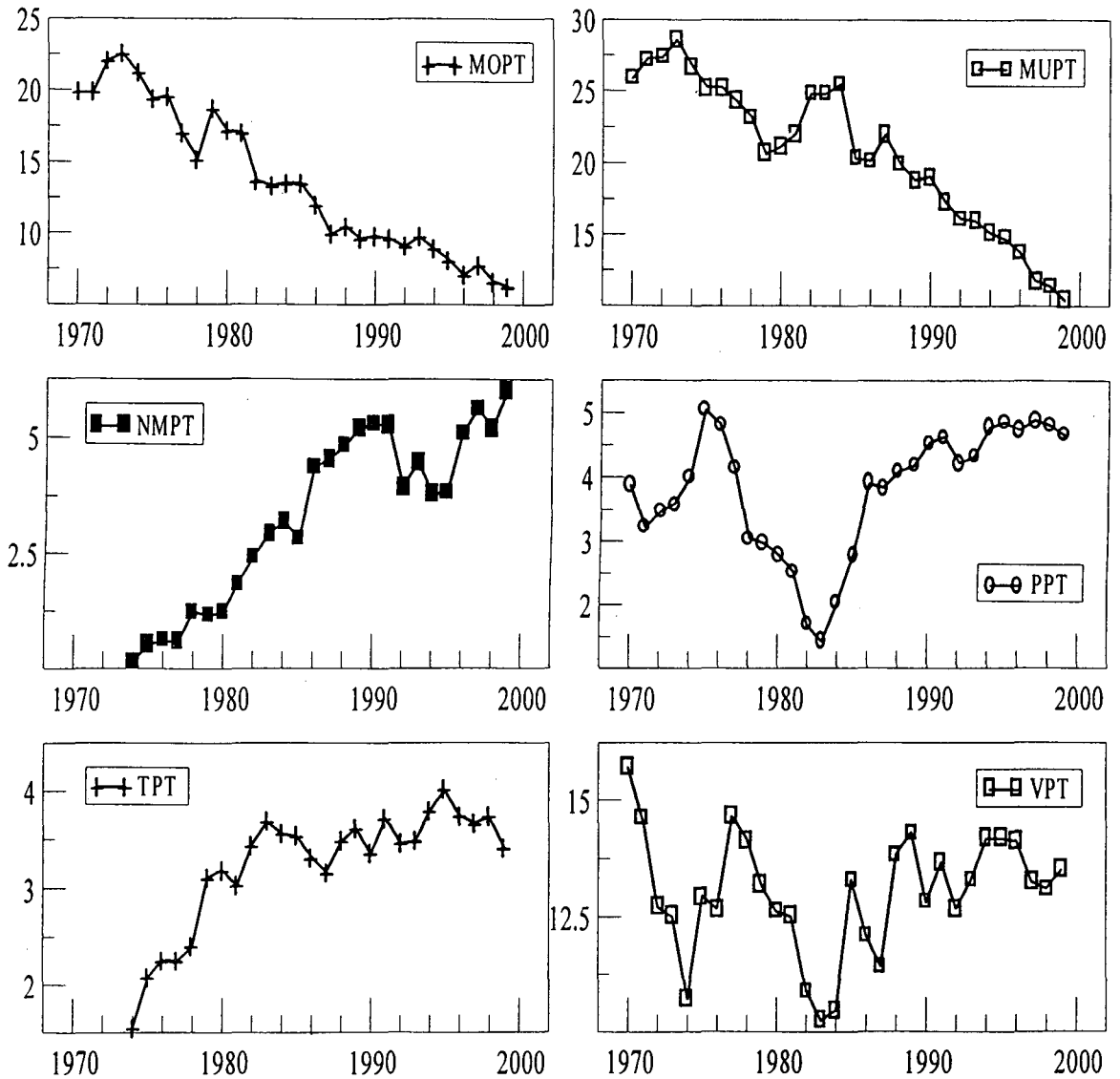


Fig 4.2.7 Share of traffic handled at Mormugao Port in total traffic handled (MOPT)
Fig 4.2.8 Share of traffic handled at Mumbai Port in total traffic handled (MUPT)
Fig 4.2.9 Share of traffic handled at New Mangalore Port in total traffic handled (NMPT)
Fig 4.2.10 Share of traffic handled at Paradip Port in total traffic handled (PPT)
Fig 4.2.11 Share of traffic handled at Tuticorin Port in total traffic handled (TPT)
Fig 4.2.12 Share of traffic handled at Visakhapatnam Port in total traffic handled (VPT)
Source: Compiled from CMIE, "Infrastructure", January (2001).

