PERFORMANCE AND PRODUCTIVITY OF COCHIN PORT, 1970-71 TO 1985-86

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF MASTER OF PHILOSOPHY
IN APPLIED ECONOMICS OF THE JAWAHARLAL NEHRU UNIVERSITY, NEW DELHI

ANIL KUMAR. V.

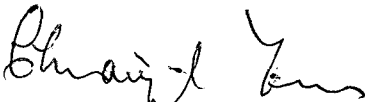CENTRE FOR DEVELOPMENT STUDIES
TRIVANDRUM
1988

I hereby affirm that the research for this dissertaton titled "Performance and Productivity of Cochin Port 1970/71 to 1985/86" being submitted to the Jawaharlal Nehru University for the award of Master of Philosophy in Applied Economics, was carried entirely by me at the Centre for Development Studies, Trivandrum.
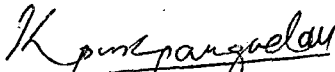

Trivandrum,

22-12-1988

Anil Kumar. V.

Certified that this dissertation, the bonafide work of Sri. Anil Kumar. V., has not been considered for the award of any other degree by any other University.
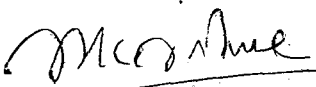

Dr. Chiranjib Sen

Fellow

Dr. K. Pushpangadan

Associate Fellow

Supervisors

Prof. T.N.Krishnan
Director
Centre for Development Studies

ACKNOWLEDGEMENT

CONTENTS

LIST OF TABLES

v

LIST OF GRAPHS

LIST OF MAPS

CHAPTER I

INTRODUCTION

1.1. Scope and Relevance of the Study

The competition to dominate the world markets for goods and services has resulted in the growing awareness among the nations, especially, the third world countries, to improve their transport infrastructure, mainly sea-ports, through which the major chunk of their international trade takes place. Moreover, the overwhelming advancement in the world of shipping (the sophisticated 'third generation' ships), strides made in bulk cargo handling techniques, (the innovations such as containerisation, palletisation, etc), and the emergence of modernistic 'conferences' in shipping has also contributed to the rejuvenation of the role of sea-ports in the recent years. The latest innovations in cargo handling have sped up the movement of goods, as also lowered their costs of transportation. The expeditious transport of goods at lower costs has been of great assistance in furthering international trade and promoting economic development. The reduction in the relative cost of transport particularly of shipping has influenced the growth of international trade since World War II.

During the past two decades or so there have been substantial changes in the technology of shipping as well as in the associated activities of ports. Increased capital expenditure on vessels has been accompanied by large investments in ports. Unlike shipping, the ports in most of the developing countries are usually owned by governments; large investments in sea-ports, therefore, have become a part of the respective government's

development programmes. The far reaching improvements in the methods of cargo handling, that have been initiated in recent times, are expected to become much more widespread. Goods transport by containers (or other unit loads) over land and by sea to other ports has become increasingly common. Ships have been fitted out to carry containers or enable cargo to be loaded on the roll-on/roll-off principle(i.e. vehicles with cargo can really drive in and out from the ship). The equipment and organisation of ports have also been improved. This kind of technological progress and the accompanying impact on the composition and skill of the work force have contributed to the overall efficiency and productivity of the ports. As a United Nations expert pointed out, "There is no doubt that a number of factors influence speed, quality, and cost of cargo handling. But the human element represented by port labour is still to be regarded as the basic and decisive one"[1].

The study of port activities and its working is important in a developing economy like India for its overall development. All the sectors of the economy are in one way or other connected with port, so the efficiency with which the activities of the port are improving have both direct and indirect bearing on all sectors of the economy. In 1947, India was left with only five active ports. Now, we have 11 major ports in operation. The development of ports got a big boost only since the Fourth Five Year Plan. The Seventh Plan has proposed an allocation of Rs.1326 crore for port development. It will be interesting to study how far the ports of India could cope up with the modern trends in cargo handling. The port of Cochin was where, a container ship was first anchored. The

development of Cochin port and its problems is interesting to study in the light of the emerging major ports such as Tuticorin and New-Mangalore as potential competitors. It is therefore important to study the factors that caused the decline of the Cochin port's traffic, trade, and performance in detail for the last one decade and a half. The importance of Cochin and its natural and man-made facilities are discussed in the second chapter.

1.2. An Overview of the Studies on Cochin Port

The major analytical and/or research work in this field has been done by various study groups, commissions and committees appointed by the Government of India. Eventhough port and its operations affect every sector of the economy, comprehensive studies concerning the working of the major ports of India have not been carried out[2]. Port literature in India is mainly in the form of reports by committees appointed by the government for specific purposes relating to one or more of Indian ports[3]. Most of these reports were mainly technical in nature and none of these looks into the entire working economics of any port, or for that matter, presents any detailed traffic survey of the port concerned.

Here we shall briefly review the studies carried out on Cochin port and their important findings.

The study by Pankajakshan (1963), on Cochin port, was one of the few systematic studies carried out extensively on Cochin port[4]. The output studies of Pankajakshan in the cargo-handling operations is based on the detailed working particulars of 612

steamers which worked at the port of Cochin during 1960/61. The
study estimates the rates of output in cargo handling at the port
under conditions of port-working during 1960-61, and attempts a
comparison with those of the earlier years. It also provides an
alternative estimate of the port's performance using the data
regarding the "average turn-round time" of the vessels calling at
Cochin port during the past few years since 1960/61. The main
conclusions of the study are: [1]. that the average out-turn of
cargo handling at the port of Cochin was 9.05 tonnes per hour per
hook (crane or ship's derrick), during 1960/61; [2]. that the rate
of cargo-handling was about 18 per cent more when the steamers
were berthed in the stream than when berthed alongside the wharf;
[3]. that the rate of output during day shifts was about 17 per
cent higher, than during night shifts; [4]. that the hourly out-
turn of bulk cargo was 26 per cent more, and that of other cargo
81 per cent more, than the corresponding output rates in handling
general cargo at the port; [5]. that between 1955 and 1961, there
was a decline of about 15 per cent in the output rate in cargo
handling at the port; and [6]. that considering the turn round
time of vessels, the output of work per steamer-day at Cochin
declined by about 19 per cent between 1954/55 and 1960/61.

Agarwal and Johri(1968), dealing with the labour
productivity in the major ports of India, have covered the port of
Cochin from the period 1954-1966 [5]. Using three types of
measures, viz. the overall port efficiency as measured by the turn
round time of ships, cargo handled per unit of labour and the
direct labour cost of cargo handling, they measured labour
productivity. Their study reveals that labour productivity has

been generally falling in the Indian ports. They further observe that the 'incentive schemes' introduced in the Indian ports are the only cause of improving efficiency. The incentive schemes in the 'post-decasualisation' period, that is, the period after the port workers were decasualized(only casual workers exists before) in the port has not proved to be effective. Regarding the port efficiency measured in terms of the turn round time of ships, the authors could not arrive at any concrete conclusions. Their specific enquiry on Cochin port reveals that the average turn round time increased from 3.13 days in 1963/64 to 4.14 days in 1965/66, after the shore labour was put on an incentive scheme, but has ceased to rise since the stevedore labour has become 'piece rated'.

The study also gives an interesting picture of the turn round time, that is, even though the number of ships visiting the port of Cochin increased, from 1039 in 1957/58 to 1219 in 1958/59 and to 1469 in 1963/64, the average turn round time has gone down from 5.62 days in 1957/58 to 4.82 days in 1958/59 and to 3.13 days in 1963/64. Regarding the rate of cargo handling at Cochin port, they conclude that, the output data per gang-shift do not reveal any clear overall trend, the trend in output per shift-both for shore and stevedore labour -is markedly upward. They have found that the productivity of the shore labour has been going up, since 1959, the year in which the incentive scheme was introduced. The rise is more distinct after 1962-63, due to the fact that the decasualisation and introduction of incentive schemes to the stevedore workers. when workers on both ship and shore were on 'piece-rates', output handled per man-shift started

5

rising faster. Yet another finding of their study is that the high rate of idle time reduces the output per man-shift, and also the 'avoidable idle time', forms as high as 80 to 90 per cent of total idle time. This avoidable idle time refers to the period of no or slow work arising due to cargo not ready for shipment, frequent breakdown of cranes and so on. Thus, they argue that, if the idle or unproductive time is reduced the labour productivity can be raised. In their study, the trends in labour cost per tonne of cargo handled do not show any definite trend, but they give clear indication for the rise in labour productivity over the years.

The National Council of Applied Economic Research(NCAER) conducted a comprehensive survey (1969) of Cochin port(covering the period 1950-1966), its traffic potential and matching facilities. The study concentrate on traffic survey with limited objectives like, to forecast the likely traffic growth through Cochin port. A critical examination of the existing port facilities is also done in view of meeting the needs of the present and the anticipated traffic and suggests the additional facilities and the approximate investments that may have to be provided[6]. The port of Cochin handled 1.37 million tonnes of traffic in 1950/51, which has steadily increased to 2.9 million tonnes by 1965/66. They also forecast the future total traffic of the port with the expectation that from 1966/67 onwards the petroleum traffic will augment the total traffic. The total traffic was thus expected to increase to 8.40 million tonnes by 1975/76. But this target the port could not attain mainly because of the decline of the general cargo through the port. The study also gives a detailed description about the port facilities

regarding stream berths, wharf berths, and all other technical
details regarding pilotage, navigational aid facilities existing
in the port. One of the important suggestions of this study is
that, the port needs extensive dredging on priority basis in order
to avoid congestion, for the low depth of water caused by
continuous siltation makes most of the stream berths unfit for use
by heavier vessels.

The recommendations made by the NCAER for the improvement
of the facilities at Cochin port involved an investment of
Rs.119.7 millions by 1970/71 and a further sum of Rs.85 millions
by 1975/76. The study also recommends coordination of port working
with railways, road and inland water transport administrative
authorities for the future port planning, since they all were
represented in the board of trustees of the port. The study did
not attempt to demarcate the respective ports hinterland on the
basis of the actual traffic spread data, which is essential for
any sound forecast of the port's future trade.

The study by Baldeo Sahai(1986) on the ports of India also
covers the history, emergence, development, utilization of the
facilities and the prospects of containerization of the port of
Cochin[7]. The nature of his analysis is rather descriptive. The
development and growth of the port of Cochin is discussed in
detail especially for the post-independence period. He also
discusses the investment and planning activities of the port
during various Five Year Plan periods. The capability of Cochin
port to handle containers is also highlighted in his study. The
study in general does not possess any conclusions.

7

1.3. The Context of the Present Study

Cochin port's performance in recent years has deteriorated due to various reasons. The present study is an attempt to examine the causes for the declining trends in the port activities. The port of Cochin, with its glorious past, has potentials to develop as one of the most prominent ports of the southern end of the Indian peninsula due to its locational advantage in the international maritime transport network from Europe to Australia and its geographical advantages as a 'natural port' even in the roughest monsoon seasons. The present study will be mainly concentrating on the performance and productivity of the port of Cochin. Sound operational performance and financial health of a port is a necessity for its future growth. The efficiency of the port is also an important criterion for its development. The efficiency in labour use of a port is one of the important indicators of a port's overall efficiency. The study will also look into the problems of labour efficiency of Cochin port, since the fear of labour displacement to the adaption of new technological change has raised much hue and cry from the labour unions of this port. Yet another indicator is the efficiency in capital use. Eventhough the port has started its functions from the early 1930s, our analysis of capital efficiency is confined to the period since the early 'seventies, taking into account of the overall investment so far taken place. But the major investments had taken place only in the seventies. The measurement of the total factor productivity growth reveals how for the technological factors contributed to the overall growth of the port.

8

1.4. The Objectives of the Study

The main objectives of the present study are

(1). to trace the evolution of the natural conditions and the man-made facilities for Cochin port to emerge as one of the major ports in India in a historical perspective with a view to document the forces which influenced the growth pattern.

(2). to analyse the structure of growth and pattern of development of Cochin port in terms of output trends and the trends in the factors of production of the port in the last one and a half decade (1971 to 1986).

(3). to carry out a comprehensive analysis of the performance of the port, in terms of both operational and financial indicators.

(4). to analyse the performance of the port in terms of Productivity, (both partial and total), capacity utilization, and hence to examine it's implications on the growth of the port.

1.5. The Framework of Analysis

The methodology followed in this study is generally the one followed for a firm. In that case the port is considered as a firm/unit, output of the firm is the cargo handled (import and export), which is measured in tonnes. The capital input used and the estimation procedure followed for measuring the capital stock is same as that of the firm. In the case of employees and workers, there are two types, one fixed employees, and the other variable according to the fluctuations in the output, that is, the shore

and casual labourers.

The study begins with a brief examination of the evolution of Cochin port through various phases in the history and important factors that contributed to the rise of cochin Cochin as a major port. Thereafter we move on to a detailed analysis of the trends in the output performance and the factors of production. The methodology for estimating the capital stock and the price of capital is discussed in detail in section two of chapter three. In order to measure the capital stock of the port we followed the 'Perpetual Inventory Method'. Since the study of Goldsmith (1951), and most studies[8], have followed this method for estimating capital. Here we are tracing the capital stock of a given year from the stream of past investments at constant prices.

As the future of a port is totally dependent on the sound financial health and better operational performance, both of these indicators are important for a port's brighter future. The methodology adopted for the measurement of the ports performance indicators are the generally accepted ones by the UNCTAD.[9]. The important performance indicators are of two types, Financial Indicators, which propose to answer the questions like (a) what revenue is produced from a service and (b) what is the cost of the service. The important operational performance indicators are (1) the trends in number and tonnage of vessels visited at Cochin(category wise, flagwise and stream/wharf wise), (2) the turn round time, that is, the time spent by a ship in the process of entering port, discharging cargo, reloading and leaving; (3) detention time, that is, waiting for a berth at the

outer roads, (4) the average service time per ship(total time in berth days), (5) average service time for 1000 tonnes of cargo(in hours), (6) average output of shore labour per gang-shift(in tonnes), (7) average output of shore labour per man hours (in tonnes), and (8) utilization of storage and cargo handling facilities, etc.

The efficiency of the port is measured in this study using the trends in the efficiency of the factors of production, the partial productivity indices, such as the labour productivity and capital productivity. The measurement of labour productivity is done by dividing the output by the number of labour, what we are getting is the output per unit of labour. This is done for different categories of labour and also for types of cargo such as general cargo.

The importance of technology in the growth in output and the overall efficiency is captured through the measurement of the total factor productivity (TFP) growth of the port. The need for calculating the TFP is to see the residual, the factors other than capital and labour, that contributed to the growth/or decline of the productivity of the port. This is obtained by subtracting the weighted growth rates of labour and capital from the growth rate of output. The weights being the share of labour and the share of capital in value added. The share of labour is calculated as the share of wages and salaries in value added. The share of capital is calculated by subtracting the share of wages from one. That is, we are assuming 'constant returns to scale', in the production process.

A general measure of capacity utilization of the port is also attempted[10]. The method we have tried is the minimum capital output ratio method. Here first of all 'fixed capital' output ratios are estimated in terms of constant prices. A benchmark year is then selected on the basis of the observed lowest capital output ratio. The lowest observed capital output ratio is considered as referring to the capacity output. The estimate of the capacity is obtained by dividing real fixed capital stock by minimum capital output ratio. The utilization rate is given by actual output as a proportion of the estimated capacity.

1.6. Sources of Data

The main sources from which the data for the present study drawn are (1) published reports and documents, and (2) unpublished port records. The main published reports and documents include the Annual Administration Reports of the Cochin Port Trust, the Annual Reports of the Cochin Chamber of Commerce. The unpublished records of the port consists of the " Working Reports" of the individual steamers working at the ports from day to day.

The data and variables in this study are output, labour, capital, and technological change. Output in this study is measured as tonnage handled of import and export cargo, labour is measured as number of employees including shore and casual labour, capital is measured as gross capital stock at constant prices and technological changes is measured as the percentage containerized cargo.

1.7. Structure of the Thesis

The Structure of the thesis is developed in the following way. Chapter one discusses the scope of the study, the methodology followed and data sources. In chapter two we are giving a brief historical review of the origin, development, decline, and growth of Cochin as a major port of India using secondary source materials. The pattern of development and Structure of Growth of Cochin port's output and the factors of production is discussed in chapter three. Here an attempt has been made to estimate the capital stock of Cochin port for the years 1971 to 1986 in constant prices. Chapter four discusses in detail the performance indicators of the port, both operational and financial. In chapter five we are giving a detailed analysis of the trends in productivity both partial [capital and labour] and total, of Cochin port from the period 1970/71 to 1985/86. Here we also look at the trends in the capacity utilisation. In chapter six we are giving the results and the conclusions of the study.

Notes and References

1. United Nations Economic and Social Council, Economic Commission for Africa, <u>A Report on a Preliminary Survey of Factors Contributing to the Level of Freight Rates in the Sea-borne Trade of Africa</u>, 1965, para 101.

2. Mridula Krishna, '<u>Survey of Research in Economics, Infrastructure', Vol.VI., 'Economics of Transport' Indian Council of Social Science Research,</u> 1975, p.100.

3. ibid, p.102.

4. Pankajakshan T. "<u>An Economic Studyof the Port of Cochin - Its Traffic, Trade, and Working</u>, Ph.D. Thesis, University of Poona, 1963.

5. Johri C.K and Agarwal N.C. 'Labour Productivity in the Major Ports of India' in <u>Indian Journal of Industrial Relations</u>, Vol.4, No.1, July 1968, pp.33-69.

6. National Council of Applied Economic Research, New Delhi, '<u>The Traffic Survey of the Cochin Port'</u>, 1969.

7. Baldeo Sahai "<u>The Ports of India</u>" June 1986.

8. Goldsmith, R.W., "<u>A Perpetual Inventory of National Wealth</u>" in <u>Studies in Income and Wealth</u>, Vol.14, NBER, 1951., Hashim.B.R. and Dadi, M.M. <u>Capital-Output Relations in Indian Manufacturing(1946-64)</u>,1973., and Goldar B.N.<u>Productivity Growth in Indian Industry</u>, 1986.

9. UNCTAD,'<u>Port Performance Indicators'</u>,1976.

10. Sastry D.U.,'<u>Capacity Utilization in Textile Industry,</u> 1980.

CHAPTER II

THE RISE OF COCHIN INTO A MAJOR PORT

Introduction

The origin of Cochin port dates back to antiquity. In one sense it may be considered to be the commercial and geographical successor to Muziris (the present day Cranganore). Muziris, famous among the Romans as the foremost trade emporium of India, was a sea-outlet on the same back water system as is Cochin. The Muziris outlet got increasingly silted over time. The flood of 1341 finally sealed its fate, practically blocking any traffic from the sea into the back water[1]. None-the-less the same flood waters created a smaller opening further south of Muziris at Cochin. Cochin is an etymological derivation from 'Kochu Azhi' which means a small outlet. The process of growth of the 'small outlet' into one of the finest major harbours in India is the main theme that has been dealt with in this chapter.

We shall briefly examine the evolution of the harbour from around the sixteenth century. Even though there are references to Cochin in the eighth century literature it emerged as a centre of trade only after the flood of 1341, when the Jews and the Christian merchants migrated to Cochin from Muziris[2]. The active history of this roadstead[3] as a port starts in 1500 A.D., when the Portuguese established trade connections at Cochin port. The growth of Cochin port since then may be divided into four phases: (i) the Portuguese-Dutch period(1540 - 1740); (ii) the period of stagnation (1740 - 1850); (iii) the beginning of the modern

15

commerce (185Ø - 1926); (iv) the growth as a major port(1926-1951), and (v) the post independence Period(1951-1971).

We shall examine the factors that facilitated the growth of Cochin from the status of a ubiquitous harbour into a prime port of the west coast. First of all we compare the trends in the shipping traffic at Cochin as well as at other major harbours of the Kerala coast and attempt to demarcate the various phases in the rise of Cochin into pre-eminence. Subsequently we discuss various factors that contributed to the rise of Cochin port, namely, (a) favourable geographical factors, (b) the political factors, (c) the growth of economic hinterland of the port and (d) development of man-made harbour facilities. The last two set of factors seem to play increasingly important role in the modern phase of the growth of Cochin port while the former two were more decisive in the earlier phase of its development.

(i) The Portuguese-Dutch Period (154Ø - 174Ø)

The beginning of the sixteenth century witnessed the settlement and active participation in trade of the Portuguese at Cochin. Cochin became the first European settlement, the first European fort and the location of the first European factor in India. Thereon Cochin experienced a new kind of trading technique, that combined trade, religion and violent means of persuasion. The principal aim of the Portuguese was to control the spice trade along the Kerala coast. Their attempts to secure monopoly at Calicut resulted in an unsuccessful confrontation with the Muslims, who had a cordial trade relationship with the

Zamorins[4]. The Portuguese settlement at Cochin, the seat of the Portuguese viceroy in India, was attacked by the Moslem traders, who feared that the direct route to Lisbon would give more importance to Cochin than to Calicut. Both these offensives in 1503 and 1504 by land and sea were successfully repulsed by the Portuguese.

The Portuguese established trade monopoly along the Kerala coast as early as 1559. The main item of trade through Cochin was pepper. The Portuguese attempt to secure trade monopoly through the introduction of the pass system etc. was not successful, partly because of the competition from local traders (Moplahs) who transported out huge quantities of pepper by both land and sea from the port's hinterlands. The decline of the Portuguese in Kerala partly due to the internal jealousy and disunity among themselves, made it easy for the Dutch to take over the trade at Cochin during 1662-63. The Dutch were even less successful in securing the monopoly of the Malabar trade. However, there was significant diversion of traffic from Calicut to Cochin during the Dutch period. It became major supply centre for the Asian vessels and the Indian traders from other places such as Surat.

Thus, during the Portuguese-Dutch phase Cochin became major centre of world Asian trade. Cochin was not only a growing trade centre for the export of Malabar spices[5], but also an entrepot of East-West trade. This was made possible because Cochin was the focal point of all the sea-routes connecting the nations of the South East Asia, the Arab region, Africa and Europe; and Wares of all these countries were regularly brought, stored and transhipped

at Cochin. In this phase Cochin developed into a magnificent port with its huge business buildings, stone wharves, where ships could come in and anchor alongside(see map-1)[6].

(ii) The Period of Stagnation (1740 - 1850)

The English, after capturing the Cochin port from the Dutch, destroyed it completely in 1806 fearing that the Dutch might recapture it. The destruction was complete- they had blew up the fort and wharves. As the East India Company gazetteers recorded "not only war and trade and government were made impossible, but animal life itself"[7]. Even after a decade, Cochin remained as "a wretched and miserable fishing village"[8]. Calicut in the north regained its preeminance in this phase. As Arasaratnam observes, " ...... there was an upsurge in the trade of Malabar caused partly by the decline of the Dutch naval power in these waters and :the expansion of English company and private trade in collaboration with Indian traders from Surat and Malabar. The major Dutch port of Cochin had declined totally in its volume of trade, and Calicut to the north and Travancore(Alleppy port) to the south were increasing their share of oceanic trade"[9].

The emergence of Alleppy port in the 1780s was another factor that contributed to the total decline of Cochin. Travancore challenged and broke the Dutch blockade of the coastal sea through establishing a new port at Alleppy, a little to the south of Cochin. Until then, Quilon was the major port of southern Kerala(it was sometimes called the Calicut of Travancore). Quilon was a centre of flourishing Chinese :trade, and the trade existed

18

till the 15th Century. With the rapid growth of Alleppy with greater natural facilities, the importance of Quilon decreased.

(iii) The Beginning of the Modern Commerce(1850 - 1926)

The port of Cochin began to regain its lost glory during the decade of the 1850s. The old trading techniques came to an end and customs of modern commerce began to emerge. The starting of a number of new commercial firms and also the birth of the Cochin Chamber of Commerce marks the beginning of modern commerce at Cochin.

The growth of trade(both in value and tonnage) at Cochin since the mid-nineteenth century is clear from table 2.1. The table gives the decadal averages of tonnage and value of trade through Cochin. During the decade 1871/80 the value of export(Rs.86 lakhs) was higher than import(Rs. 62 lakhs), but in the case of tonnage the import tonnage (55771 tonnes) was higher than the export tonnage(44512 tonnes). The value of import and export has increased to four times(Rs 242 lakhs and Rs.330 lakhs) during the decade 1907/16. The tonnage also steadily increased during this period. From a detailed analysis we can observe that the value of export through Cochin has grown from Rs. 23.40 lakhs to Rs.496.4 lakhs and the value of import has increased from Rs.27.80 lakhs to Rs.480 lakhs, and the total value of trade has increased from 51.2 lakhs to Rs. 976 lakhs over the period 1858 to 1926. The total tonnage over the period has also increased from 74,208 tons to 427,946 tons over the period 1871 to 1924. From table 2.2 we can observe that the share of Cochin port compared to Calicut and Travancore has increased steadily. In 1906 the share

of Cochin port to total tonnage was 40 where as that of Calicut and Travancore was 32 and 27 respectively. By 1926 the share of Cochin declined to 36 and that of Travancore has increased to 31 and the share of Calicut remained the same. The external trade through Cochin in this phase increased considerably due to the prosperity in Europe coupled with the introduction of steam ships in 1850s. Another important factor for the increase in trade through Cochin is the diversion of Travancore trade to Cochin to avoid the penal duties which Travancore otherwise had to pay according to the Inter-portal Convention then in vogue[10]. The increase in the agriculture production through large scale investment in plantation in this period was also one of the reasons behind the increase in the export potential of the port's hinterland. Rapid commercialisation of agriculture began to take place during this time. The increase in the production of tea, coffee, coconut, spices are the important among them.

The working conditions during the 19th century at Cochin was not satisfactory due to many reasons, the most important ones among them may be the large scale pilferage and loss of cargo while being discharged from steamers to lighters; the 'efficiency' of the port in the 1890s was clear from the low traffic it handled. It was only about 250 to 300 tons per day. During this period most of the trade activities were taking place at the stream.

The wharf traffic for bigger vessels were being obstructed by a bar of hard sand encircling the entrance to the harbour. Several attempts and investigations were made to cut the bar and
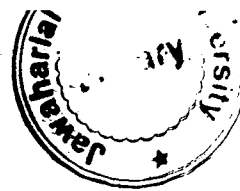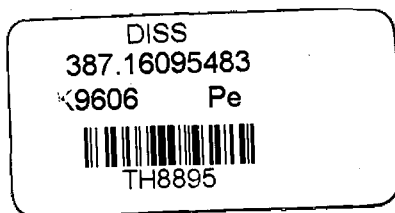
to construct an approach channel about 5 kms. long. The government was also reluctant to proceed because of varying conclusions from different expert groups, but the continuous pressure from the trading interests at Cochin kept on till the Government of Madras decided to start the project of getting the bar cut by dredging and providing an entrance channel by appointing Robert Bristow, a competent engineer.

(iv) The Growth of Cochin into a Major Port(1926-1951)

The development of Cochin into a major port is intertwined with the name of Robert Bristow, who was appointed as the harbour engineer-in-charge in 1920. Bristow can rightly be called the founder of modern Cochin port. He undertook and executed the different phases of work to make Cochin one of the major ports of India, like cutting of the outer sand bar, dredging the channel and reclamation of the 'Wellington Island', and the construction of the necessary shore facilities such as wharves, sheds, rails, etc., within limited time and money and, of course, with a touch of genius.

The merchant community of Cochin had been the ardent supporters of the port scheme from the very beginning. This is clear from their act of voluntary introduction of the 'landing and shipping fees' in 1914 (Rs. 0.12 per ton), and further increasing the fees in 1921 (Rs.1.00 per ton) with a view to 'service the investment' outlay to be advanced by the participating governments. Such an initiative was the first of its kind in India. According to Pankajakshan, " The act of revising these rates also separated the port of Cochin from the 'western group of

21

ports' in the Madras Presidency, and made it a port with
independent control over its finances" [11].

The tonnage and value of trade through Cochin during this
period also increased steadily. The average tonnage and value of
trade through Cochin port during the period 1931/40 and 1941/50
has increased from Rs.1233 lakhs to Rs. 4583 lakhs and from 728444
tonnes to 989596 tonnes respectively(table 2.1). The share of
Cochin also has increased from 36 to 64 over the period 1926 to
1950(where as the share of Travancore has declined from 31 to 21
and that of the Calicut port has declined from 32 to 13 over the
same period(see table 2.2). The figures indicate the superiority
of Cochin over the other ports of Kerala.

Another major stride in the developmental scheme of the
port was the successful 'Four-Party Agreement' between the
Government of India, the Madras Presidency, the Cochin State and
the Travancore State in 1925 to jointly sponcer the port scheme.
The agreement approved the scheme for the final dredging of the
channels and for the construction of 'wharves and other shore
facilities' and capital cost was to be contributed by the three
representative governments and the customs collection at the port
was to be shared between them[12].

The port of Cochin on its path to development had to face
a lot of obstacles from different sides. The reluctance of the
Port Authority(The Madras Government) to invest on any kind of
developmental activities (during that period Cochin port was under
the control of the Madras Government) was one of the major hurdles

22

the port had to face. Even though the administration of Cochin port was directly under the port officer of the Madras Presidency, and they were collecting the port dues on vessels, and the customs duties on cargo with the help of a Master Attendant at Cochin, the Government of Madras was unwilling to 'invest' even for a steam-tug for movements of cargo, by towing lighter's between the stream and the shore.

There was also a loud voice of opposition against the fourth stage works, like construction of wharves etc., from all the members of the Four-Party Agreement, and also from the South Indian Railways [SIR], the Madras Port Trust [MPT] and surprisingly even from the Cochin Chamber of Commerce [CCC]. Each had their own genuine reasons for their disagreement. The members of the Four-Party Agreement feared that the returns on the investment would be risky, for they felt that the trade through the port would not flourish. The SIR and the MPT feared about the drain of their traffic to the Cochin port. The members of the CCC feared that the construction of the wharf facilities, etc., would take away their highly flourishing and profitable lighter trade, from which they are getting fairly high profits. Finally, a compromise was made between various parties regarding the issues.

A final agreement between the various governments was signed in 1935 in a conference held at Delhi. The Government of India took over the administration of the port from the Madras Government in 1936 and declared Cochin as a major port. R.Bristow was appointed as its first Administrative Officer. Thus the fourth stage of works was started in 1936. The actions being speedy so

that by 1939 the first two deep-water wharves on the Willington Island were declared open for steamers. In the same year the island was provided with the rail road bridge which connects the island with the mainland.

Now the steamers did not need to wait in the outer sea, they could come to the inner harbour and work along side the wharves and warehouses. The port activities flourished with the help of the natural network of back water systems and rivers which was the main source of transportation, and also with the newly constructed road-rail bridge facilities. The change in the traffic handled was drastic when the inner harbour was opened in 1936-37, it went up to 1000 tons per day compared to 250 to 300 tons during the 1890s.

(v) The Post Independence Period(1951-1970)

During the post independence period the trade through Cochin has increased steadily. Table 2.1(decadal average) reveals that during the period 1951/60 to 1961/70 the value of total trade has increased from Rs.11852 lakhs to Rs.23779 lakhs and the total tonnage has increased from 17,22,086 tonnes to 34,36,558 tonnes. The share of Cochin port's tonnage in total tonnage of Kerala has increased from 64 to 70, and those of Travancore and Calicut has declined drastically during the period 1950 to 1960. Table 2.3 gives a more clear picture of the increase in the value of trade through Cochin compared to Calicut, Alleppy and Other ports. The value of import trade through Cochin has increased from Rs. 226 million to Rs. 1120 million and that of export trade has increased from Rs. 509 million to Rs. 1557 million over the period 1951/52 to 1969/70.

The growth of the port's trade since the completion of the fourth stage works was simply tremendous. The trade tonnage having gone up by 100 per cent, and its value by over 900 per cent, in the following twenty years, the revenue receipts of the port also went up remarkably during this period- from about Rs.12 lakhs in 1940/41 to over Rs.127 lakhs in 1960/61, and the shipping tonnage visiting the port rose from 8 lakh gross registered tonnage(GRT) to over 42 lakhs GRT during the same period. With the above growth in traffic, the port of Cochin has grown fast in its capacity and facilities even after the completion of the fourth stage scheme in 1940.

The two wharf berths in 1941 has increased to four in 1951, again to nine in 1961, with another set of four most modern wharf-berths fast nearing completion. The cargo handling capacity of these berths expanded from 2.5 lakhs tonnes to over 30 lakhs tonnes in the same period, and the port's capital investment (at current prices), was Rs.2.3 crores in 1941 rose to Rs.7.6 crores by 1961.

An interesting point to be noted here is that, in spite of the construction and continued growth of wharf-berth the traffic handled in stream (dry cargo) and the utilisation of lighters in the port's traffic did not decline from the level in 1930/31. The port's finances were sound according to a study by the NCAER. The study observes that," the total capital expenditure incurred on its development since 1920s, when the project was started up to the 31st march 1966 amounted to only Rs.9.86 crores. Port funds

have contributed Rs.5.89 crores towards the development cost. The impact of port charges on the import and export trade at Cochin was moderate. The average revenue per tonne of traffic, realised in 1964-65, was Rs.7.10. The corresponding figures for Madras, Bombay, and Calcutta were Rs.10.50,Rs.10.63 and Rs.17.13 respectively. The NCAER study, also gives the estimates of the traffic projections for 1970/71 and 1975/76. There is an increase in export and import trade. The study forecasts that total traffic of import and export cargo is expected to increase from 2.87 million tonnes in 1965/66 to 6.81 million tonnes in 1970/71, and 8.40 million tonnes in 1975/76.[13]

Cochin port increased its share of the total traffic by all major ports from 5.1 per cent in 1960-61 to 9.9 per cent in 1967-68, and during the period the traffic at Cochin registered an annual growth rate of 15.2 per cent against 4.9 per cent through all major ports together[14]. The share of Cochin port's traffic since 1970s started declining, the traffic share of Cochin port to all the ports in India declined from 8.67 per cent (in 1970/71) to 3.85 per cent (in 1984/85)[15]. A detailed analysis in the third chapter of the port's output and factors of production will give us an idea about the trends in the port working in this period.

We shall now attempt to summarise the various factors that contributed to the growth of Cochin as a major port.

(a) Favourable Geographical Factors

Geographically, Kerala is gifted with an extensive backwater system, connected with canals, navigable during all

26

seasons of the year. The state also possesses forty four rivers flowing from the ghats to the Arabian sea, and 580 kilometer long coastal line. The total area of the inter-connected back water system amounts to 230 square miles and stretches a distance of over 200 miles from south to north. Kerala coast had all the natural endowments for anchorage of ships sailing in from deep sea. The anchoring places were called 'azhis' or 'pozhis' (estuaries) where the back waters or the rivers met the sea. Safe anchoring in these estuaries were made possible by the existence of mud-banks [16]. Cochin had become an all-weather port of immense commercial importance in the west coast of India in the early period with the help of the 'Narrakal' mud-banks, about seven miles north of the Cochin entrance. During the monsoons vessels anchored there and lighters were used to carry cargo to the shore. Even from the early days of trade these anchoring places were known to the long distance traders of the West.

The geographical location of the Indian Peninsula was highly favourable in this respect. According to Bouchon and Lombard, " the west coast of India was an indispensable stop-over for traders to Canton and Malaca, which they were unable to do in one single monsoon, also the sea traders of Gujrat and Malabar[17] undertook only the task of transporting and depositing in their ports products from China, Insulinda and Srilanka[18].

Along the coast, in the absence of inland transportation, numerous ports were developed from creek to creek with the help of these mud-banks. As internal integration and relative transportation developed the less advantageous of the numerous

27

ports began to decline[19]. Cochin proved to be one of the most naturally gifted ports of Kerala. It was situated at the mouth of the one of the largest back water systems. Though the mouth was shallow smaller vessels could enter the harbour. It offered immense possibilities of development with substantially lower investment when compared to the other ports. The Narrakal mud banks were one of the most reliable in the coast. Cochin was also more advantageously situated as it was around of the Malabar coast.

(b) Political Factors

Our chronological narration of the changing fortunes of the port over the last five centuries points to the importance of political factors. They indeed constitute the single most important factor defining the fortunes of the ports in the Malabar coast in the early years.

It has been argued that the decline of the ancient ports of the Kerala coast namely Bakare and Nelcynda[20] was mainly due to the withdrawal of the Pandian Patronage, and the suppression of these trade centres by the Chera kings, who were interested in giving the trade monopoly to Muziris[21]. The rise and fall of the Empires in the west was also a determining factor in the prosperous long distance trade. The collapse of the Roman empire was an important factor for the elimination of Muziris from the trade map of Kerala.

We have already discussed the trade rivalry between the European powers and how the relative prosperity of the ports were

linked to the rise and fall of these powers. The petty cheftains of different small sea-borne 'states ' of Kerala were easy prey to the European traders. They exploited the rivalry among the local chieftains to their advantage.

Among the Europeans traders along the coast, the Portuguese had the dubious distinction of being the people who introduced politics into the ocean. The Arab-Portuguese battles of the Calicut port and the long fought Zamorin-Portuguese wars[22] for the trade monopoly at Calicut were the foremost of the confrontations that 'the land of peaceful trade' had come across during the reign of the Europeans on the Kerala coast. The intermitent wars between the Zamorin of Calicut (with the assistance from the Moores, the local traders of Calicut, and the Portuguese, not only ruined both the powers but also resulted in the decay of the Calicut port.

Travancore had been often forced to send pepper across to the eastern coast over the hills in the early years due to the Dutch harrasment. But in the 1780's, under king Rama Varma they broke the Dutch monopoly by making a port at Alleppey to the south of Cochin and traded directly with the Indian ocean.

The British-Dutch rivalry resulted in near eclipse of Cochin almost for a century. The exclusion of Alleppey in the modern period from the later road (highways) and railways construction programme, was a major factor that contributed to the neglect of the Alleppy port. On the other hand the importance given to Cochin by the English together with its locational

advantage, through the modern transport network concentration, helped a lot in its emergence as one of the major ports of Kerala even as early as during the 1870's.

(c) The Growth of the Port's Hinterland

The hinterland of a port may be defined as the region lying behind the port, connected to it by transport links and depending upon it for its sea-ward trade. According to G.G. Weigend, the port-hinterland is the "organised and developed land space which is connected to the port by means of transport lines, and which receives or ships goods through that port" [23]. As we know the hinterland potentials of a port is one of the most important factors that determine the port's prosperity. Even in the early days of trade numerous ports developed along the coast of Kerala mainly depending upon their hinterland potentials. During those days each port enjoyed only extremely limited hinterland. There existed little lateral inter-connection except for head load roads and canoe transport.

With the emergence of major lines of penetration, hinterland transportation costs were reduced for certain ports, thus, leading to port concentration. The transportation development started in Kerala only in the middle of the 19th century. Wide differences can be observed in the development of different modes of transportation facilities in different regions of the state. The regional variations is mainly due to the differences in the social and political conditions prevailed at Malabar, Cochin and Travancore[24]. In the case of Cochin for the period 1900 to 1947, while the road density increased steadily,

the rail density stood at 3.32 miles.

The sudden increase in different modes of transportation facilities in Kerala was felt in the period 1840 to 1940. All important canals now existing at Cochin were constructed during the period 1840 to 1880. Wheeled traffic between Cochin and Coimbatore was for the first time established in 1844. The introduction of railways in Cochin 1902 made possible distant

contacts. Construction of ghhat roads were also done in this period to carry all the hill produce such as tea, coffee etc.for export to the nearby ports. In 1880 there was only about 400 miles of roads in Cochin which spread by another 50 miles within two decades. The growth of road mileage in Travancore was so rapid that from a mere 52 miles in 1862 it rose suddenly to 900 miles in 1880 and further to 3000 miles by 1900. Travancore also concentrated in the development of water transport facilities. By 1880 a continuous and uninterrupted waterway from Trivandrum to Beypore in Malabar, a distance of 228 miles was made possible. With the transport network the effective hinterland of Cochin port steadily increased.

The development of the economic activities in the vicinity of Cochin since it became a major port is tremendous. During 1930s the Travancore government gave more importance to industrialisation, numerous industrial establishments have come along the Alwaye-Ernakulam belt wholly depending upon Cochin port. The important among them are the Fertilizer project, the Travancore Cochin Chemicals, the Indian Aluminium Company, the Cochin Refineries and the ancillaries in the petro-chemical field

etc. Cochin was gradually changing to an industrial town of Kerala with the development of the port. The hinterland of Cochin port during 1960/61 is given in map-2.

(d). The Development of Man-made Facilities

Modern ports owes as much to the natural factors as to the man made infrastructure. The construction of the necessary facilities such as the breakwaters, wharfs, etc., for safe anchoring of the ships made it possible the freight transport speedy and effective by reducing the cargo handling time and saving the cost.

The idea of developing Cochin as an important port dates back to 1835 when the 'Navy' had undertaken some engineering surveys at Cochin port. The 'commercial interest' to develop Cochin as a major port came only after a long time when the trading communities in the port's vicinity started putting forward proposals since 1870. One of the major hurdles for the port to overcome was the cutting of the sand bar at the port's entrance which prevented bigger vessels from entering into the inner waters.

The development of man-made facilities, that is, the development of Cochin as modern port can be divided into four stages. The first stage consisted of all preliminary work of an investigatory nature. The second stage was mainly of foreshore protection, part of reclamation wall and the experimental dredging. The project authorities made history in the world of harbour dredging by achieving the task of cutting the sand bar

32

using a suction cutter dredger with pipelines in just eight years.
By 1929, the approach channel-450 feet wide and 3.5 miles long-was
cut across the bar and the harbour mouth was connected with the
deep sea.

The third stage of works consisted of major dredging
operations inside and outside, the construction of the moorings, a
large area of reclamation about 900 acres in area, and a dry dock.
By 1928 and 1929 steamers used enter into the inner harbour. In
1930-31 the port was formally thrown open for vessels of up to 30
feet draught.

The making of the wharf facilities, quay berths, cranes,
warehouses and transit sheds, offices, roads and railway, water
supply, and ancillary works were initiated and executed in
different phases during the fourth stage. The first ocean going
vessel came alongside the wharf of Mattancherry on 2 june 1939.
The next stage of work with the introduction of five year plans
was tremendous, especially during the first two plans. Coal berths
and Tanker jetties were made during this period, and during the
third plan the expansion of the port was done with the
construction of four additional wharf berths at Ernakulam fully
equipped with cranes, railway lines, etc.

During the Third and Fourth Five Year Plans some of the
important developmental activities occurred at Cochin. These
included the construction of the eastern wharf with four
additional berths (quay 5 to 8), alongside the Ernakulam channel,
fully equipped with cranes, railway lines, transit sheds,

warehouses and modern cargo handling equipments. The eastern wharf was commissioned in May 1964, the year in which 'Cochin Port Trust' was constituted. In 1966 the north tank jetty was modified and opened to cope up with the demands of large imports of crude for the Cochin refinery. The equipments acquired during the period 1966/67 to 1968/69 include a 120-tonne self propelled floating crane, a high power tug, a hopper suction dredger, a fire float, a pilot launch and a number of fork lift trucks. During the Fourth Plan period (1969/74) the developmental programmes completed included the construction of an open berth in continuation of berths Q5 to Q8 of the Ernakulam wharf. The berth was commissioned in 1969 and extended in 1974. Four wharf cranes with grabs for the open berth and a multipurpose tug were also acquired during the fourth plan period.

An allotment of Rs.12.49 crores for the Cochin port during the Fifth Plan was made mainly for two important schemes, one to replace the dredger at a cost of Rs. 7 crores and the other to provide a full fledged container handling facility, with an expenditure of about Rs.4.5 crores. The Fifth Plan also included several schemes for augmenting berthing and dredging facilities. The port also acquired a hopper suction dredger in 1975, a high power tug in 1976 and a new pilot launch and a hopper grab dredger in 1977. In the same year four wharf cranes were purchased and skeleton facilities were provided for handling containers.

An integrated scheme for the development of the port was proposed and Rs.53.02 crores had been provided for the development of Cochin port of this Rs.46.07 crores for new schemes and the

rest for spill over projects. The major works in the schemes include the construction of a deep drafted oil berth and a fertilizer berth with mechanical facilities in the Ernakulam channel. The shifting of the fertilizer berth from Q9 to the newly constructed fertilizer berth would leave the berth Q9 exclusively for the development of a conta iner terminal. As a first stage of developing Q9 to a full-fledged container berth, two-tyre mounted transfer cranes were positioned there to handle loaded containers and for stacking them in the parking yard and also two fork lift trucks with side spreaders to handle empty containers.