Chapter V

Summary and Findings

Ports are vital assets for any economy from economic and strategic point of view. As facilitators to coastal and international trade they act as a crucial interface between the origin and destination of trade. Inspite of possessing a vast coastline with twelve major ports, India has not been able to gain substantially from international trade due to existence of various barriers to trade. But from 1991 onwards India has moved into an export oriented policy regime by integrating herself with the rest of the world. In this open economic scenario possessing efficient infrastructural facilities especially ports is highly essential. With more than ninety percent of India's trade being sea borne it is essential for India to possess atleast two or three world-class ports. But the pitiable situation is that India does not posses any world-class ports and the existing ports are faced with numerous problems. In this context the present study focuses on performance of major ports in India. By performance we mean trends and pattern of cargo-handled at all major ports and the problems, which affect the same. This warrants a detailed study on the functioning and problems of Indian ports at the micro level. For this purpose we have taken Tuticorin port, a primary survey of the port was conducted, and relevant information was gathered.

The study has been organised into five chapters. Chapter one begins with a discussion on the background of the study followed by a brief presentation on infrastructure from which we have narrowed down to the port sub-sector, following this we have discussed about the objectives of the study, data sources and limitations, and the framework of the study. Chapter two contains a brief discussion about ports and their importance, physical features, capacities and various facilities available for cargo handling at all major Indian ports. This is followed by a discussion about the performance of all major Indian ports in terms of trends and pattern of traffic handled by them. The chapter concludes with a discussion on the problems faced by Indian ports. Chapter three begins with a detailed narration of the historical and economic factors that favoured the emergence of Tuticorin port and the development of the New Port of Tuticorin to the present stage. Following this in the subsequent section we have discussed about the volume and value of traffic handled at Port of New Tuticorin. Chapter four examines the role of port-specific factors (factors within the port) in influencing cargo-handling operations. As a prelude to it we have discussed broadly about the trends and patterns of output of all major ports in India. Then we have looked into the trends in output,

employment and physical assets of Tuticorin Port. After this we have examined about some crude measures of productivity. Finally the chapter concludes with a brief presentation on operational and financial performance of the port. The last chapter contains the summary and findings of the study.

The database used by us in the study had some serious limitations. They are the value added in the process of handling cargo at Tuticorin port was not available. Information pertaining to cargo handling labourers could not be collected from the port. This is because cargo handling operations i.e., loading and unloading of cargo in the port was undertaken by contract labourers managed by private stevedoring firms. Hence, continuous statistics pertaining to these labourers was not available. As data on revenue obtained through handling of each principal commodity was not available we could not construct a weighted index for the cargo-handled at the port.

The results of the study can be summarised as follows during the period 1970-71 to 1999-00 the total cargo-handled at all major ports grew by 5.43 per cent. POL, ironore and other cargo were the most prominent commodities in the commodity basket handled at Indian ports. But, the share of iron ore handled at major Indian ports has been declining over the period under consideration. Disaggregation of the principal commodities handled during the nineties into export and import revealed that import traffic handled at all major ports registered a higher growth rate compared to export traffic. This confirmed the fact that exports usually respond to export oriented policies with a lag.

The examination of the problems faced by Indian ports revealed that lower productivity and higher turn around time at the Indian ports have been adversely affecting cargo-handling operations. Since, India has already moved into an era of open policy regime infrastructure bottlenecks like this demands immediate attention by the policy makers. This requires a detailed study on the functioning of Indian ports and the their problems. For this purpose we have taken Tuticorin port. We have examined the performance of Tuticorin port in terms of trends in cargo- handled and also the factors that inhibited the same at the port.

The trends in principal commodities handled at Tuticorin Port revealed that during the period 1974-75 to 1999-00 total cargo-handled at Tuticorin port grew by 9.49 per cent. A comparison between the growth rates of import traffic and export traffic handled at the port during the period 1979-80 to 1999-00 indicated that import traffic registered a higher growth

rate compared to export traffic. The container traffic handled at Tuticorin port during the period 1980-81 to 1999-00 registered a positive growth. This rise in container traffic could possibly be due to the port being located at a close proximity to the international trade route. Another reason could be the distance between international ports like Colombo and Singapore being less. Category wise cargo-handled revealed that bulk cargo (dry bulk as well as break bulk) occupied a substantial portion of the total cargo-handled at Tuticorin port. The combined share of dry as well as break bulk cargo was 80.09 per cent during the period 1985-86 to 1999-00. Cargo-handled at Tuticorin port in value terms also revealed that import traffic registered a higher growth rate when compared to export traffic.