In the second phase it was proposed to have additional 'transfer cranes' and two 'gantry cranes' for ship to shore handling of containers. The development of the port since the introduction of container traffic was tremendous. Almost all the general cargo handled through Cochin port was containerised. The su den change from the highly labour intensive technology to that of a capital biased one made a lot of impact on the traffic and structure of the port.

In the recent period the developmental activities at Cochin were not kept in pace with the increase in the trade. The first container vessel in India called at Cochin in Q5 berth, in 1973. Subsequently an export documentation centre(1977) and a container freight station at Q9 berth(1979) were opened and by 1984 an inland container depot(ICD) at Coimbatore was started and Cochin was linked to it. The port brought two transfer cranes in 1985 to move the containers from the berth to the container yard, thereby improving the Container handling facilities. But in order to

compete with the technologically uptodate ports such as Colombo and Madras, Cochin must invest in latest cargo handling equipments like gantry cranes etc.

We have already detailed the scheme of Bristow and its successful implementation. Similarly as a part of the planned development in the post independence period certain modernization measures were also adopted. It may be interesting in this respect to compare the facilities available in the other ports of Kerala, namely Calicut and Alleppy, not to say of other minor ports. The contrast is very sharp. There has been hardly any subsequent development activity in the modern period. We have briefly attempted the facilities of these ports below.

The port of Calicut is situated about 120 km. north of Cochin. The ships anchor at Calicut about 5 km. off the shore. There is a mud-bank in the near waters and which go on shifting their position within certain limits. There are two piers at this port, known as the north pier about 164 meters long and the south pier about 182 meters. The import cargo is unloaded into the lighters lying alongside the steamer and towed to the piers, there it is unloaded on the piers by means of cranes. The same arrangements exist in respect of export cargo.

The port of Alleppy, situated about 70 km. south of Cochin also posses a mud-bank off the coast, and which stabilizes only after the break of the monsoon. The general anchorage at Alleppy is about 3 km. off the shore. The port possesses a pier of length 387 meters and having 12 working stages for handling bags and

light cargo. The construction of a light house in Alleppy was done in 1860 with the revenue from the port-dues imposed on shipping traffic.

Conclusion

Cochin, one of the glorious trade centres of the west coast of India was known to the long distance traders of the West as early as the fifteenth Century. It served not only as a centre of export trade of spices with its vast hinterland potentials, but also as an entrepot too. The fortune of the port for the last four centuries were mainly dependent on the rise and fall of the European Trading Communities, for this the location of the port in the middle of Kerala coast and its vast potential hinterland were the main factors. That is, more than purely political motives, deliberate geographical consideration were also behind choosing Cochin as their trade centre. In the modern period too the port of Cochin flourished in trade activities overtaking the port's of Calicut and Alleppy due to its natural locational advantage. The trade at Cochin port began to decline only in the last one and a half decade due to various reasons. A detailed analysis of the nature and causes of the trade decline is the focus in the coming chapters.

Table 2.1. TONNAGE & VALUE OF TRADE AT COCHIN (decadal averages)

Value of Trade (Rs lakhs)			Tonnage of Trade (tonnes)		
Year	Import	Export	Total	Import	Export	Total
1871/80	62	86	148	55771	44512	100284
1907/16	242	330	572	209999	100614	310613
1931/40	653	579	1233	585252	143191	728444
1941/50	2192	2391	4583	654554	335041	989596
1951/60	4898	6954	11852	1280907	441180	1722086
1961/70	8600	15179	23779	2609580	826978	3436558

Source: T. Pankajakshan op. cit. PP.86 to 87.and Cochin Chamber of Commerce Administration Reports relevant years.

Table 2.2. SHIPPING TRADE OF KERALA (Tonnage)
Percentage to Total Trade of Kerala

YEAR	TRAVANCORE PORTS	CALICUT PORT	COCHIN PORT
1906	501200	594880	736282
1908	469824	660371	708384
1910	451685	707706	858691
1912	510012	703130	834770
1914	458060	644173	834213
1916	168740	306813	398906
1918	79036	147421	194446
1920	142354	326572	317346
1922	382376	511448	631120
1924	535070	806448	802758
1926	760587	762948	857039
1928	972361	1008559	1005354
1930	1280288	1071636	1256738
1932	1446904	1099569	1434375
1934	1403752	1219623	1687838
1936	1706921	1364842	2137053
1938	1699106	1175225	1975726
1940	992625	857958	1767826
1942	96838	273558	802546
1944	136602	283887	882624
1946	225562	122595	1720099
1948	481214	292426	1823384
1950	751175	461999	2221392
1952	481049	504918	2346729
1954	728601	765259	3029268
1956	680337	638890	2895157
1958	812902	713041	3239520
1960	946518	786539	4105561

Source: Cochin Chamber of Commerce, Administration reports.

	Export				Import			
YEAR	Cochin	Calicut	Alleppy	Others	Cochin	Calicut	Alleppy	Others
1951/52	5Ø9	3Ø	33	4	226	17	2	Ø
1952/53	467	35	37	14	212	8	2	1
1953/54	442	43	42	21	238	2	1	4
1954/55	47Ø	37	32	2Ø	3Ø1	6	3	4
1955/56	47Ø	38	29	29	235	4	2.	14
1956/57	476	17	28	32	278	2	3	Ø
1957/58	472	38	17	49	258	9	Ø	7
1958/59	475	47	36	36	242	5	1	9
1959/6Ø	572	37	44	2Ø	293	26	6	13
196Ø/61	574	41	4Ø	42	384	28	1	28
1961/62	589	44	57	33	375	13	3	2Ø
1962/63	673	47	47	35	34Ø	9	5	31
1963/64	681	23	44	39	449	3	4	26
1964/65	828	23	44	14	579	55	–	46
1965/66	823	16	45	17	646	3Ø	–	56
1966/67	1271	21	56	28	1Ø68	35	–	82
1967/68	144Ø	23	45	75	1278	–	–	77
1968/69	1479	19	54	45	1258	–	–	118
1969/7Ø	1557	19	45	51	112Ø	–	–	1Ø7

Table 2.3. STATISTICS OF EXPORT AND IMPORT TRADE - KERALA PORTS

Value of Trade (in million rupees)

Source: Government of Kerala, 1972, Statistics for Planning, Series 1Ø, Export, Import Statistics, Trivandrum.

The River of Cochin

Island of Vaypin

The Mouth of ye River Cochin

100 Rynlusse Roeden

THE CITY OF COCHIN
at the time of its being taken by ye Admiral
and Ieneral van Goens. 8. Ian: 1663.

Cavelhero

St. Lazaro

Nelso: Seni d gis

Convent of ye Italian Fryers

MAP. 1 PORT OF COCHIN DURING 1663

40
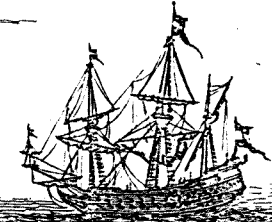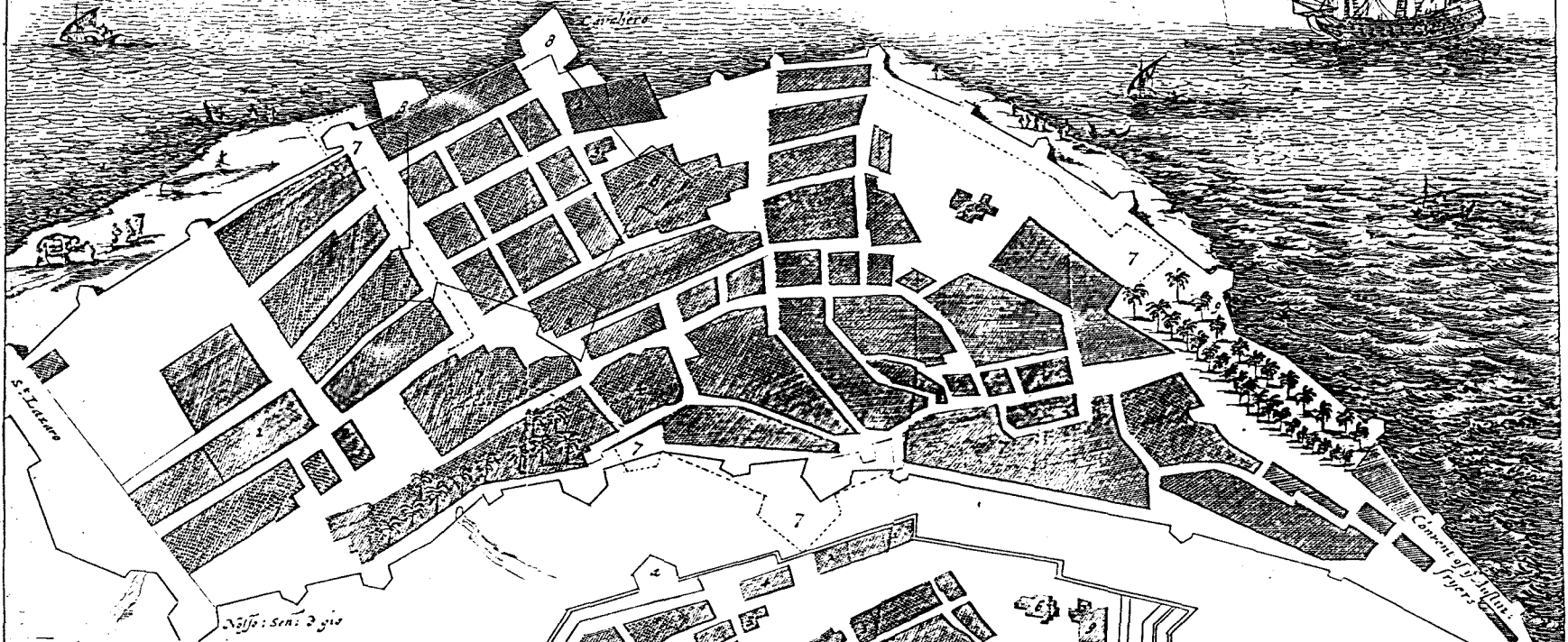
Directions for Old Cochin
1. St. Pauls Convent.
2. Governors Pallis
3. ye Church Bon rouge
4. ye Ches ch. of St. Domingo
5. St. Mary's Church
6. ye Stad house
7. ye Draught of new Cochin
8. ye Dra: by Mr. Newstard
9. ye Timber wharfe

Directions for New Cochin
a. ye Bastion of Gelderland
b. ye Bastion of Holland
c. ye Bastion of Zeland
d. ye Bastion of Friseland
e. ye Bastion of Utrecht
f. ye Bastion of Gröningen
g. Overusse
h. Cuylenbergh
i. Pelican
k. Bear
l. ye Inward ditch
m. ye Outward ditch
n. ye Counterscarp
o. ye Foussbree ye Chiefest
   livings in new Cochin.
1. Pallace of ye Governer
2. of ye Administrator
3.4. of ye Mins: & Assist:
5. ye Reformed Church
6. Cathedrall called Ce'
7. ye Ch: Misericordia
8. Convent of Franciscans
9. ye Stad house
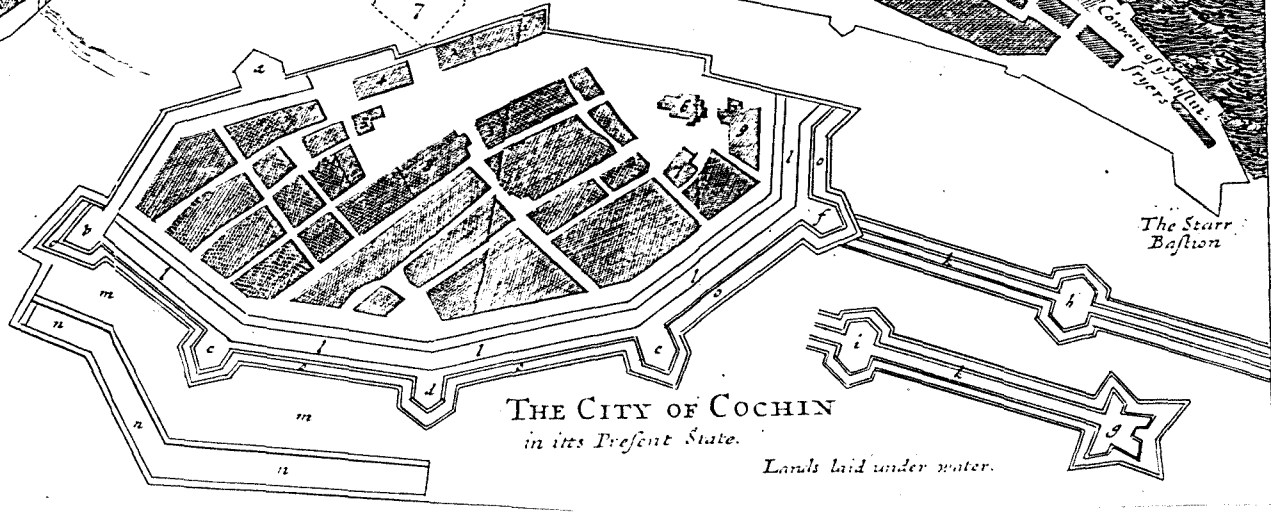
THE CITY OF COCHIN
in itts Present State.

Lands laid under water.

The Starr
Bastion
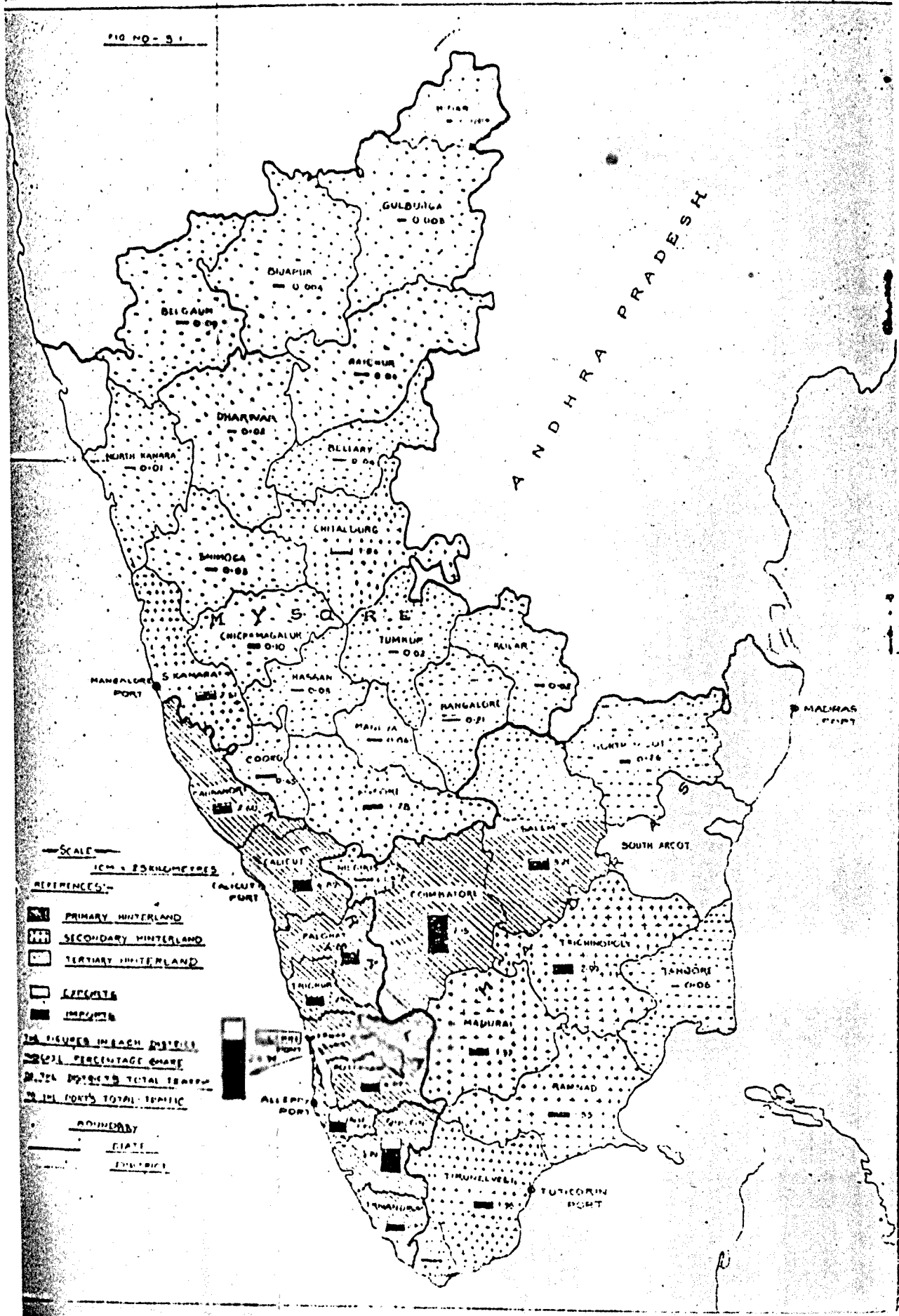
THE HINTERLAND OF COCHIN PORT

MAP 2 THE HINTERLAND OF COCHIN DURING 1960/61

Notes and References

1. Muziris, the main port of Kerala was the centre of trade with the Roman Empire of Augustus. According to Pliny, "Muziris, a city at the height of prosperity frequented by ships from Ariako and Greek ships from Egypt". The main export of kerala during the period consisted mainly of pepper and other spices, pearls etc., and imports were mainly coral, lead, tin, stibium etc. Regarding the ruin of Muziris Bouchon and Lombard observes, "The flooding of Periyar in the year 1341 brought mud to ancient Cranganore, and the progression of the off-shore bar closed the port of Eli; Cochin, Canannore and especially Calicut gained importance as a result of this". See article by Bouchon and Lombard 1987, p.58. ' Indian Ocean in the Fifteenth Century'in _India and indian Ocean 1500-1800_, Ashin Das Gupta and Pearson (Ed.) 1987.

2. Kerala, the maritime state had age long commercial exchange with Arabia, Egypt and the West which resulted in absorbing the whole length of the coast different races and religions. Evidences can be traced in case of flourishing trade that the jews and the christian communities had in the seventh century. The jewish synagogue at cochin is to be seen as a monument of their flourishing culture and trade even now(see _'The Cochin Port Story'_ Planning and Research(P&R) Cell, Cochin Port Trust.

3. All the ports of the Kerala coast were once roadsteads. Cochin also remained as a roadstead because of a long hard sand bar and silt at the mouth of the harbour created by river Periyar, when it forced into the sea. At these roadsteads sailing vessels used to lie at anchor in the open sea and local country vessels, called 'valloms' move up and down the backwaters taking out export cargo to be shipped and bringing in imports of foreign vessels.

4. History record that on Christmas Day in 1500 A.D. the Portuguese Admiral brought his fleet into Cochin Harbour and that Vaco da Gama came to cochin in 1502 and died here. The first European building in India was erected near cochin in 1504. The Portuguese fought continuously (between 1498-1663) many wars, mainly off cochin Harbour with the seamen of the kerala coast for trade monopoly. The details of the confrontation between the portuguese merchants and the Moorish merchants can also be found in 'Kerala Pazahama' or 'The Chronicles of Kerala 'by Gundert '.

5. With the end of the trade blockade of maritime trade by the portuguese, the trade of kerala began to grow. The export products from Kerala grew with the encouragement given by the Dutch to grow Coconut, indigo and to the salt farming industry. The ports of Kerala all over Kerala witnessed signs of Prosperity and Cochin was a very important port with its harbour filled with ships, streets crowded with merchants and warehouses stored with goods from every part of Asia and Europe indicating the industry, the commerce and the wealth of the people.

6. The map 1 gives an idea about the port of cochin during 1663.

7. K.P.Padmanabha Menon, <u>History of Kerala</u>, 1924 p.181-182.

8. Pankajakshan.T, 'An Economic Study of the Port of Cochin, its traffic trade and working, 1963.

9. Arasaratnam,'The Indian Ocean in the fifteenth Century', 1987, p.116.

10. Ibrahim, P.'Development of Transport Facilities in Kerala; A Historical Review, <u>Social Scientist</u>, Vol.6. No.8, 1978.

11.Pankajakshan. T. op.cit. p.50.

12. Velu pillai.,T.K. 1940. p.450.

13.National Council of applied Economic research, 'The Traffic Survey of cochin Port', 1969., p.97.

14.National Council of Applied Economic Research, <u>The traffic Survey of cochin Port</u>., 1975. p.138.

15. Basic Port Statistics, 1984/85, Transport Research Division,

16. The mud-banks are the peculiarity of the Malabar coast and many a traveller and navigator have documented it. During the monsoons maritime deposits of fine sized particles of green and black mud have been found about 300 km. distance between Calicut and Quilon and these sediments reduce the movement of waves and allow vessels to throw their anchors safely and can easily discharge the cargo even at the height of the monsoon. Jean Deloche, 1983, p.433. For references of the mud-banks along the Kerala coast can also be seen in the works of Starvorinus 1789, p.215 and Robert Bristow 'Cochin Saga' 1967, p. 18.

17. Malabar is the name given by Arab sailors to Kerala-the land of Cheras-which extends along the western coast of India, from Mangalore to Cape Comorin, and monsoon winds dictated the economic life of this region in the early days of trade by subjecting its ports to periods of activity and months of isolation, bringing ships from Rome, Africa, Arabia, and Persia to its shores.

18. Bouchon and Lombard, op. cit. 1987, p.58.

19. As the development of the economy passes through different phases the internal accessibility through the expansion of transportation network in the form of roads, canals etc. is from its beginning, at once, a continuous process of spatial diffusion influenced by many economic, social and political forces in underdeveloped regions is necessary for their economic growth. A detailed discussion of the sequence of transportation development, concentration of ports, etc. can be obtained from 'Transport Geography Comments and Readings', (Ed.), Michael E. Eliot Hurst, Article by E.J. Taaffe, R.L.Morrill, and P.R. Gonld, 'Transport Expansion in Underdeveloped Countries: A Comparative Analysis, 1974.,p.386.

20. Some of the ports recorded in the literature are Nelcynda(Neramon),Naura(Canannore),Tyndis(Beypore), Bacare(Porakad), Muziris(Cranganore). A detailed description about the geography of the Malabar Coast can be obtained from a book " Periplus maris Erythroen" by a Greek unknown author. The ships which frequent these ports are of a large size, on account of the great amount of bulkiness of pepper and betal of which their lading consists. The main items of export include pepper, betal, diamond and pearls, ivory, fine sliks etc., and the main import items include gold coins, white glass, etc.[William Logan, Malabar Mannual, 1981 (ed.) p.103. Many ancient travellers also mentioned about these trade centres. The identification of the ancient ports and trade centres with the present day ones were attempted by scholars like, Mc. Crindle, W.H. Schoff, V. Kanakasabhai, B.A. Saletore, Elamkulam Kunjan Pillai, but they could succeed in a limited cases only.

21. Thomas, 1932. p.32.

22. The wars were fought between the worlds greatest maritime power of the 16th century and the heroes of the valiant dynasty of Calicut Admirals known by the honorific title of Kunjalis of Kottakkal. They fought mainly for the freedom of the seas and free trade, though later it took on a religious and political turn.

23. G.G. Weigend, 1958, P.182.

24 Ibrahim, P. op.cit. p.40. '

CHAPTER III

TRENDS OF OUTPUT, CAPITAL AND LABOUR AT COCHIN PORT

In this section we shall discuss in detail about the trends of output, capital and labour of the port of Cochin for the period 1970/71 to 1985/86. An important reason for the selection of this period is the availability of the data on output, capital and labor. Moreover, there was a considerable amount of investment during this period to keep in pace with the 'containerisation' that was taking over the entire international maritime-trade.

The output, that is, the tonnage handled is further discussed in detail by decomposing the total traffic into coastal and foreign trade, export and import trade, bulk and break-bulk trade and also to components of trade to analyse the traffic pattern through Cochin port. The trends in capital stock and the growth rate of capital of Cochin port are also estimated in 1970/71 prices. The trends in the number of different categories of labor and their wages are also discussed in the subsequent sections.

3.1. Growth of Output at Cochin Port:

The trends in the output at Cochin port since 1970/71 is discussed in detail in this section. From table 3.1 it is clear that the share of Cochin port's traffic to all ports traffic in India is declining steadily during the period 1970/71 to 1984/85. In fact the share has declined more than fifty per cent of the

initial share.

Table 3.1. TRAFFIC SHARE OF COCHIN PORT TO ALL PORTS

YEAR	COCHIN [m.tonnes]	ALL PORTS [m.tonnes]	SHARE OF COCHIN IN ALL PORTS
1970\71	4.818	55.585	8.67 per cent
1975\76	4.259	64.917	6.65 per cent
1980\81	5.233	80.270	6.52 per cent
1981\82	5.500	88.067	6.25 per cent
1982\83	5.720	96.120	5.95 per cent
1983\84	5.004	96.377	5.19 per cent
1984\85	4.075	105.823	3.85 per cent

Source; Basic Port Statistics, 1984\85, Transport Research
       Division, Government of India, New Delhi.

For a detailed analysis of this decline in trade , we have
to look in detail in the internal and external trade, that is,
the foreign and coastal trade through Cochin Port, which gives
the details of the ports trade within and outside the country.
The coastal trade of the port is the trade carried out within the
country, that is, with other ports of India. The foreign trade is
the trade carried out with foreign ports. The table 3.2. gives
the breakdown of the traffic into foreign and coastal [import and
export trade together] trade through Cochin Port.

Table 3.2. shows that foreign trade occupies a major
portion of traffic through Cochin Port. Over the years its share
in the total trade shows a declining trend. In 1974, 81.46 per.
cent of the total trade handled through Cochin port was foreign
trade, whereas by 1986 it has declined to 43.60 per cent of the
total trade. In the same period share of the coastal trade

46

through Cochin port has increased from 18.54 per cent to 56.40 per cent.

Table.3.2. COASTAL AND FOREIGN TRADE OF COCHIN PORT [in m.tonnes]

YEAR [1]	COASTAL TRADE [2]	[2] AS A % OF [6] [3]	FOREIGN TRADE [4]	[4] AS A % OF [6] [5]	TOTAL TRADE ([2]+[4]) [6]
1974	Ø.69	18.54	3.Ø3	81.46	3.72
1975	1.Ø9	22.61	3.73	77.39	4.81
1976	1.Ø1	23.74	3.25	76.26	4.26
1977	1.Ø1	21.24	3.76	78.76	4.77
1978	1.29	24.96	3.89	75.Ø4	5.18
1979	1.33	24.33	4.14	75.67	5.47
198Ø	1.43	27.27	3.81	72.73	5.23
1981	1.43	27.28	3.8Ø	72.72	5.23
1982	1.52	28.Ø7	3.88	71.93	5.4Ø
1983	1.47	25.7Ø	4.24	74.3Ø	5.71
1984	2.Ø6	41.26	2.94	58.74	5.ØØ
1985	1.56	38.18	2.52	61.82	4.Ø8
1986	2.98	56.4Ø	2.3Ø	43.6Ø	5.28

Source: Administration Reports of Cochin Port, relevant years.
Trade in the table is measured in million tonnes.
Information Collected only from 1974 onwards.

However, if we decompose the total trade into export and import trade, the picture of the traffic will be different as shown in table 3.3. The share of export trade has shown a steady declining trend from 29.79 per cent to 13.64 per cent and the share of import trade has increased from 7Ø.21 percent to 86.36 per cent over the period from 197Ø to 1986. The trends in export and import trade is given in graph 3.1.

In the graph we have taken the year 1970/71 as the base year. The graph clearly shows that in the years 1974, 1976, 1984, and 1985 there was a sudden decline in the index of (1970/71 base) both in export and import trade. The graph also reveals that the trends in import trade through Cochin port was higher than both export trade and total trade, which is mainly because of the oil and fertilizer component in the import trade.

Table 3.3. EXPORT AND IMPORT TRADE OF COCHIN PORT [in m. tonnes].

YEAR	EXPORTS TRADE	% TO TOTAL	IMPORTS TRADE	% TO TOTAL	TOTAL TRADE
1970	1.43	29.79	3.37	70.21	4.80
1971	1.39	28.72	3.45	71.28	4.84
1972	1.18	25.11	3.52	74.89	4.70
1973	1.09	25.89	3.12	74.11	4.21
1974	0.85	22.79	2.88	77.21	3.73
1975	1.22	25.36	3.59	74.64	4.81
1976	0.94	22.07	3.32	77.93	4.26
1977	1.20	25.16	3.57	74.84	4.77
1978	1.25	24.13	3.93	75.87	5.18
1979	1.24	22.67	4.23	77.33	5.47
1980	1.11	20.29	4.36	79.71	5.47
1981	1.12	21.41	4.11	78.59	5.23
1982	1.30	24.07	4.10	75.93	5.40
1983	1.24	21.72	4.47	78.28	5.71
1984	0.90	18.00	4.10	82.00	5.00
1985	0.40	9.80	3.68	90.20	4.08
1986	0.72	13.64	4.56	86.36	5.28

Source: Administration Reports of Cochin Port, relevant years. Trade is measured in million tonnes.

Table 3.4. VALUE OF TRADE AT COCHIN PORT

[Coastal & Foreign, Import & Export] [in Rs. Crores]

YEAR	COASTAL		FOREIGN		TOTAL TRADE	
	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT
1971	49.34	9.72	163.86	107.68	213.20	117.40
1974	39.68	5.67	273.00	142.41	312.68	148.08
1975	72.26	5.33	326.94	322.16	399.20	327.49
1976	35.94	7.33	325.38	349.69	361.32	357.02
1977	41.23	4.72	432.95	379.74	474.18	384.46
1978	37.19	14.01	574.78	403.70	611.97	417.71
1979	36.84	14.31	431.56	423.90	468.40	438.21
1980	24.22	30.30	554.22	617.25	578.44	647.55
1981	43.03	27.11	511.17	759.44	554.20	786.55
1982	46.70	30.02	574.14	850.15	620.84	880.17
1983	29.65	122.39	669.11	929.84	698.76	1052.23
1984	24.90	177.84	660.95	561.73	685.85	739.57
1985	13.20	180.21	870.05	367.95	883.25	548.16
1986	40.33	297.69	839.32	503.32	879.65	801.01

Source: Administration Reports of Cochin Port, relevant years.

One of the determinants of the importance of a port is the value of trade through it. The value of trade (the value of import and export trade from which the port earns income and also the foreign exchange earnings for the country) through Cochin port is important as far as the port's future is concerned. The value of trade through Cochin Port [coastal and foreign] in import and export trade separatily is given in table 3.4.

In the case of coastal trade, the value of import trade

compared to the export trade has grown considerably (mainly because of the oil trade). The value of coastal exports trade was Rs. 49.34 crores in 1971 and it declined to Rs. 40.33 crores in 1986, where as the value of coastal imports has steadily increased from Rs.9.72 crores to Rs.297.69 crores over the same period(in current prices). The increase in the value of coastal import is very high since 1983. That is, the importance of coastal trade is not exploited fully in Indian freight transport. Compared to other modes of bulk cargo traffic, the merits of coastal traffic in terms of saving energy and time is further to be exploited in freight transport.

The value of export trade component in foreign trade has shown a higher position throughout the period compared to the value of import trade. We have seen from table 3.3. that the quantity of export trade through the port declined or almost stagnated over the period, and now its value has increased from Rs.213.20 crores (1971) to Rs.879.65 crores (1986)., the reason for this may be the change in the composition of export trade and also the higher value attributable to the spice trade (main component of the foreign export trade through Cochin is spice trade). It is also to be worth noticing that the value of coastal export over the period is very low compared to foreign export. In the case of foreign exports the value of trade has increased from Rs. 163.86 crores (1971) to Rs. 839.32 crores (1986) and the value of coastal exports declined from Rs. 49.34 crores (1971) to Rs. 40.33 (1986).

The value of foreign imports trade through Cochin port

also increased from Rs.107.68 crores (1971) to Rs.503.32 crores (1986) over the period of analysis. The value of import trade (both foreign & coastal] has increased from Rs.117.40 crores (1971) to Rs.801.01 crores (1986).

The graph 3.2 gives a clear picture of the trends in the value of export, import and total trade through Cochin port. From the graph it is clear that the trend in the value of import trade was higher than both the value of export trade and total trade. The trend in the value of import trade since 1974 was increasing steadily till 1983, then declined for the next two years and again in 1985 it has shown an increasing trend.

Now let us look at the total traffic disaggregating it into two components that is, bulk cargo trade and break-bulk cargo trade. The bulk cargo is defined as cargo that can be shipped in complete ship loads without packing and break-bulk cargo is that cargo which can be shipped as separate packages or parcels. The latest technological change in cargo handling, that is containerisation is applicable only in the case of the later type of cargo. Of the total traffic handled at Cochin Port, major chunk of the traffic was bulk cargo (oil, fertilizer etc.), next comes break-bulk cargo [that is, general cargo]. Major portion of the bulk cargo coming to Cochin Port are oil and fertilizer. The oil and fertilizer trade is mainly to the Cochin Oil Refinery and Fertilizers & Chemicals Travancore Ltd respectively.

GRAPH_3.1 EXPORT, IMPORT & TOTAL TRADE TRENDS

INDEX'S 1970 = 100

| □ | IMPORT TRADE | + | EXPORT TRADE | ◇ | TOTAL TRADE |
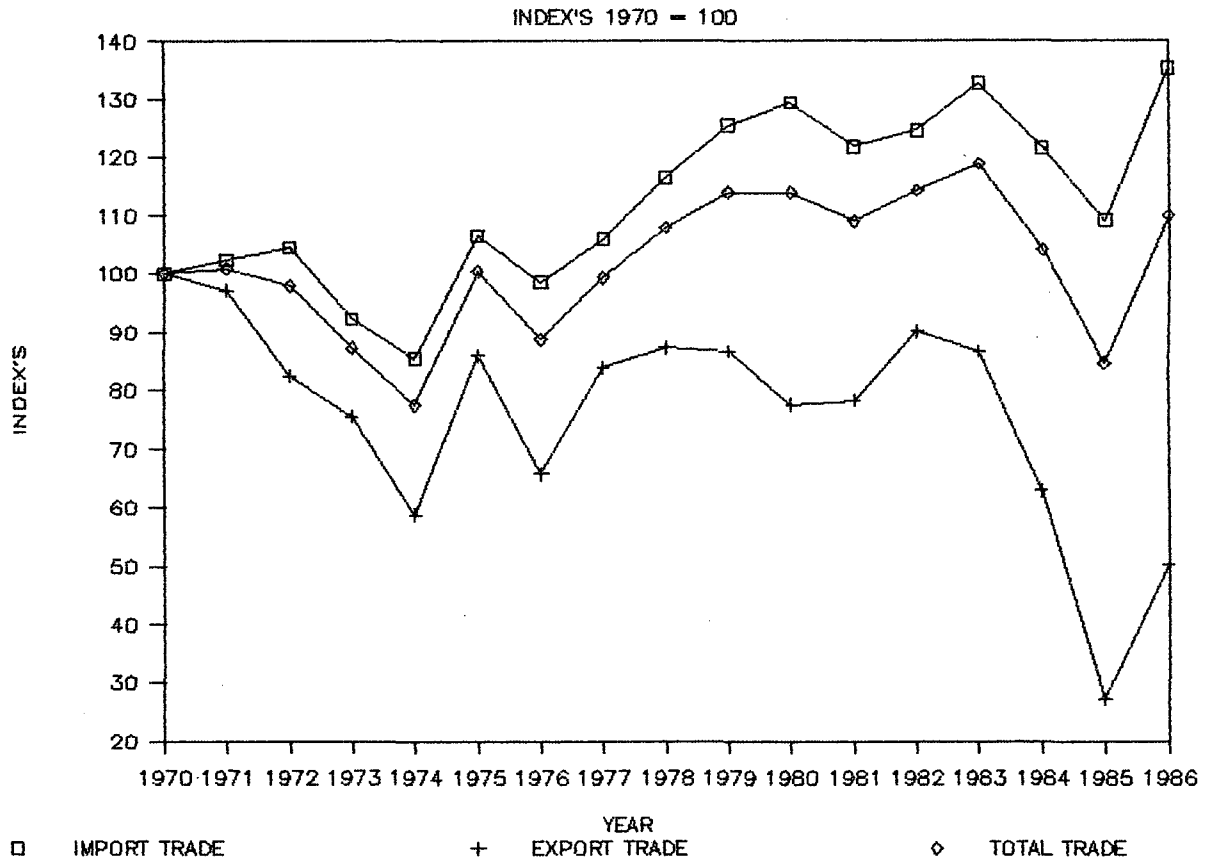
GRAPH_3.2 VALUE OF EXPORT, IMPORT & TOTAL TRADE

INDEX'S 1970 = 100

□ IMPORT   + EXPORT   YEAR
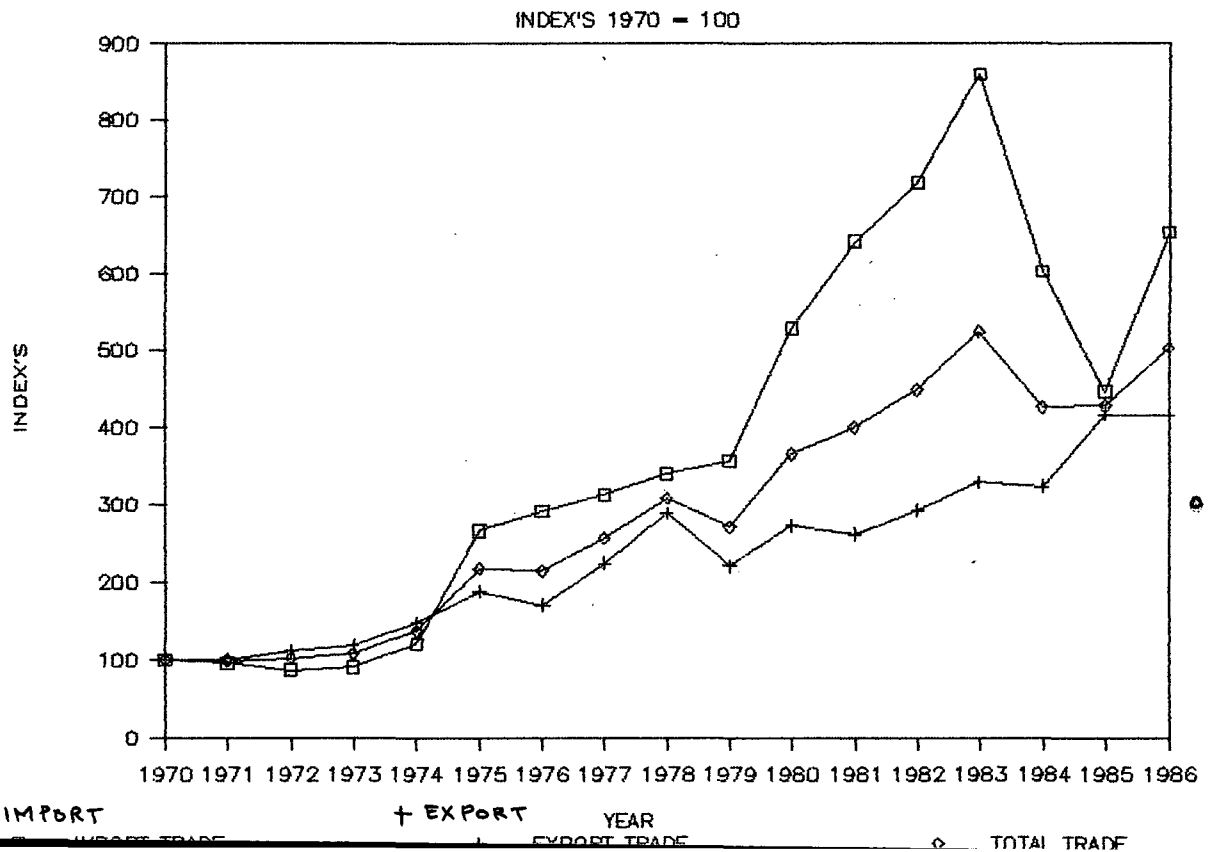
Table 3.5. gives the details of Bulk and Break-Bulk trade through Cochin Port. The Bulk cargo trade has increased from 29.65 lakh tonnes [80 percent of the total trade] in 1974 to 48.28 lakh tonnes [92 percent of the total trade] in 1981 and then declined to 46.88 lakh tonnes [89 percent of the total trade] by 1986. Whereas the Break-Bulk cargo trade of Cochin was only 7.56 lakh tonnes [20 percent of the total trade] in 1974 and it declined to 4.05 lakh tonnes [8 percent of the total trade] in 1981 and by 1986 it was only 5.9 lakh tonnes [11 percent of the total trade].

TRAFFIC HANDLED AT COCHIN PORT
Table 3.5. [Bulk and Break-Bulk cargo]   [in lakh tonnes]

YEARS	BULK CARGO TRADE	PERCENTAGE TO TOTAL TRADE	BREAK BULK CARGO TRADE	PERCENTAGE TO TOTAL TRADE
1974	29.65	80	7.56	20
1975	41.57	86	6.56	14
1976	36.62	86	5.96	14
1977	41.71	88	5.96	13
1978	44.92	87	6.82	13
1979	47.12	86	7.58	14
1980	46.03	84	8.61	16
1981	48.28	92	4.05	8
1982	49.69	90	5.32	10
1983	51.83	91	5.27	9
1984	44.26	88	5.78	11
1985	34.62	85	6.12	15
1986	46.88	89	5.90	11

Source: Administration Reports Cochin Port, relevant years.

Having examined the performance of the export and import traffic through Cochin port; it is interesting to look into the commodity composition of the traffic .For the details of the

composition of traffic through Cochin Port we may have to look into the main components of trade [see table 3.6]. The major item of trade through Cochin is the oil, and even in oil trade, the major part is import trade of oil, then comes the export trade of oil. In 1971, 35.7 lakh tonnes [74 percent of the total trade] of total oil trade [export and import trade together] was carried out through Cochin port and by 1986 it has increased up to 38.63 lakh tonnes [73 percent of the total trade]. In the case of export of oil, the trade has declined from 9.62 lakh tonnes to 3.99 lakh tonnes and the import of oil trade has increased from 26.08 lakh tonnes to 34.64 lakh tonnes in the period of analysis. Another major part of the total trade through Cochin port is the fertilizer trade. The fertilizer trade through the port has increased from 2.61 lakh tonnes [7.57 percent of the total import trade] in 1971 to 7.71 lakh tonnes [16.91 lakh tonnes of the total import trade] in 1986.

The oil and fertilizer(bulk cargo) trade together through Cochin Port in 1971 was 79 percent of the total trade and by 1986 it has increased up to 88 percent of the total trade. That is, the general cargo trade(total trade less oil and fertilizer trade) of the port over the years has been showing a declining trend The general cargo trade through was 10.09 lakh tonnes [20 percent of the total trade] in 1971 and by 1986 it declined to 6.44 lakh tonnes [12 percent of the total trade]. If this trend continues the future of Cochin port in the case of general cargo trade is in danger. The main reason for the decline in the general cargo trade is the diversion of this trade to other new emerging major ports like Tuticorin and New-Mangalore(see table 4.8).

The graph 3.3 gives the trends of main components of trade through Cochin port with 1970/71 as the base year. From the graph we can see that the oil and fertilizer trade together shows an increasing trend and it is above all other components of trade. The traffic trends of oil, fertilizer, total trade less oil and fertilizer and total trade(in lakh tonnes) is given in graph 3.4. From the graph it is clear that the oil trade holds a major portion of trade. From graph 3.5 is it clear that the general cargo trade, that is the total trade less oil and fertilizer trade shows a steep declining trend and the container trade, which started only in 1974 slowly picking up after 1979 and steadily increasing. The graph 3.6 gives the index(1974=100) of containerised traffic through Cochin port.

We have also looked into the seasonal fluctuations in output trade of Cochin port. From the monthly output of trade through Cochin port, we have calculated seasonal indices(quarterly) by grouping the output for the months of [January, February, March], [April, May, September], [June, July and August] and [October, November and December] as four quarters. The logic behind this kind of a grouping is the monsoon and non-monsoon months. The trends in output in these quarters(as index numbers) is given in the graphs 3.7 to 3.11.