We have concluded the discussion on all major ports by looking into the trends and pattern of output (cargo-handled) at all major ports in India. During the period 1970-71 to 1999-00 cargo-handled at all major ports combined grew at a rate of 5.69 per cent. The shares of cargo-handled at the ports of Calcutta and Chennai in the east coast, and the ports of Cochin, Mormagao and Mumbai in the west coast was found to be declining over the period 1970-71 to 1999-00. The distribution of each major ports growth rate, around the all major ports combined growth rate, made us suspect that there must be some reason behind the difference in the growth rates of cargo- handled at the ports situated along the two coasts of India. To verify this we have divided the entire major ports into two groups namely west coast ports and east coast ports. These two groups were obtained by aggregating all the major ports located in west and east coasts separately. The difference between the growth rate of cargo-handled at the major port situated along the west coast and east coast could have been due to geographical proximity of the west coast ports with the trading partners of India i.e., the countries with which India has got trading relations. Another reason for this difference can be due to the difference in industrial development among the various Indian states. In the initial years the share of cargo-handled at the major ports situated along the western coast was higher when compared with those on the eastern coast. But, after 1991-92 east coast ports have been handling more cargo than compared to their west coast counterparts. This could be mainly attributed to change in India's direction of trade to South East Asian Countries.

The trend in output of Tuticorin port indicated that it was growing over the period 1979-80 to 1997-98. The trends in employment, which included only official staff of the port, indicated that it was slowly declining over the period and the trends in capital, which included all form of physical assets of the port, indicated that it has been growing over the same period. The productivity measures computed indicated that labour productivity (of the official staff alone,

measured in terms of revenue per unit of wages) was higher when compared with capital productivity (revenue per unit of capital input). But as the official staffs are not directly involved in the day-to-day cargo handling operations of the port this result has to be interpreted with caution. Capital productivity measured in terms of revenue per unit of capital indicated that it was slowly increasing. The two productivity ratios computed were found to be contributing positively to output. Capital intensity also showed a substantial rise during the period under consideration.

The analysis of other efficiency indicators namely average turn around time and average output rate per berth hour indicated that in case container vessel during the period from 1985-86 to 1996-97 both average output rate per berth hour and average turn around time increased. But during the last three years 1996-97 to 1999-00 the average output rate per berth hour increased and average turn around declined marginally. In case of non-containerised cargo vessels, during the period 1990-91 to 1995-96 both the efficiency indicators increased. But during the last three years average output rate per berth hour reduced, and turn around time increased. The high turn around time in case of non-containerised cargo vessels indicated that the delay is cargo specific. The analysis of factors contributing to the delay of ships due to non-working of berths indicated that port related factors had only a marginal share and non-port related factors had a substantial share. In case of non-port related factors, the share of those factors, which we have taken into, account for analysis has declined over time, other new factors have started emerging, and these factors were contributing to the delay.

Apart from these observations the capacity of the port i.e., expansion in terms of the number of berths was almost stagnant during the period 1984 to 1994. From 1995 onwards again development of the port has been started and already one berth has been commissioned. One is under construction while yet another is being planned. One of the most essential requirements in case of any port is the availability of adequate draught for its approach channel and harbour basin. The non-availability of sufficient draught due to the seabed being rocky in nature prevented the port from handling bigger cargo vessels and handling larger parcel sizes thereby preventing the port from enjoying scale economies.

The data analysis on traffic handled by Tuticorin port revealed that a significant portion of the cargo handled by the port fell into dry and break bulk category. From the analysis it can also be seen that the average turn around time is high and average output rate per berth hour is low only in case of non-containerised cargo vessels. Therefore, the port authorities need to look

into the problems involved in handling these type of cargoes closely except in case of coal which is a major bulk commodity handled at the port as the handling process used is mechanical in nature. Some relief for the port users as well as shippers has started emerging after the dredging process. As the handling of bulk commodities is labour intensive in nature it is necessary to improve the skill of labourers in handling these commodities and also increase the datum (amount of cargo to be handled) to be handled per labour or gang. The construction of new berth, procurement of new wharf cranes and capital dredging, which has been completed presently, will altogether augment the cargo handling potential of the port. Higher productivity can be achieved only if the entire cargo handling operation at the port is computerised as it is currently done in case of container cargo.

While analysing the factors that hindered the performance we have taken into account only port-specific factors. From the survey of the port we found that other reasons such as cargo handling equipment being obsolete in nature, lower capacity of the cargo handling equipment, under utilisation of equipment due to non-availability of specific cargo, technical constraints which prevent the continuous operation of cargo handling equipment, high tariff rates, customs regulation, labour related problems, inconsistency in policy changes by Government of India regarding handling of commodities etc affected the cargo handling operations at the port. Moreover, we have not looked into factors which are external to the port but which affect the cargo handling operations at the port. Therefore, we cannot arrive at any definite conclusion regarding what causes delay in cargo handling. These external factors include poor infrastructure facilities like lack of bilane highways, regular railway container service connecting the port with Internal Container Depots (ICDs), improved communication links etc. If these non port-specific factors, which affect cargo-handling operations, can be improved then the prospects of the port would go up.

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