Table.3.6.   MAIN COMPONENTS OF TRADE THROUGH COCHIN PORT
[in lakh tonnes]

YEAR [1]	TOTAL TRADE [2]	EXP. TRADE [3]	IMP. TRADE [4]	OIL TRADE		FERT TRADE [7]	OIL & FERT [8]	GEN. TRADE [2]-[8] [9]	CONT. TRADE [10]
				EXP. [5	IMP. [6]				
1971	48.4	13.92	34.47	9.62	26.08	2.61	38.31	10.09	0.00
1972	46.9	11.78	35.16	7.22	26.69	2.37	36.28	10.62	0.00
1973	42.01	10.87	31.15	5.97	23.66	1.81	31.44	10.57	0.00
1974	37.00	8.45	28.75	3.27	21.74	2.14	27.15	10.05	0.03
1975	48.13	12.23	35.9	8.01	27.39	2.92	38.32	9.81	0.23
1976	42.58	9.37	33.21	5.66	23.07	2.80	31.53	11.05	0.27
1977	47.67	11.97	35.70	7.56	26.95	3.36	37.87	9.80	0.30
1978	51.74	12.49	39.25	8.27	29.86	5.00	43.13	8.61	0.21
1979	54.70	12.41	42.29	9.02	29.40	6.68	45.10	9.60	0.35
1980	54.64	11.08	43.56	6.86	31.81	6.84	45.51	9.13	1.16
1981	52.33	11.21	41.12	8.23	31.41	6.63	46.27	6.06	1.38
1982	55.01	12.98	42.03	9.76	32.02	5.34	47.12	7.89	1.47
1983	57.10	12.39	44.71	9.04	33.95	5.45	48.44	8.66	1.64
1984	50.04	9.09	41.02	5.63	31.12	5.14	41.89	8.15	1.74
1985	40.74	3.98	36.77	0.57	25.54	8.01	34.12	6.62	1.87
1986	52.78	7.19	45.59	3.99	34.64	7.71	46.34	6.44	2.21

Source:Administration Reports Cochin Port, relevant years.
[8] is the sum of [5], [6] and [7].
[9] is the total trade less oil and fertilizer trade,
[10] is the containerized trade carried out through Cochin port.

The graph 3.7 shows that in the first quarter, that is January, February and March the trend in output over the years is giving a fluctuating picture.   In the years of 1974, 1976, and 1984 the output had shown a downward trend. For the quarter April, May and September the downward trend includes 1974, 1976, 1981, 1983 and 1985. For the quarter June, July and August drastic fluctuations occour

GRAPH.3.3 TRAFFIC TRENDS IN COCHIN PORT

INDEX

□ OIL & FERT TRADE   + TTL TRADE   ◇ OIL TRADE
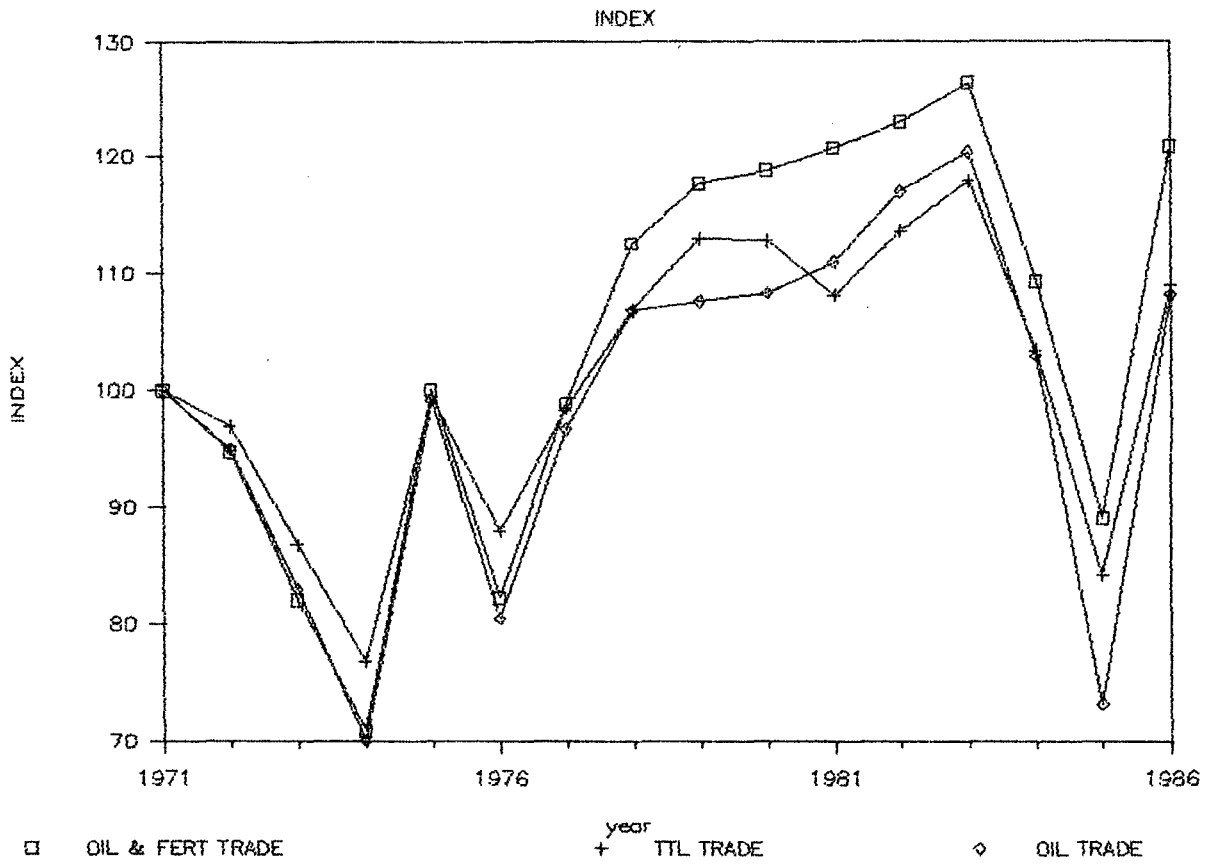
GRAPH. 3.4 TRAFFIC TRENDS IN COCHIN PORT

in lakh tonnes

□ TOTAL TRADE   + fert trade   ◇ oil trade   △ ttl—(fert&oil)

57
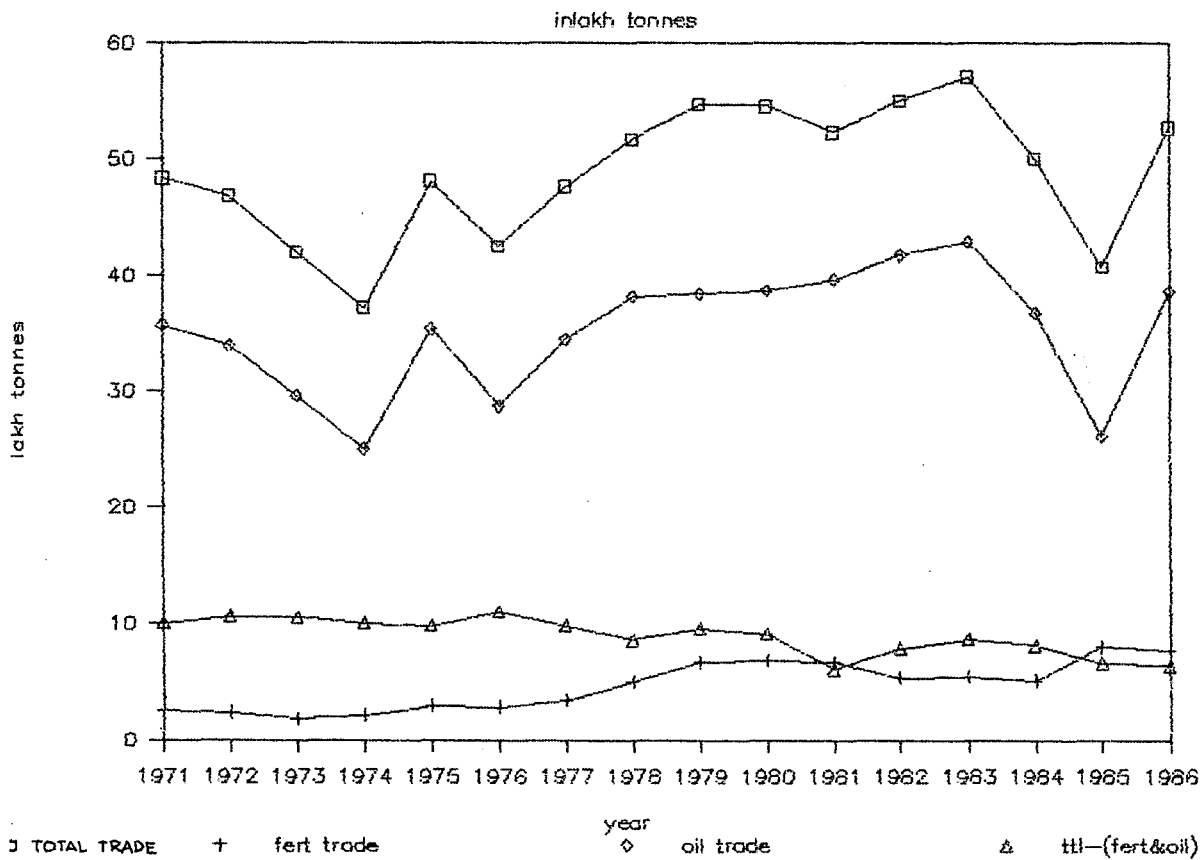
GRAPH. 3.5. TRAFFIC TRENDS IN COCHIN PORT

inlakh tonnes

□   ttl trade—(oil+frt)   +   cont output
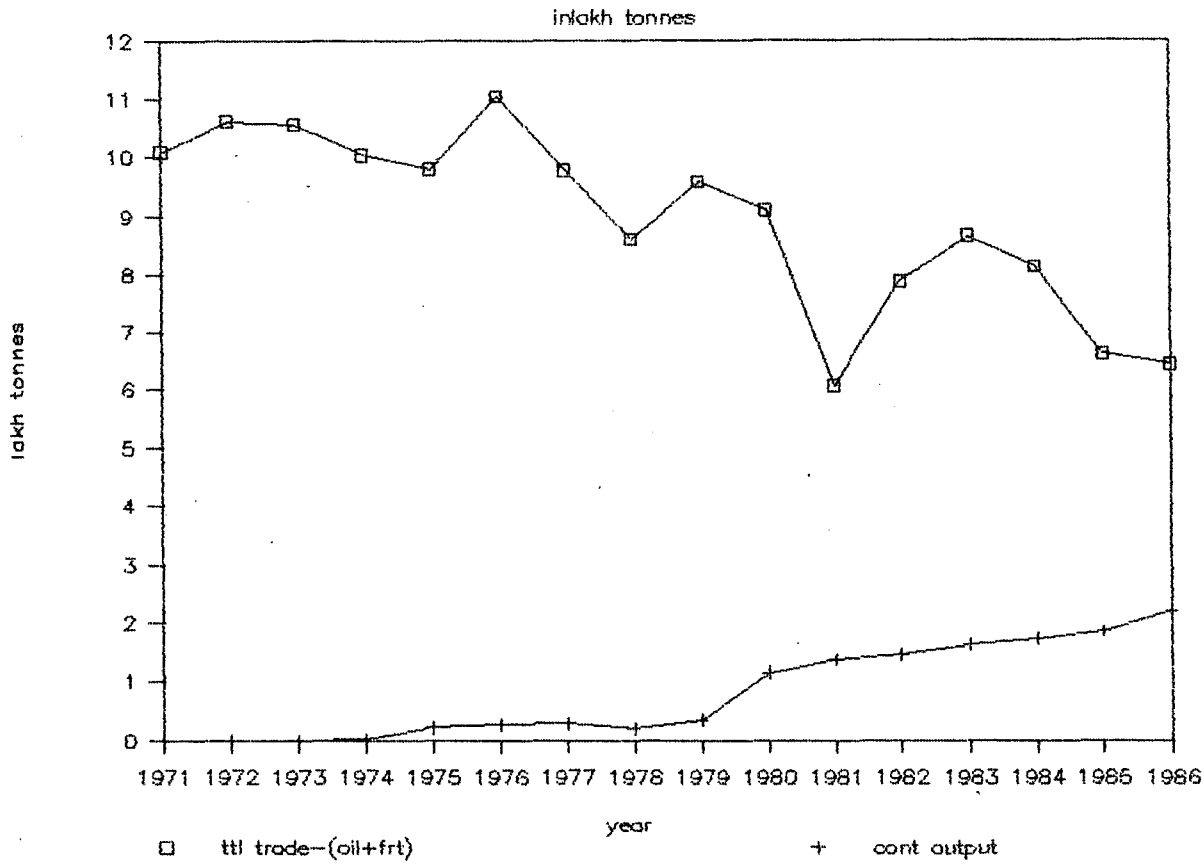
GRAPH. 3.6. TRAFFIC TRENDS IN COCHIN PORT

INDEX 1974=100

+   CONTAINERISED OPT
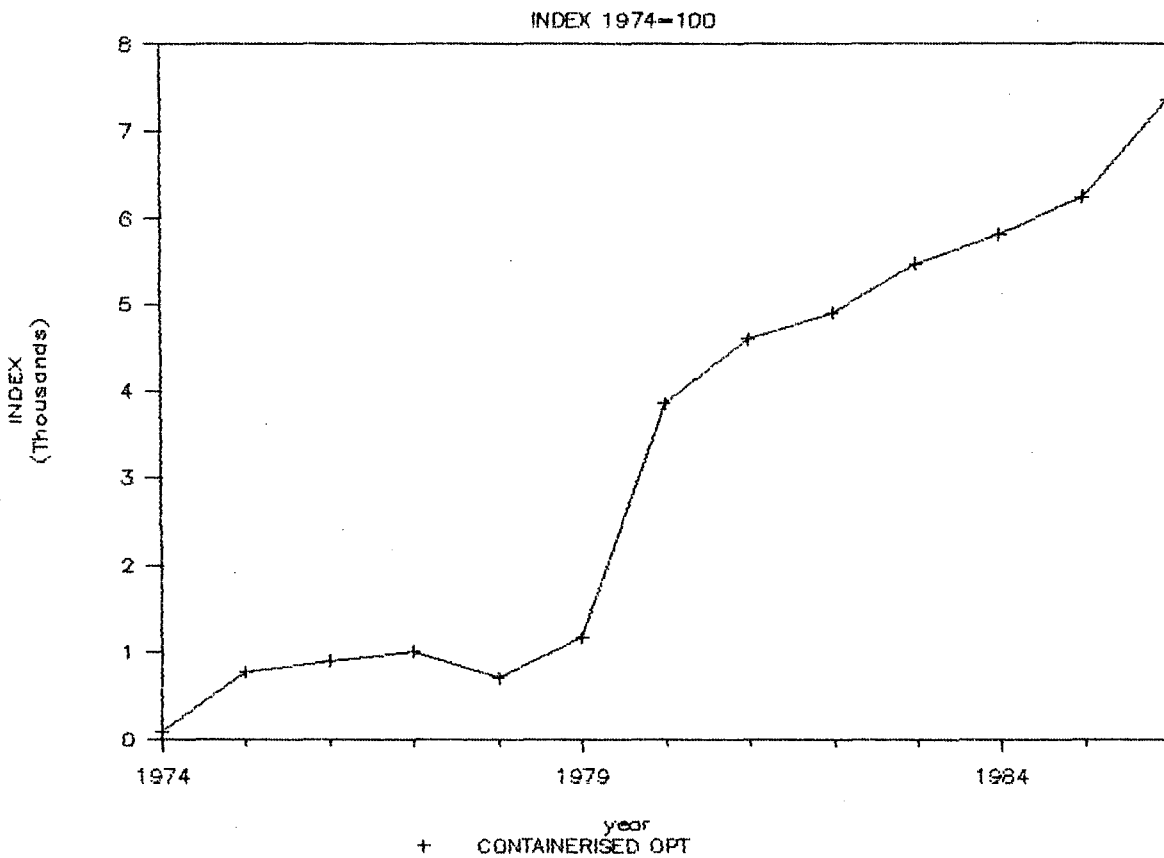
GRAPH-3.7 QUARTERLY OUTPUT AT COCHIN PORT

INDEX'S

YEAR

□ JAN.FEB.MAR.
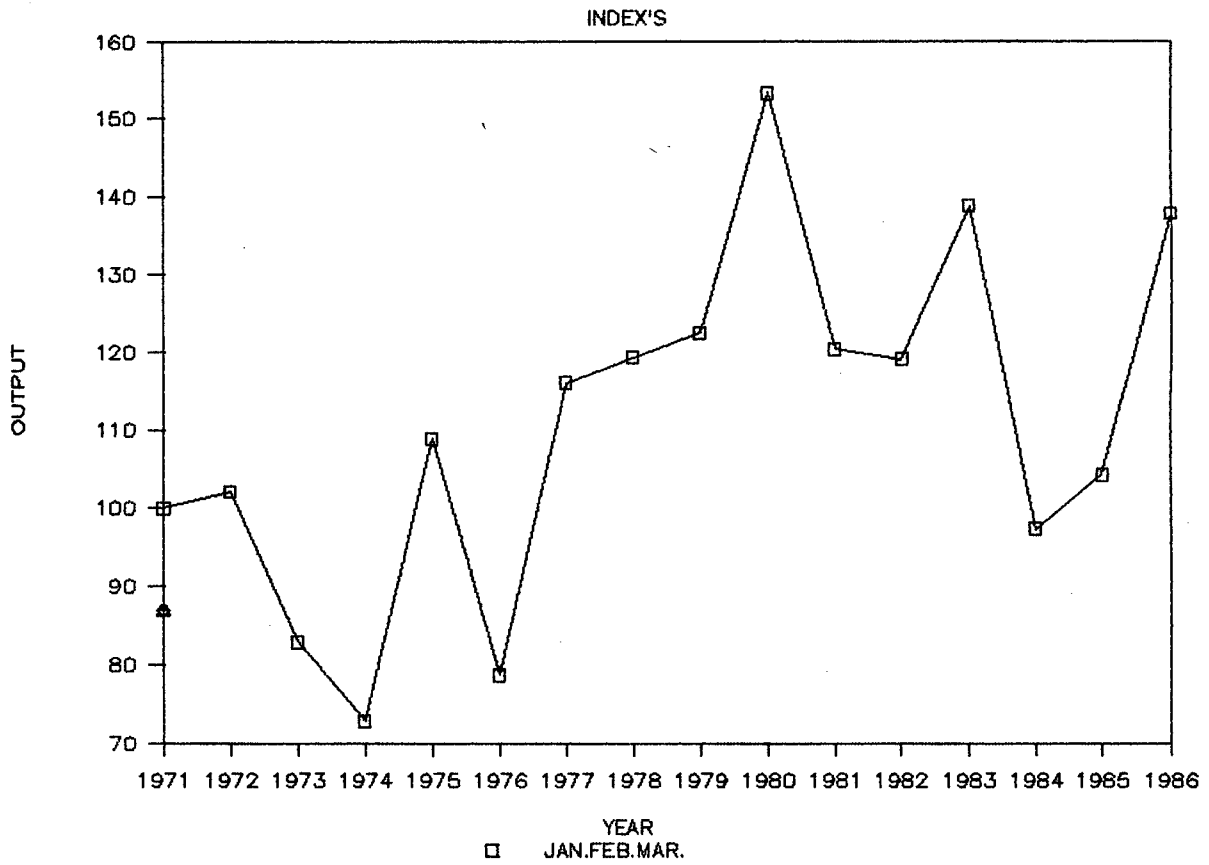
GRAPH-3.8 QUARTERLY OUTPUT AT COCHIN PORT

INDEX'S

YEAR

□ APR.MAY.SEPT.
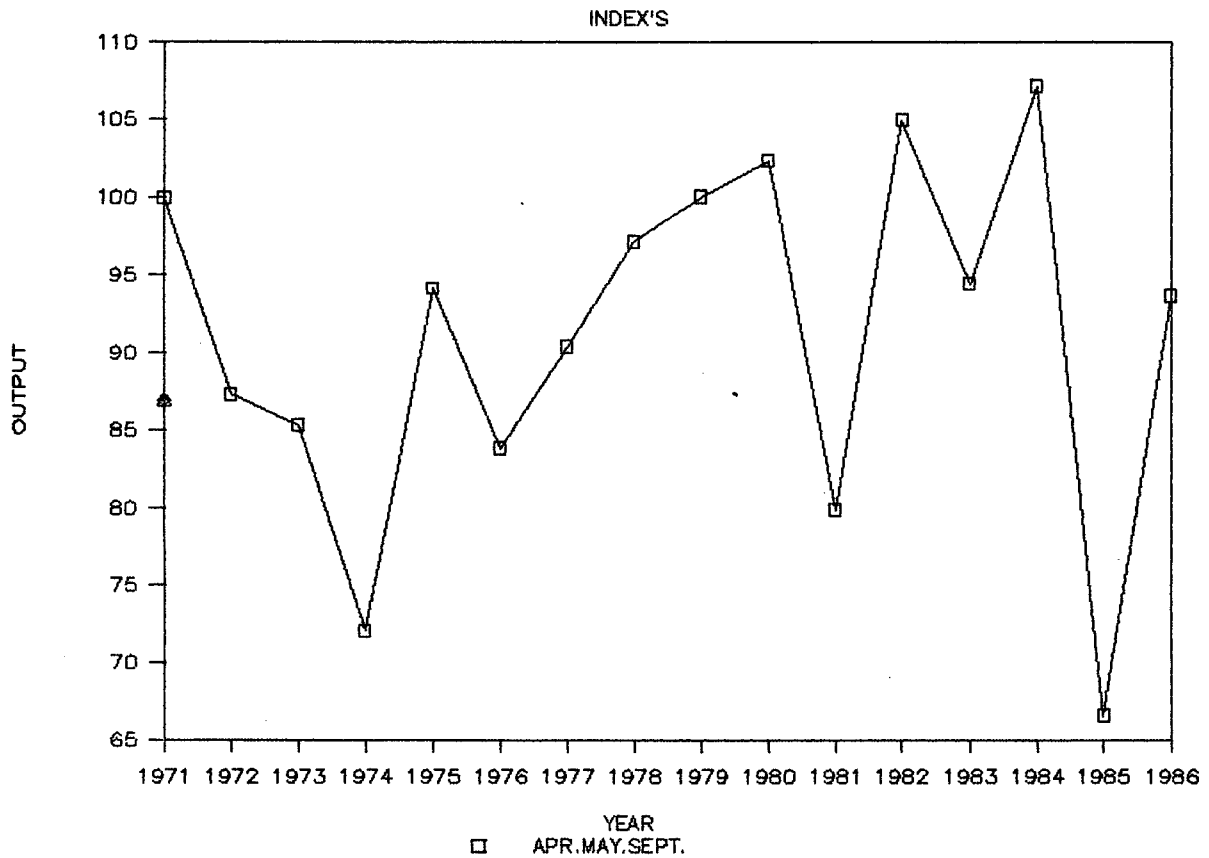
GRAPH-3.9 QUARTERLY OUTPUT AT COCHIN PORT

INDEX'S

YEAR

☐ JU,JL,AG)
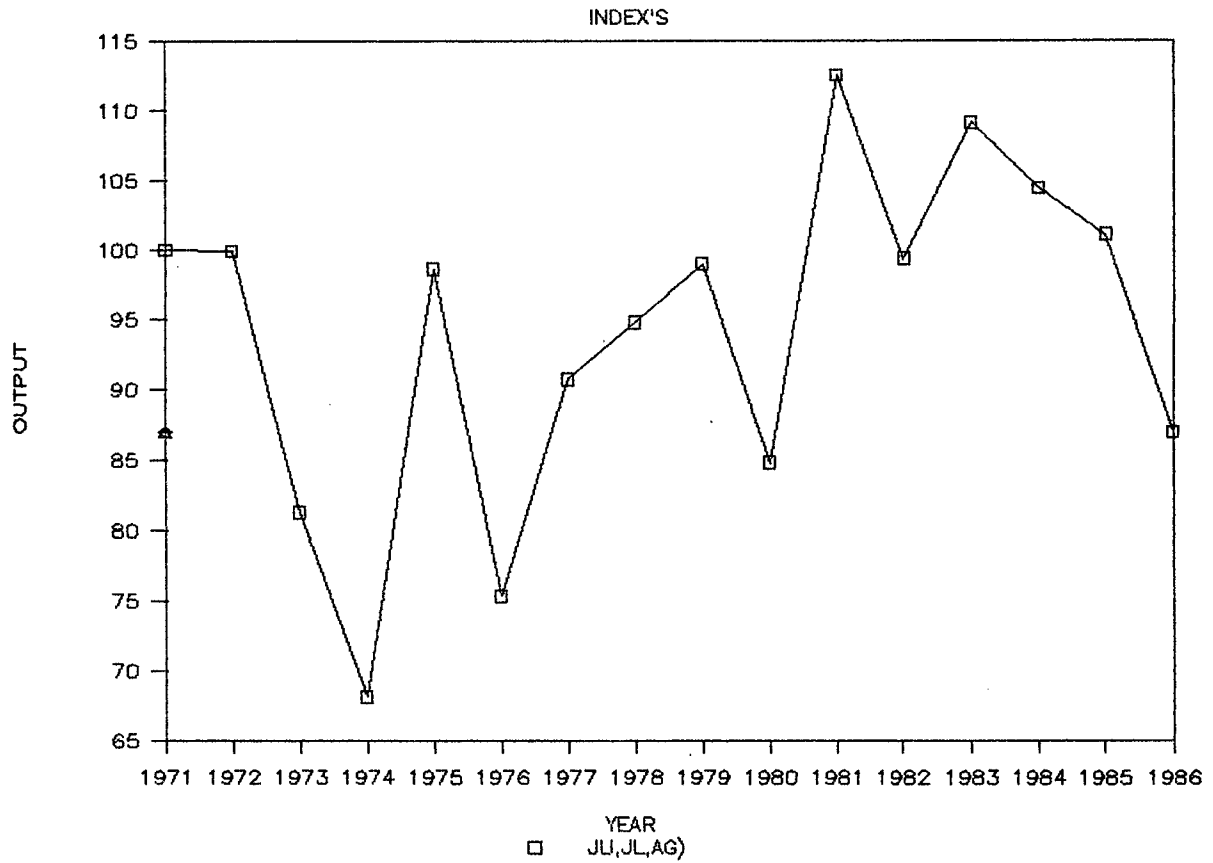
GRAPH-3.10 QUARTERLY OUTPUT AT COCHIN PORT

INDEX'S

YEAR

☐ OCT.NOV.DEC.

60
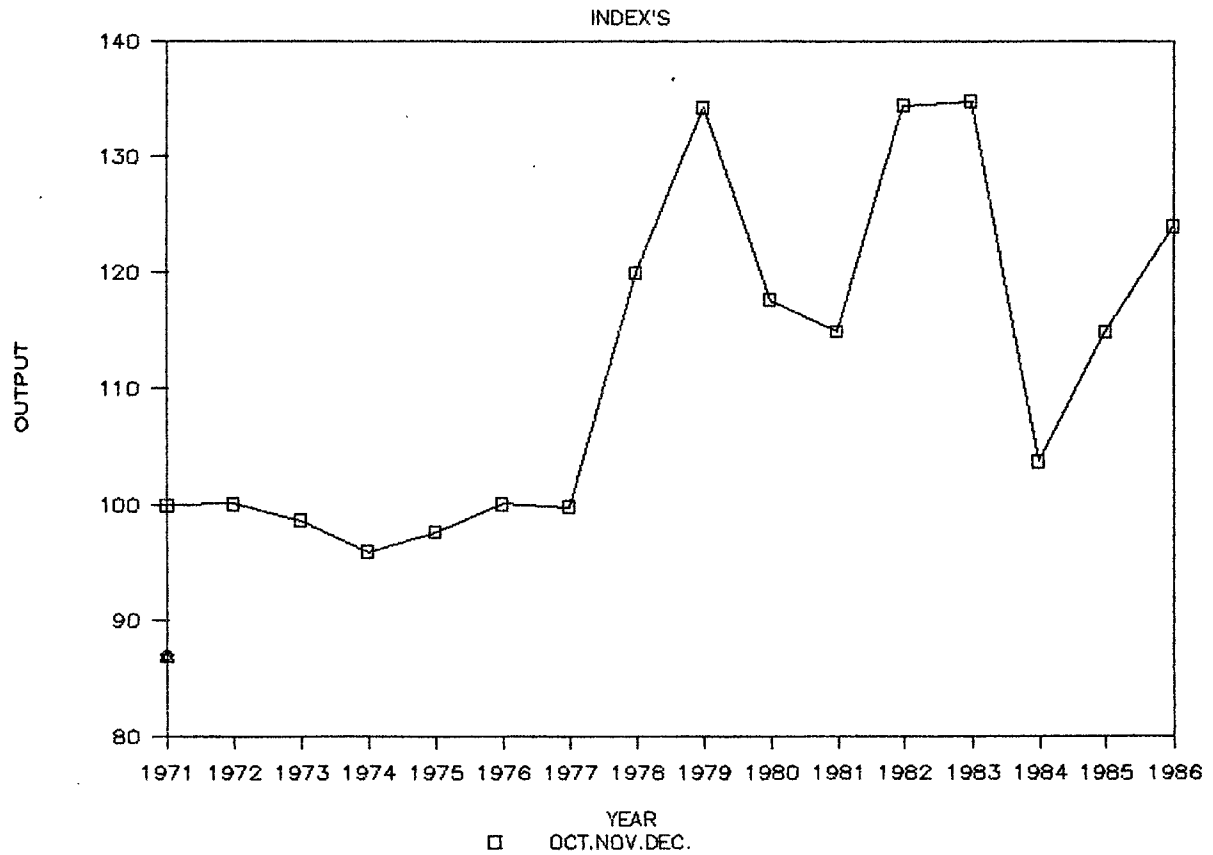
GRAPH_3.11 MONSOON& NON—MONSOON OUTPUT TRENDS

INDEX'S

□   MONSOOM MONTHS   +   NON—MONSOON MONTHS

61
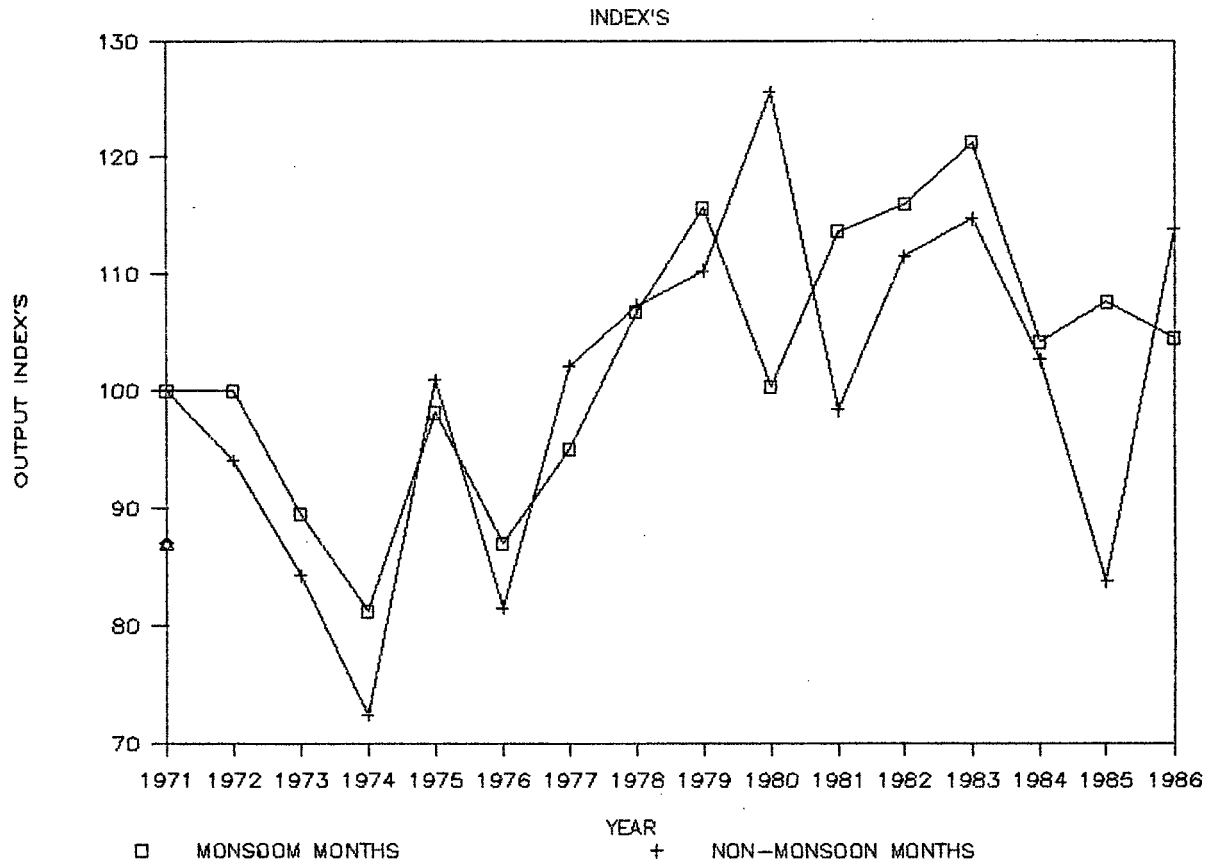
in the initial years. For the quarter Octorber, November, and December the initial years the trend is steady and in the eighties it started fluctuating.

The graph 3.11. gives the fluctuations of the monsoon and non-monsoon trends in output. The trend of the monsoon output over the years has shown an increasing trend compared to the non-monsoon output trend. During the monsoons when all the ports in the West coast operates with difficulty, at Cochin vessels can anchor in the inner waters and work. This is one of the important advantages of Cochin port.

In the case of containerized trade, there was an increasing trend in output. That is, the container trade through Cochin port has increased from Ø.Ø3 lakh tonnes [Ø.3Ø percent of the general cargo trade] in 1974 to 2.21 lakh tonnes [34 percent of the general cargo trade] in 1986. The important point is that almost 8Ø per cent of the General cargo trade is containerised trade. Table 3.7. gives the details of the important commodities containerized through Cochin Port. Containerised trade through the port has increased from 2,728 tones to 2,2Ø,978 tonnes over the period of analysis. Of this total containerised trade a major portion is export trade, in 1974 the export trade was 2,727 tonnes [percentage of the total containerized trade] and by 1986 it has increased upto 1,78,462 tonnes [percentage of the total containerised trade].

Table 3.7. CONTAINER TRAFFIC HANDLED AT COCHIN PORT (tonnes).

YEAR	EXPORT TRADE	IMPORT TRADE	TOTAL TRADE
1974	2227	1.2	2228
1975	14440	8499	22939
1976	25059	2305	27364
1977	27808	2617	30425
1978	17367	3984	21351
1979	30985	3037	34822
1980	109599	6818	116417
1981	128835	9655	136490
1982	130788	16263	147051
1983	149976	13944	163920
1984	159583	14221	173804
1985	164511	22698	187209
1986	178462	42516	220978

Source: Administrative Reports, Cochin Port, relevant years.

If we look at the commoditywise details of the containerized output through Cochin Port we can observe that most of the important export items over the years has increased, in the case of cashew kernals the trade has increased from 1,105 tonnes to 28,412 tonnes, coir products has increased from 731 tonnes to 22,182 tonnes, pepper from 529 tonnes to 20,137 tonnes, fish from 107 tonnes to 25,806 tonnes, coffee from 36 tonnes to 24,435 tonnes, over the period 1974 to 1986. The turmeric trade has increased from 367 tonnes to 1,334 tonnes and the chemical trade has increased from 1,073 tonnes to 5,719 tonnes over the period 1976 to 1986.

Table 3.8. COMMODITYWISE CONTAINER TRAFFIC HANDLED AT COCHIN PORT
[in tonnes]

YEAR	CASH-EW	COIR	PEPP-ER	FISH	TEA	COFF-EE	TURM-ERIC	CHEM-ICALS	MISC-ELLA-NEOUS	TOTAL
1974	1105	–	529	107	195	36	nil	nil	690	2728
1975	5427	731	1504	2079	1764	1496	nil	nil	1439	22939
1976	10598	1824	1152	3525	2240	3359	367	1073	921	27364
1977	3587	2890	366	6409	9628	1300	202	1558	1868	30425
1978	446	712	555	5320	4633	1997	580	1419	1705	21351
1979	3020	1904	140	7433	4552	1432	212	668	11624	34822
1980	10443	8846	1263	15591	27668	4713	424	865	39786	116417
1981	8052	1312	1179	23578	22184	8511	812	1797	49597	138490
1982	5955	22527	2265	24404	13721	17311	526	2151	42059	147051
1983	14592	22087	3151	27155	16675	21973	751	4803	35773	163920
1984	23924	20951	8117	26125	12466	15935	498	4999	37123	173804
1985	26629	22757	4172	25523	18292	17452	995	4496	29463	187209
1986	28412	22182	20137	25806	7388	24435	1334	5719	29225	220978

Source: Administration Reports Cochin Port, relevant years.

In the case of tea trade, the output has increased from 195 tonnes in 1974 to 27,668 tonnes in 1980 and then it started declining and by 1986 it has come down to 7,388 tonnes. The miscellaneous containerized trade has increased from 690 tonnes to 29,225 tonnes over the period 1974 to 1986. The reason for a sudden decline in tea trade at Cochin since 1980s is due to the shift in the place of auction of tea from Cochin to Coimbatore.

Growth Rates in Output

In this section we are calculating the growth rate of output through Cochin port over the period of analysis. We are following the regression method and the average annual growth rate method. We have fitted a semi logarithmic regression equation to find out the growth rate of total output over the period 1971 to 1986, the growth rate of output over the period is only + 1.10 per cent [Std Err of Coef. = 0.0062 and T ratio = 1.7862].

As the trends in growth rate shows fluctuations over the period, we have to estimate growth rates separately for the two periods; 1972-1979 and 1980-86. The cut off point has been selected mainly because the major technological changes were introduced only in the later period. The usual method is to estimate linear regressions for the two periods separately, which 'assumes' that there is a discontinuity in the growth rates between the two periods. Boyce's(1986) recent empirical study shows that the assumption of discontinuity can lead to misleading growth rates without the above assumption[1]. He also suggests a new method of estimating the growth rates. Following Boyce, discontinuous growth rate estimate for the two sub-periods can be calculated as follows.

$$\ln Y = a_1 d_1 + a_2 d_2 + (b_1 d_1 + b_2 d_2)t + u \text{ ------------(i)}$$

where $d_1 = 1$ for 1971 to 1979

$\qquad = 0$ otherwise.

$\quad d_2 = 1$ for 1980 to 1986

$\qquad = 0$ otherwise.

The discontinuity is eliminated by a linearization

at the break point k,

$a_1 + b_1 k = a_2 + b_2 k$

From the restriction

$a_2 = a_1 + b_1 k - b_2 k$

$d_2 = 1 - d_1$ ----------(ii)

Substituting (ii) in (i)

$$\ln Y = a_1 d_1 + (a_1 + b_1 k - b_2 k)d_2 + (b_1 + b_2 d_2)t + u$$

$$= a_1 d_1 + a_1(1 - d_1) + b_1(d_1 t + d_2 k) + b_2(d_2 t - d_2 k) + u$$

i.e., $\ln Y = a_1 + b_1(d_1 t + d_2 k) + b_2(d_2 t - d_2 k) + u$

This is called the Kinked exponential model. This is used for the

period wise estimation of the growth rates. Obviously, b_1 is the

first period growth rate and b_2, the second period growth rate[2].

In our analysis, k the break point is taken as the mid

period, that is 8.5. In the first period that is for the period

1971 to 1979 the output growth rate was + 2.6773 percent [Std Err

of Coef.= 0.011405 and T ratio =2.3474] and in the second period

that is for the period 1980 to 1986 the output growth rate was-

1.197 per cent [Std Err of Coef. =0.0154 and T ratio -0.7757]. In

the case of the annual growth rates, there is a little bit of

difference what we observed from the above results [see table

3.9]. From the above analysis we can conclude that growth of

output in the second period was almost negligible.

Table 3.9. TRENDS IN OUTPUT AT COCHIN PORT

YEAR	OUTPUT IN LAKH TONNES	OUTPUT INDEX	ANNUAL GROWTH RATE
1971	48.4	100	--
1972	47.0	97	-0.29
1973	42.1	87	-0.11
1974	37.3	77	-0.121
1975	48.1	99	+0.254
1976	42.6	88	-0.121
1977	47.7	99	+0.113
1978	51.8	107	+0.082
1979	54.7	113	+0.054
1980	54.7	113	+0.000
1981	52.3	108	-0.045
1982	54.0	112	+0.032
1983	57.1	118	+0.056
1984	50.0	103	-0.103
1985	40.8	84	-0.203
1986	52.8	109	+0.258

Average Growth Rate(1972-'80)== +1.4%

Average Growth Rate(1981-'86)==-0.6%

Average Growth Rate(1972-'86)==+0.6%

Source: Calculated from given data from CPT.

From table 3.9., the average growth rate of output over the period(1972-86) is only + 0.6 per cent [where as in the above regression analysis it was little higher + 1.1 per cent], also for the period 1972 to 1980 the growth rate is given by + 1.4 per cent [+2.677 per cent in the regression analysis], and for the period 1981 to 1986, the average growth rate is given by -0.60 per cent [-1.197 per cent in the regression analysis]. From the above results it is evident that the output at Cochin port was growing in the first period, even though in a very small percentage, in the second period the growth rate in output was negligible. The decline in output may be due to a host of factors, like the lack of demand in the international market for the exports, the conditions of the port in terms of labour etc.

3.2. Growth of Capital Input at Cochin Port:

In order to calculate the growth of capital input, we have to generate a physical capital series in value terms from the book value of the capital assets given in the administration reports of Cochin port. An examination of these assets show that they include land, building, cranes, and other cargo handling equipments and vehicles. For estimating the physical 'Capital Stock' of Cochin port in constant prices, we have grouped all the capital inputs into different categories namely 'Construction' and 'Plant and Machinery'. The 'Construction' group includes land, building and other structures, wharves, roads and boundaries, docks, sea walls, piers and navigational aids etc., and the 'Plant and Machinery' group include cranes and vehicles, plant and machinery, floating crafts, railway and rolling stock, etc.

The Capital assets at Cochin Port are of different vintages, as the port started functioning in 1939 with a wharf and other facilities. To measure the Capital Stock of Cochin Port for the period 1970/71 to 1985/86 [financial year] with 1970/71 as the base year, we have to take into consideration the age structure of assets that the port has acquired since 1939. As the time series value of these assets were not available we have to depend on the price indices of the two groups of assets namely 'construction' and 'plant and machinery'. So in order to construct a capital stock series for Cochin port, we need first to construct a price index to deflate the value of the capital assets, which is in current prices. We have the capital assets of Cochin port at current prices only for the period 1970/71 to 1985/86 [as stated

earlier, the new system of accounting started at Cochin port in the year 1969/70].

As the port started its functions since 1939, we collected the price indices of 'Construction' and 'Machinery and Transport Equipment' from the year 1939 to 1986 from different sources. For this we mainly depend on four sources, (1) George Rosen [1939-1951], (2) Goldar[1951-1973], (3) Chandok series[1972-1978] and(4) RBI's Report on Currency and Finance[1978/79-1985/86]. We have taken the price indices for 'construction', for the period 1939 to 1951 from George Rosen (1959)[3], with 1939 as the base year and for the period 1950/51 to 1972/73, from Goldar(1986)[4], with base as 1960/61. For extending these price indices up to 1986 we have used the price indices of wood, iron and steel and cement available in the Chandok's Wholesale Price Indices[5] series and RBI's Currency and Finance[6] to construct the composit price index, as a proxy for 'Construction' price index and thus constructed a price index from 1972/73 to 1985/86. Finally a price index for 'Construction' is obtained with base as 1970/71 by splicing the above price indices (first index 1939 = 100, and 1960/61 = 100) in 1970/71 as the base.

In the case of machinery, the price indices for the period 1939 to 1951 is collected from Goldar(1986), and for the period 1950/51 onwards we have two price indices for machinery, one that of price indices of 'imported machinery', and the other the price indices of the 'domestically produced machinary'. As we know the imported machinery in ports in the earlier period will be cranes, vehicles, etc., we have collected the price indices of imported

machinery also from Goldar, for the period 1950/51 to 1972/73 and extended the series upto 1983 by taking price indices of imported machinery from RBI's Report on Currency and Finance. The price index of domestically produced machinery is collected from Chandok's Wholesale Price indices series, for extending it upto 1986 by collecting indices from RBI's Report on Currency and finance. Finally, a composite price index for machinery both for domestically produced and imported, for the period 1939 to 1986 is constructed with 1970/71 as the base.

As we have already mentioned, for constructing a price index of capital in constant prices we arranged the capital assets into two main groups such as construction, plant and machinery. A detailed view of the capital assets(here we have grouped the assets into three main groups) can be seen in the table 3.10. where we have given the division as construction, plant and machinery, and transport equipment.

As seen from the table 3.10.the 'construction' assets did not show any significant growth in capital assets, it was Rs.304.5 lakhs in 1970/71 and by 1985/86 it increased up to only Rs.496 lakhs. Transport Equipment assets has increased from Rs.70.33 lakhs to Rs.95 lakhs and the assets on Plant and Machinery has steadily increased from Rs.421 lakhs to Rs.1212 lakhs over the period of analysis. The total capital assets in Cochin Port has increased from Rs.795 lakhs in 1970/71 to Rs.1801 lakhs by 1986.

Table 3.1Ø.   COMPONENTS OF CAPITAL ASSETS AT COCHIN PORT
[in   current prices & in rupees lakhs]

YEAR	CONSTRUCTION ASSETS	PLANT AND MACHINERY ASSETS	TRANSPORT EQUIPMENT ASSETS	TOTAL ASSETS
1971	3Ø4.5Ø	421.Ø6	7Ø.33	795.89
1972	31Ø.44	457.65	7Ø.33	838.42
1973	313.39	457.65	7Ø.99	842.Ø3
1974	34Ø.47	457.94	7Ø.98	869.39
1975	343.78	457.94	7Ø.99	872.71
1976	368.99	458.Ø3	93.83	92Ø.85
1977	417.39	458.6Ø	94.36	97Ø.35
1978	425.51	993.74	93.89	1513.14
1979	45Ø.13	994.41	95.Ø6	1539.6Ø
198Ø	496.56	1212.34	95.Ø6	18Ø3.96
1981	495.82	1212.21	95.Ø6	18Ø3.Ø9
1982	496.87	12Ø9.29	95.Ø6	18Ø1.22
1983	496.ØØ	121Ø.ØØ	95.ØØ	18Ø1.ØØ
1984	496.ØØ	121Ø.ØØ	95.ØØ	18Ø1.ØØ
1985	496.ØØ	121Ø.ØØ	95.ØØ	18Ø1.ØØ
1986	496.ØØ	121Ø.ØØ	95.ØØ	18Ø1.ØØ

Source: Administration Reports, Cochin Port, relevant years.

In order to construct an aggregate capital price series we combined the two price indices, that of 'construction' and 'machinery and transport equipment' with base as 197Ø/71, with proper weights. The weights have been calculated using the shares of 'construction' and 'machinery and transport equipment' in total assets in the bench mark year(197Ø/71). The 'construction' indices were given the weight of Ø.3825, and 'machinery and transport equipment' were given the weight of Ø.6175. The weights

have been calculated with respect to the share of these capital
inputs in the total capital stock for the period 1970/71. Thus we
have the capital asset price indices in 1970/71 prices. Over the
period it has increased from 100 in 1970/71 to 376 in 1985/86.

The capital stock of Cochin port at 1970/71 prices is
constructed for the base year 1970 by dividing the current
capital assets by the average of the price indices from 1939 to
1970 (the average price indices for 32 years is 42.01). The logic
behind this step is that, since the port must have acquired
different equipments at different prices during different points
of time, the price of all these machines etc. is impossible to
collect. So, in order to obtain a bench mark year(1970/71),
capital stock, we have taken the average of the price indices
over time (32 years), constructed for the period 1939-1970, and
divided the bench mark year's capital assets (gross) with this
average. The assumption we are making here is that, this is the
stock of capital the port has acquired over the period 1939-1970.
So for the year 1970, the stock of capital in 1970/71 prices is
calculated as Rs.1298.74 lakhs. For each succeeding years,
following the 'Perpetual Inventory Method' [PIM], we generated a
'Capital Stock' series by adding the 'deflated sum of additional
investment'$(B_t - B_{t-1})$, and the 'annual depreciation'(D_t) in
constant prices (at 1970/71 prices), to the earlier stock of
capital.
The equation we followed for estimating the capital stock is given
below,

$$K_t = K_0 + \sum_{t=1}^{n} [((B_t - B_{t-1}) + D_t)/p_t]$$

where K_0 denote the base year(bench mark year) capital stock,

(Bt-Bt-1) is the additional investment (at base year prices), Dt is the annual depreciation and Pt is the price deflator.

Growth Rate of Capital

The Stock of Capital Stock (in 1970-71 prices) have increased from Rs.1298.74 lakhs in 1970 to Rs. 1574.23 lakhs in 1971 and by 1986 it has increased upto Rs.2499.102 lakhs. The 'average annual growth rate' of Capital Stock over the period under study is only 3.1 per cent. In the period 1972 to 1980 the average annual growth rate of Capital Stock is 4.6 per cent and for the period 1981 to 1986 the average growth rate is 0.9 per cent[see table 3.11.]. It shows that in the latter period there was no significant addition to capital stock at Cochin port.

Table 3.11. CAPITAL STOCK AND CAPITAL GROWTH RATE OF COCHIN PORT

YEAR	TOTAL ASSETS	INVEST-MENT	ANNUAL DEPREN.	CAPITAL STOCK	CAPITAL STK.INDX.	CAPT. STK. GRTH.RATE
1970	545.70	--	--	1298.74	---	----
1971	795.89	250.19	25.30	1574.23	100	--
1972	838.42	42.53	25.30	1640.34	104	0.041
1973	842.03	3.61	25.30	1665.93	106	0.015
1974	869.39	27.36	25.30	1708.11	109	0.025
1975	872.71	3.32	25.30	1725.81	110	0.010
1976	920.85	48.14	25.30	1766.23	112	0.023
1977	970.35	49.50	25.30	1806.89	115	0.023
1978	1513.14	542.79	133.20	2174.16	138	0.185
1979	1539.60	26.46	70.40	2221.47	141	0.022
1980	1803.96	264.36	102.67	2373.91	151	0.066
1981	1803.09	-0.87	78.37	2405.81	153	0.013
1982	1801.22	-1.87	59.76	2427.33	154	0.009
1983	1801.00	-0.22	59.70	2447.69	155	0.008
1984	1801.00	0.00	59.66	2466.12	157	0.008
1985	1801.00	0.00	59.61	2483.58	158	0.007
1986	1801.00	0.00	58.34	2499.10	159	0.006

Annual Average Growth Rate of Capital(1972/80)== 4.6 per cent.

Annual Average Growth Rate of Capital(1981/86)==0.9 per cent.

Annual Average Growth Rate of Capital(1972/86)==3.1 per cent.

Source: Calculated from the given data from CPT, relevant years.

We have also estimated the growth in Capital stock using the semi-log regression method [that is, regressing the log value of capital stock against the time variable]. The results obtained are almost similar to the above observed growth rate of capital stock. In this method the growth rate of Capital stock for the period 1971 to 1986 is 3.63 per cent [Std Err of Coef.==0.0030 and T ratio ==11.9450], and for the period 1971 to 1979 the growth rate of capital is estimated as 4.73 per cent [Std Err of Coef.==0.0049 and T ratio ==9.4841], and for the period 1981 to 1986 the growth rate of capital is estimated as 2.0 per cent [Std Err of Coef.==0.0067 and T ratio ==2.9676].

3.3. Growth of Labour input at Cochin Port

The total labour input (total number of labourers including fixed labour and casual labour) of Cochin Port hasn't shown major fluctuations over the period of analysis. In the year 1971 the total labour force was 6462 and it increased upto 7321 in 1981 and by 1986 it declined to 6699. The drastic decline was in the case of casual labour. The labour force which is not permanent and who get work only in rotation declined from 285 in the year 1974 to 10 in 1986. The number of shore labour-directly paid port workers of the port, also has declined from 1625 in the year 1971 to 631 in the year 1985 and by 1986 it increased to 660. The increase in the number of class I,II,III,and IV employees[6] of the port was steady over the period of analysis, their number [fixed labour force] increased from 4837 to 6039 over the period 1971 to 1986. Table 3.12 gives the details.

The graph 3.12 gives the details of the class I,II,III, and IV and shore and casual labours of Cochin port. The graph has been drawn with 1970/71 as the base year. The trends in the class I and II employees was steadily increasing over the period, and the trends in class III and IV employees was also increasing but less than the trend of class I and II. From the graph an important point is to make note of is that the trend in the shore and casual labourers declined over the period.

The separate trends of shore labour and casual labour can be seen from graph 3.13. The base year of the graph is 1974-75. It clearly tells us that the casual labour after the period 1980/81 was declining steadily whereas the decline in the number of shore labour are permanent to some extent- was not that much steady. Also the total number of labourers remained almost the same, with a slight increase after 1980/81.

A detailed picture of the different categories of employees and their wages is given in table 3.13. The number of class I employees has increased from 68 to 151 and the class II from 28 to 59 and their salaries(for both class I and class II) has increased from Rs.12 lakhs to Rs.83 lakhs over the period 1970 to 1985. The number of class III employees has increased from 2617 to 2952 and that of class IV from 4741 to 5829 and their salaries has increased from Rs.162 lakhs to Rs.1064 lakhs. The total salary of all the employees has increased from Rs.206.65 lakhs to Rs.1283 lakhs over the period of analysis.

Table 3.12. LABOUR INPUT OF COCHIN PORT

YEAR	CLASS I,II, III, & IV EMPLOYEES	SHORE LABOUR	CASUAL LABOUR	TOTAL LABOUR
1971	4837	1625	nil	6462
1972	4965	1609	nil	6574
1973	5023	1428	nil	6451
1974	5032	949	285	6266
1975	5111	925	303	6339
1976	5198	874	311	6383
1977	5259	823	313	6395
1978	5557	799	225	6581
1979	5503	782	355	6640
1980	5764	770	284	6818
1981	6215	744	362	7321
1982	6092	728	201	7021
1983	6021	708	172	6901
1984	6183	681	39	6903
1985	6039	631	10	6680
1986	6039	660	-	6699

Source: Administration Reports,Cochin Port, relevant years.

GRAPH.3.12 TRENDS IN EMPLOYMENT AT COCHIN PORT

CATEGORYWISE [INDEX 1971=100]
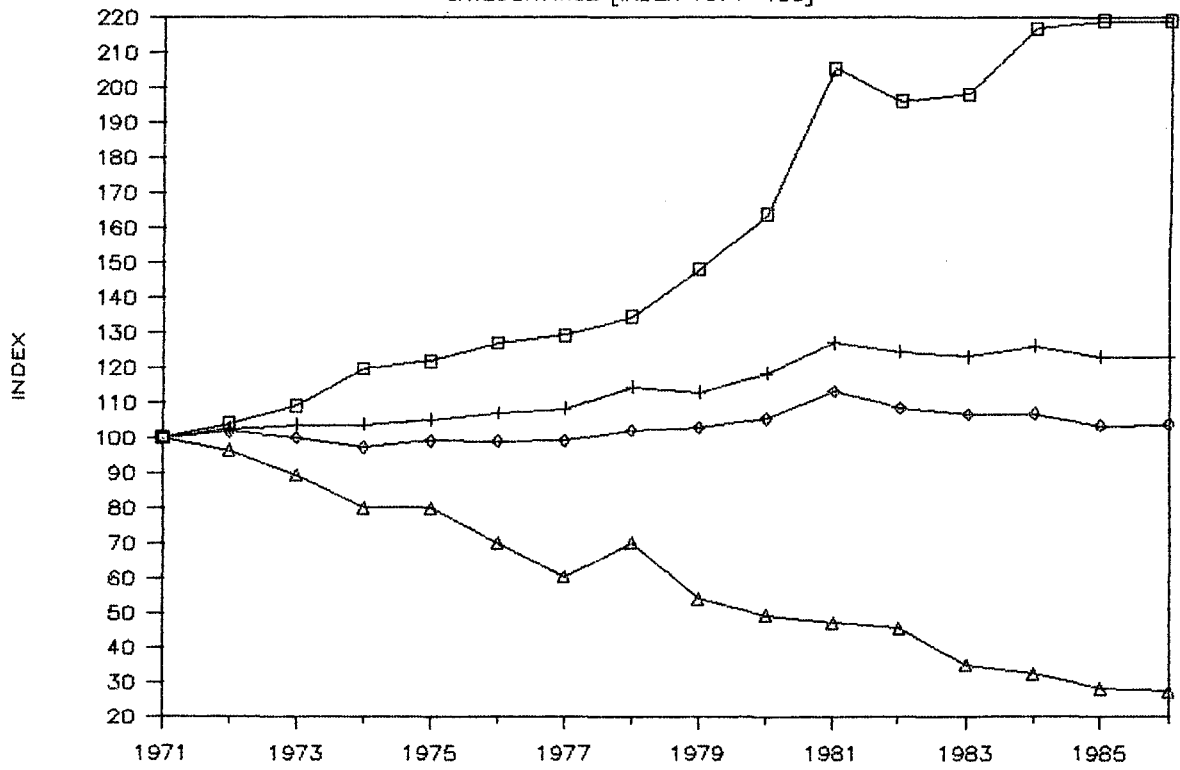
□ TOTAL LABOURERS   +   CLASS 3 & 4   ◇   TTL. WORKER'S   △   SHORE & CASUAL

Table 3.13.   NUMBER AND WAGES OF DIFFERENT CATEGORIES LABOUR

YEAR	CLASS I	CLASS II	WAGES I &II Rs. lakhs	CLASS III	CLASS IV	WAGES III &IV Rs.lakhs	TOTAL LABOUR	TOTAL WAGES Rs.lakhs
1970	68	28	12.00	2617	2124	162	6462	206.65
1971	72	28	12.49	2527	2338	175	6574	221.17
1972	70	35	17.13	2570	2348	186	6451	242.44
1973	75	40	21.77	2122	2795	198	6266	263.70
1974	76	41	24.75	2307	2687	247	6399	326.71
1975	82	40	24.10	2346	2730	341	6383	430.37
1976	82	42	26.40	2435	2700	330	6395	411.77
1977	89	40	26.53	2478	2950	370	6581	480.67
1978	108	34	34.28	2508	2853	513	6640	622.49
1979	113	44	44.20	2776	2831	539	6818	662.09
1980	143	54	49.72	2908	3110	653	7321	787.94
1981	134	54	50.03	2888	3016	649	7021	798.69
1982	134	56	60.01	2862	2969	892	6901	1059.75
1983	141	67	62.46	2965	3010	762	6903	931.52
1984	151	59	80.00	2952	2877	1014	6680	1232.00
1985	151	59	83.00	2952	2877	1064	6699	1283.00

Source:Administration Reports, Cochin Port, relevent years.

Table 3.14. gives the details of the employment and earnings of category A & B workers (the category A & B workers is the term used in the Cochin Port administration report, they are the same as the shore and casual labour as mentioned above) in Cochin Port. The effective strength of workers belonging to category A, in 1973/74 was 350 and that of category B, was 451. In the case of category A workers by 1979 the effective strength

Table3.14 EMPLOYMENT AND EARNINGS OF WORKERS IN COCHIN PORT

CATEGORY A

YEAR	STRENGTH OF WORKERS AVE. DURING THE YEAR	AVE.EARNING PER MONTH PER WORKER [Rupees]	AVE. EMPT. OF WORKERS PER MONTH [Shifts]	NO. OF WORKING DAYS	EFFECTIVE STRENTH OF WORKERS	NO. OF MAN SHIFTS WORKED	MAN SHIFTS LOST IN TERMS OF	
							WORKERS	MAN SHIFTS
1974	438	404	24	345	350	100950	88	30333
1975	508	598	20	345	415	99577	93	31993
1976	488	792	21	350	403	103174	85	29903
1977	465	712	18	346	382	84385	83	28884
1978	447	771	22	347	356	91929	91	31832
1979	491	905	23	350	387	104894	104	36674

CATEGORY B

1974	518	213	6	356	451	33475	67	23981
1975	430	299	4	360	367	17923	63	22634
1976	412	440	6	358	360	25467	52	18901
'1977	384	390	4	358	338	17065	46	16455
1978	364	486	7	358	319	27795	45	16253
1979	299	509	6	358	262	18552	37	13356

CATEGORY A & B

1974	956	296	14	351	801	134425	155	54314
1975	938	457	13	351	782	117500	156	54627
1976	900	626	14	355	763	128641	137	48804
1977	849	561	12	352	720	101450	129	45339
1978	811	636	15	352	675	119724	136	48095
1979	790	745	16	354	649	123446	141	50030
1980	776	918	18	343	647	138569	129	44267
1981	757	990	14	351	626	103798	131	45878
1982	736	1198	18	351	623	134812	113	39526
1983	718	1420	18	350	607	129047	-	39016
1984	695	1411	20	323	578	136795	-	37696
1985	655	1791	18	349	542	116150	-	39428
1986	606	1950	18	361	507	108009	-	36476

Source: Administrative Reports, Cochin Port, relevant years.

of workers has increased to 387, whereas that of category B has declined to 262. If we look at both the categories(that is category A & B), the effective strength of workers (this we get by deducting the time without work from the total strength of workers) has declined from 801 in 1974 to 507 in 1986, also their number of man-shifts worked has also shown a decline from 1,34,425 shifts in 1974 to 1,08,009 shifts in 1986. In the case of the number of man-shifts worked the category B workers has shown much decline than that of category A workers over the period 1974 to 1979. The 'man-shifts lost' in terms of man-shifts for both the categories (A & B together) has declined from 54,314 man-shifts to 36,476 man-shifts over the period 1974 to 1986, this is an encouraging trend especially after 1982 the 'man-shifts lost' in terms of workers has vanished, which has declined from 155 in 1974 to 113 in 1982. During the period 1981/82 to 1985/86 we have the details of the 'man-days lost' due to strike [see table 3.15.]. The number of man-days lost during 1983 and 1985 are the highest.

Table 3.15. MAN DAYS LOST DUE TO STRIKE

YAER	TOTAL NUMBER OF MANDAYS LOST
1981/82	1658
1982/83	3452
1983/84	85942
1984/85	47938
1985/86	3436

Source: Complied by R & P Cell, Cochin
Port Trust.

Growth Rate of Labour

We have also estimated the growth rate of labour using the semi-log regression equation. The growth rate of total labour input over the period 1971 to 1986 was negligible that is about 0.76 per cent [Std Err of Coef.0.0015 and T ratio 4.9449]. The period 1971 to 1979 has shown a growth rate of labour of 0.74 per cent [Std Err of Coef.0.0031 and T ratio 2.3678] and for the period 1980 to 1986 it was 0.79 per cent [Std Err of Coef.0.0042 and T ratio 1.8848].

The average of the annual growth rate of the total number of labourers in Cochin port is given in table no. 3.16. In the first period(1972-1980) the average annual growth rate of total number of labourers is 0.6 per cent [0.74 per cent in the case of regression] and in the second period the average annual growth rate is 0.4 per cent [0.79 per cent in the case of regression]. For the overall period of analysis the annual average growth rate of number of labourers is 0.5 per cent [0.76 per cent in the case of regression analysis]. The growth rate in the number of labourers was stagnant over the period of analysis.

Table 3.16. GROWTH RATE OF LABOUR INPUT AT COCHIN PORT

YEAR	NO. OF LABOURERS	INDEX OF NO. OF LABOURERS	GROWTH RATE OF NO. OF LABRS.
1971	6462	100	
1972	6574	102	0.017
1973	6451	100	-0.019
1974	6266	97	-0.029
1975	6339	98	0.012
1976	6383	99	0.007
1977	6395	99	0.002
1978	6581	102	0.029
1979	6640	103	0.009
1980	6818	105	0.026
1981	7321	113	0.071
1982	7021	109	-0.042
1983	6901	107	-0.017
1984	6903	107	0.000
1985	6980	108	0.011
1986	6999	108	0.003

Average Growth Rate (1972/80)== +0.6 %
Average Growth Rate (1981/86)== -0.6 %
Average Growth Rate (1972/86)== +0.5 %

Source: Calculated from the given data, CPT.

The trends in the wages has shown an increasing trend, especially after 1976 onwards it has increased steadily. The graph 3.14. gives a clear picture of the trends in the wage rate of different categories of labour such as the class I,&II, the class III & IV, and the total number of labours.

The graph 3.15 gives the details of the trends in the capital stock, number of labourers and output of Cochin port over the period 1970/71 to 1985/86(with base year 1970/71). The trends in the capital stock till the mid 70s has been growing mildly and in the year 1977 there was a steep increase in the capital stock, and after that the stock of capital has been growing, but only in a limited scale. The trends in the number of labourers has not shown a steady increase, over the period, the the trend was almost constant. In the case of output the trend has shown fluctuations over the period.

TRENDS IN LABOURERS

INDEX 1973-74=100

YEAR

▢   SHORE LABOUR   +   CASUL LABOUR   ◊   TOTAL LABOUR
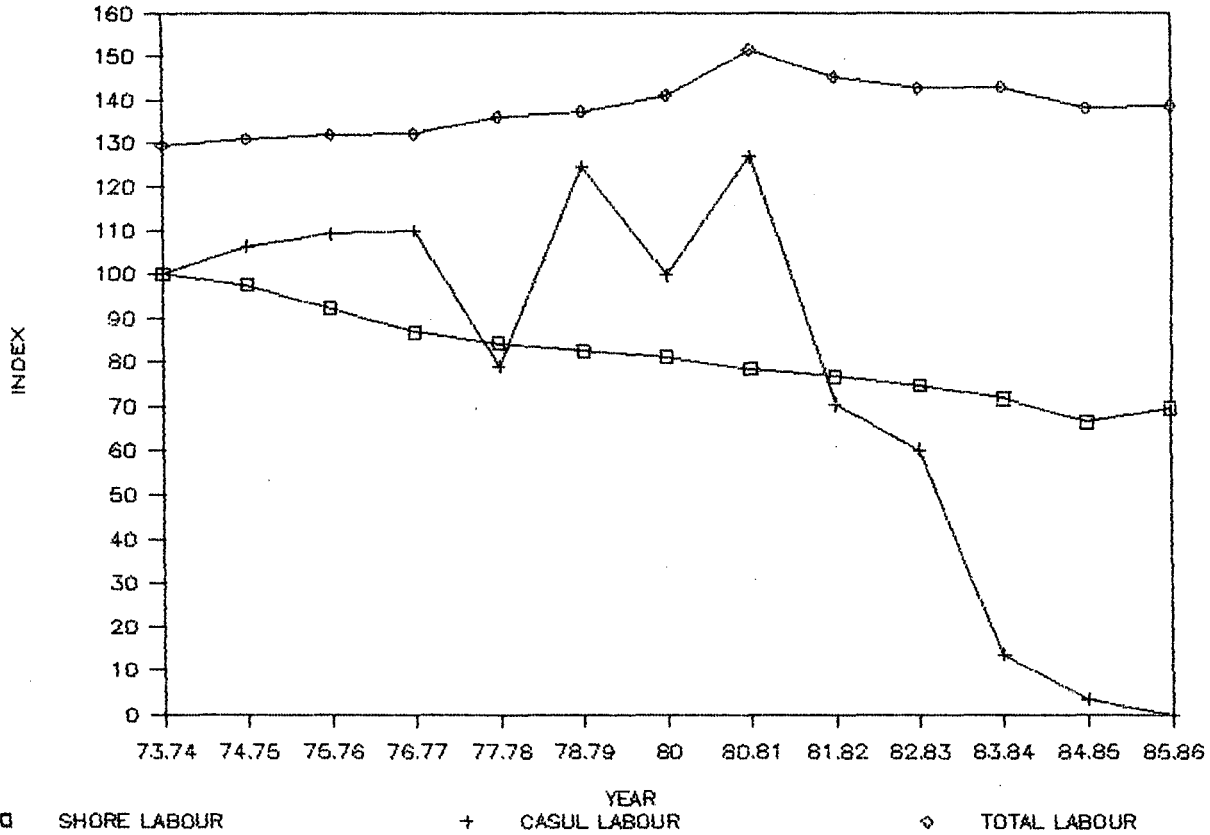
GRAPH.3.14 TRENDS IN WAGE RATES AT COCHIN PORT

INDEX NUMBERS (1970-71 = 100)

YEAR

▢   W RATE C1&2   +   W RATE C 3&4   ◊   W RATE TOTAL
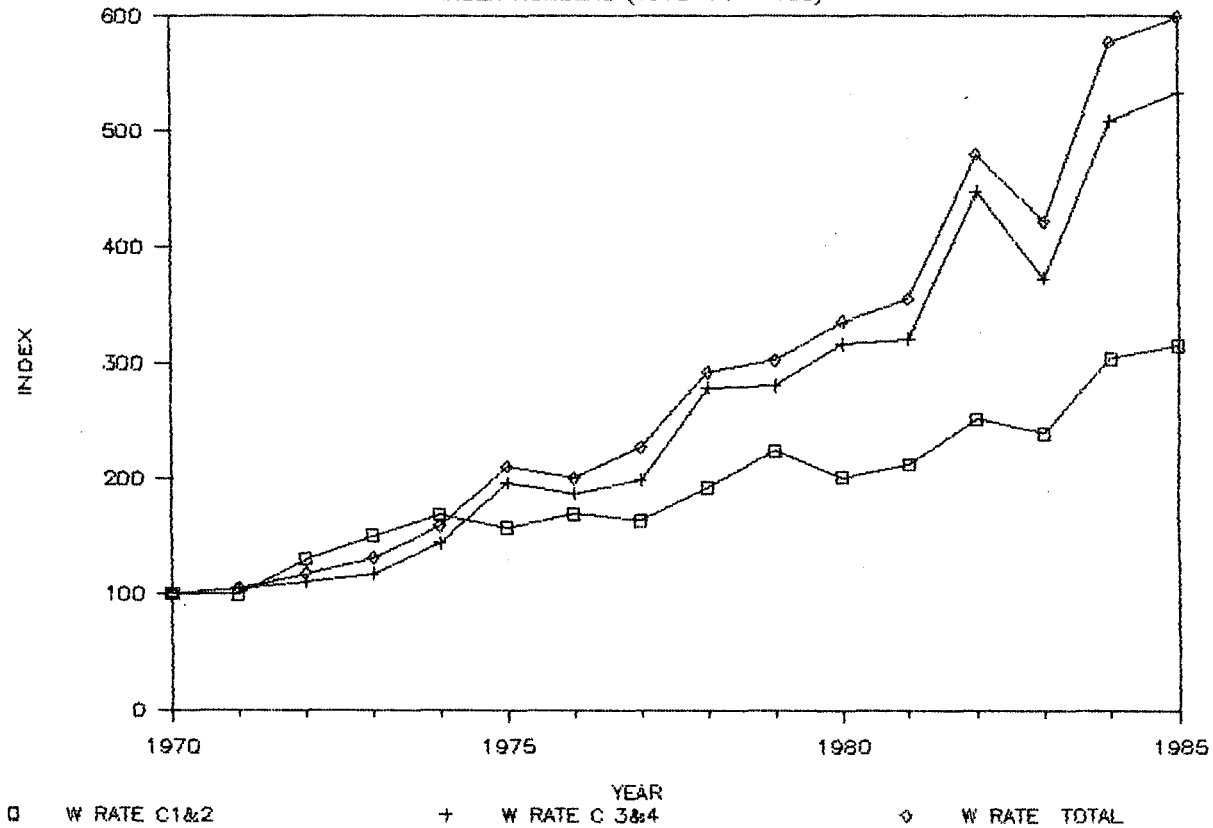
CAPITAL, LABOUR & OUTPUT

INDEX'S 1970/71 =100

| | CAPITAL STOCK | + | NO. OF LABOUR | ◇ | OUTPUT |

YEAR
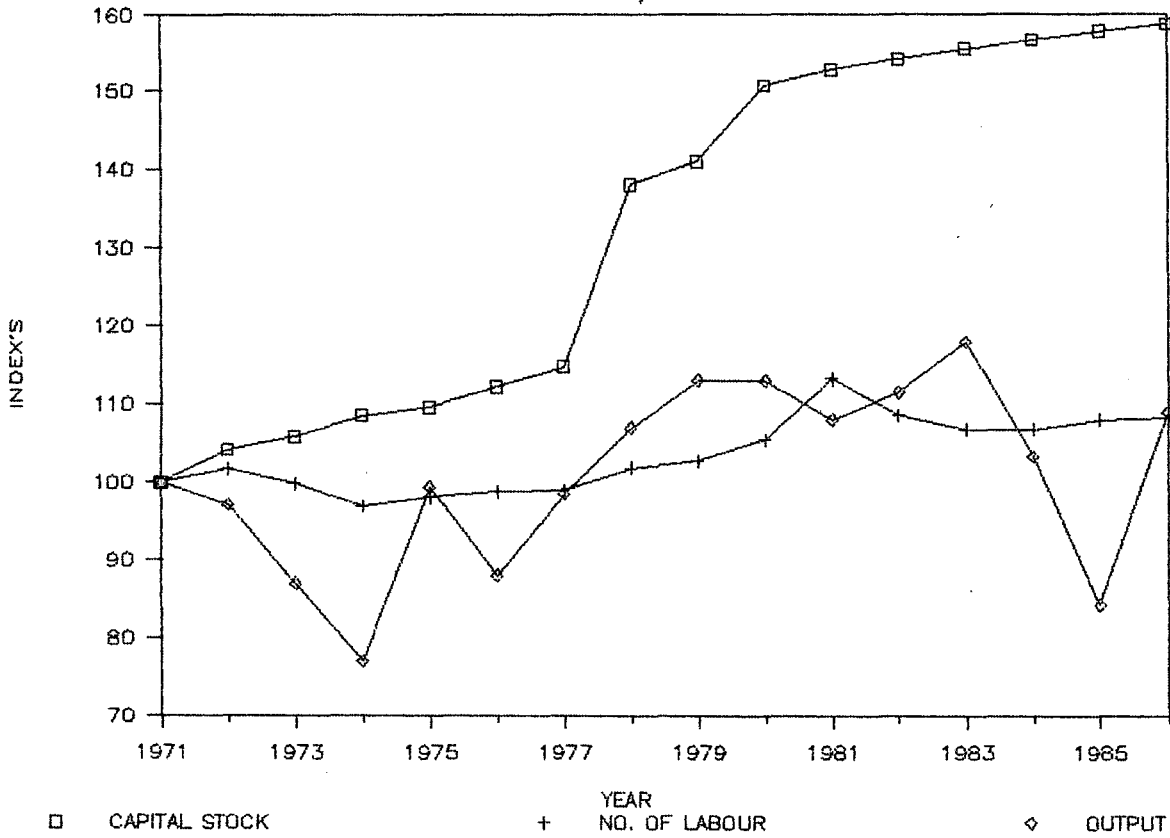
3.4. Conclusion:

The main conclusions of this chapter are discussed in the following section. The focus of this chapter was the declining phase (1971-1986) of traffic at Cochin port. The share of Cochin port's traffic compared to all the Indian major ports traffic, started declining even from the early phase of the period of analysis. The output (import and export trade) of Cochin port declined, and for general cargo traffic through the port the decline was drastic. The main reason for this is the diversion of the cargo to the newly emerging major ports like Tuticorin and New-Mangalore(see table 4.8). The value of trade through the port in the same period has shown an increasing trend. The value of trade (the value of import and export trade) through Cochin port, both export and import increased over the period from 1971 to 1986. The value of imports has shown a steady growth compared to that of exports. The cargo handled at Cochin port can be generally classified into two main categories, as bulk cargo and break-bulk cargo. The bulk cargo trade through Cochin accounts for about 80 to 90 per cent of the total trade, where as the break-bulk cargo accounts for only 10 to 20 per cent of the total trade. The decline of the break-bulk cargo trade at Cochin from 7.56 lakh tonnes(1971), (20 per cent of the total trade) to 5.90 lakh tonnes(1986), (11 per cet of the total trade) is alarming. This trend has clearly pushed Cochin to a port of bulk cargo handling- that is mainly oil and fertilizer- port. The prevailing situation can be improved if the port concentrates on investing in the container handling facilities.

The oil and fertilizer trade through Cochin port has increased from 71 per cent of the total trade in 1971 to 88 per cent by 1986. The containerized output also has shown an increasing trend since its introduction to the port. In 1974 the container traffic handled through Cochin port was only 0.03 lakh tonnes and by 1986 it increased to 2.21 lakh tonnes (that is only 34 per cent of the general cargo trade). That is even after one and a half decade since its introduction to Indian ports, containerization has not reached at Cochin in its full fledged form. The main advantage of the container traffic is the door to door delivery of the cargo, which is yet to take place at Cochin.

The port's trade is also subject to seasonal fluctuations. For different quarters (we have divided the year into four different quarters), over time, the trade through the port shows different patterns in each quarters. The monsoon output trend of Cochin port clearly shown a higher trend compared to that of non-monsoon output trend.

The average growth rate of output in Cochin port for the period 1972/1986 was only +1.1 per cent, and that for the first phase, that is, for 1972/1980 the average growth rate was +2.67 per cent and for the second phase, that is, 1981/86 the average growth rate in output was negligible. The output through Cochin port was growing in the first phase and started declining in the second phase. The decline in output may be due to the factors like, lack of demand in the international market for the exports from Cochin, the conditions of the port in terms of laborers, and the emergence of other new ports in the vicinity, etc. This has

resulted in the deterioration of the status of Cochin port, the port simply became the feeder port to major ports like Columbo port.

The Capital input (capital assets) in Cochin port has grown considerably over the period of analysis. The main components of the capital assets include Construction (grown from Rs. 304.50 lakhs in 1971 to Rs.496.00 lakhs in 1986), Plant and Machinery (grown from Rs.421.06 lakhs in 1971 to Rs.1210 lakhs in 1986), and Transport Equipments (grown from Rs.70.33 laks in 1971 to Rs.95.00 lakhs in 1986). The plant and machinery component has shown a major increase in 1979/80. .

We have used 'perpetual inventory method' to calculate the capital stock of Cochin port in constant(1970/71) prices. The growth rate of capital stock for the entire period 1971 to 1986 is 3.63 per cent; 4.73 for the first period(1971/79), and 2.0 per cent for the second period(1980/86). This implies that during the second period there was no addition to the capital stock.

The labour input (number of labourers) of Cochin port during the period of analysis has not grown much. The number of labour force increased from 6462 in the year 1971 to only 6699 in 1986. The number of fixed employees and their wages increased steadily, where as the number of shore and casual labourers declined over this period. The total wages of the labourers over the period increased from Rs.206.65 lakhs to Rs.1283 lakhs.

The growth rate of labour force over the period from 1971

86

to 1986 is only Ø.76 per cent, in the first phase(1971/1979) the growth rate is Ø.74 per cent and for the second phase(1980/86) the growth rate is Ø.79 per cent. That is, the higher growth rate in the second phase is due to the increase in the number of employees in the fixed labour group.

To conclude, though Cochin port had a glorious past, in the modern period, the port could not improve its trade mainly because of the lack of proper investment in the modern cargo handling equipments like the gantry cranes etc(whatever investment is made is accounted under the working capital). During the seventies and the early eighties the traffic and structure of the port has not improved. The traffic through the port started diverting to other emerging ports like Tuticorin and New-Mangalore and the port of Coloumbo, the result is obvious, Cochin has become a feeder port. A detailed analysis of the operational and financial performance of the port will specifically reveals the reasons for the diversion of the traffic from Cochin port.

Notes and References

1. Boyce "Kinked exponential models for growth rate estimation" <u>Oxford Bulletin of Economic and Statistics, 48.</u> 1986.

2. K.P.Kannan and K.Pushpangadan "Agriculture Stagnation in Kerala: An Explanatory Analysis. <u>C D S working paper</u>, 1988.

3.George Rosen, <u>Industrial Change in India</u>, p.227, 1958.

4.Goldar B.N. '<u>Productivity Growth in Indian Industry</u>, 1986.

5. Chandok H.L. <u>Whole Sale Price Statistics</u> , India, 1978.

6. RBI, <u>Report on Currency and Finance</u>, Various Years.

7. The class one and two employees are the officer level and the class three will be technical type and class four the peon etc.

CHAPTER IV

OPERATIONAL AND FINANCIAL PERFORMANCE

In this chapter we shall discuss the performance of Cochin port by looking at the important port performance indicators both operational and financial over the period 1970/71 to 1985/86. The period (1971-86), was selected since most of the important technological changes, such as containerization etc., in cargo handling has taken place at Cochin Port during this period and also the new system of accounting has started only in the beginning of this period.

Our analysis of the operational performance begins with a brief examination of the trend in the number and tonnage of ships at Cochin port. In order to get a disaggregated picture we have extended the above discussion on the number and tonnage of ships to category wise, flagwise, and stream/wharf wise analyses. This discussion on the trend in number and tonnage of vessels visited leads us to a study of crucial efficiency parameters of the port such as the turn round time, the detention time, number of days in the port, average service time per ship, average service time for 1000 tons of cargo, average output of shore-labour per gang shift, and average output of shore labour per man-hours.

The trends in the utilization of cargo(such as palletization and containerization), will also give us an idea on the changes in the operational performance of Cochin port with the adaptation of modern cargo handling techniques.

The financial health of a port is very important as far as a port's future is concerned. The financial analysis will help us to evaluate the viability of the investment and the impact of the investment on the financial health of the port authority as a whole. The Financial Performance Indicators include the 'trends in revenue accounts', 'operating income', 'operating expenditure', 'finance and miscellaneous income and expenditure', 'capital debt and reserve funds', 'operating ratios', and the 'trends in the total capital assets at original cost' of the port.

I. OPERATIONAL PERFORMANCE INDICATORS OF COCHIN PORT:

Time series data presented in table 4.1. on number and tonnage of ships would give us some broad idea on the operational performance of the port. Two important points that emerge may be stressed. First, the figures show if not decline, a virtual stagnation in the number of ships visited. This is reflected in figure 4.1., which depicts the average number of ships visited at Cochin per day. The number of ships per day seems to have fluctuated between 11 and 14 over the period 1974 and 1986[1]. The vessels visited at stream is almost negligible compared to that of wharf, which is on an average 8 to 10 ships' per day. The decline in number of ships visited is more clear and sharp in the case of sailing vessels. Second, while the traffic in terms of tonnage has registered some increase between 1951 and 1986, the improvement was rather marginal during the period of our analysis(1971-1986)[2]. The marginal improvement in the traffic at Cochin port does not seems to have kept pace with the rapid expansion in intra and international trade. And more importantly it does not seems to justify the additional investment made since 1970.

90

Table 4.1. NUMBER AND TONNAGE OF VESSELS AT COCHIN PORT

YEAR	NO. OF STEAMERS & MOTOR SHIPS	TONNAGE IN LAKHS	NO. OF SAILING VESSELS	TONNAGE IN LAKHS	TOTAL NO. OF VESSELS	TOTAL TONNAGE
1951	871	23.34	287	0.22	1158	23.56
1956	939	28.72	283	0.22	1222	28.94
1961	1337	42.84	144	0.15	1481	42.99
1966	1178	43.21	98	0.11	1276	43.32
1971	1026	45.25	39	0.04	1065	45.29
1974	853	36.22	42	0.05	895	36.27
1975	884	41.89	24	0.03	908	41.92
1976	892	48.08	51	0.08	943	48.16
1977	961	49.01	20	0.04	981	49.05
1978	996	52.68	34	0.07	1030	52.75
1979	994	57.37	13	0.03	1007	57.40
1980	867	52.51	20	0.04	887	52.55
1981	788	48.83	25	0.05	813	48.88
1982	918	55.59	10	0.02	928	55.61
1983	934	57.53	20	0.05	954	57.58
1984	766	51.32	20	0.03	786	51.35
1985	758	47.46	33	0.05	791	47.51
1986	777	53.99	37	0.06	814	54.04

Source:Administration Report, Cochin Port Trust, various years.

Now let us take the analysis on number and tonnage of ships to a more disaggregate' level, that is, category wise, flag wise and wharf/stream wise. This would help us locate where exactly the improvement or decline has taken place. Moreover, the disaggregate analysis gives an interesting picture on the emerging specialization of Cochin port. Category wise analysis of number and tonnage of vessels cleared(see table 4.2.) highlights following trend. There has been a consistent increase in the number as well as tonnage of Oil tankers. Fertilizer vessels, and Container vessels . Whereas both number of ships and tonnage declined under the heads of Colliers(Collier is a ship designed to carry coal), Food grain vessels, and General Cargo vessels. The results are indicative of the direction of specialization at Cochin port. There is a clear concentration of activities to Oil tankers, and Fertilizer vessels.

91

GRAPH.4.1 AVERAGE NO OF SHIPS IN COCHIN PER DAY

ANNUAL AVERAGE

☐ AT WHARF   + AT STREAM   ◇ TOTAL

92
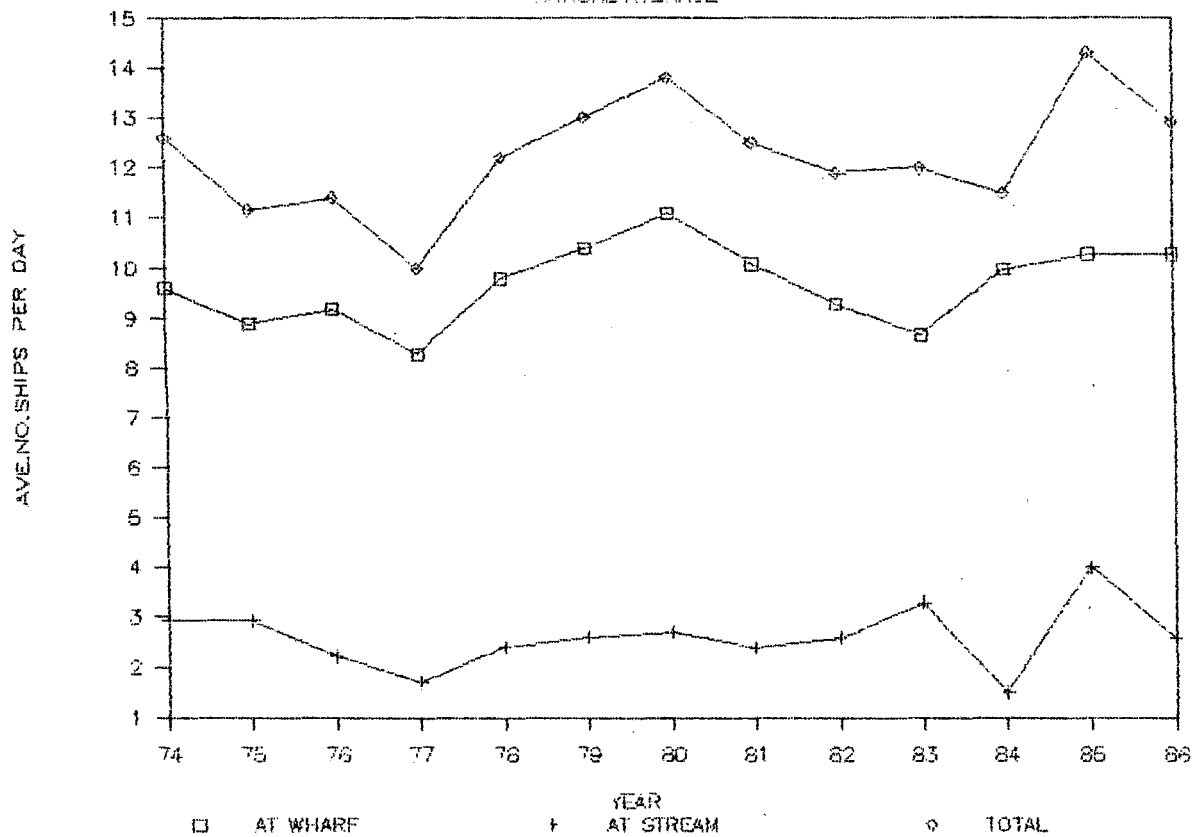
The presence of Fertilizers and Chemicals Travancore Ltd.(FACT) and Oil refinery near Cochin explains the above. The decline in the number and tonnage of both Colliers and Food grain vessels are mainly due to the lack of demand for both coal and foodgrain. The decline in the number and tonnage of General cargo vessels needs special mention because of its long run implications for the future of the port. The General cargo vessels declined from 659 (in 1974) with a registered tonnage of 22.31 lakh tonnes to 312 (in 1986) with a registered tonnage of 12.82 lakh tonnes.

In the case of Container vessels[3], the number has increased from 24 (in 1977) to 227 (in 1986) and their registered tonnage increased from 2.56 lakh tonnes to 11.6 lakh tonnes over the same period. It is obvious that the increase in the tonnage has not kept pace with the increase in the number of ships implying that, only smaller container vessels visited Cochin. The reason is that modern container vessels, which are also large do not possess any derricks(cranes) to load and unload the containers. Since Cochin port does not possess the new gantry cranes to handle containers only smaller container vessels with inbuilt cranes visit the port. Hence many small container vessels sailing from Cochin handover their cargo to larger ones at Columbo port, etc. because of modern cargo handling facilities.

Table 4.2.CATEGORY WISE ANALYSIS OF SHIPS CALLED AT COCHIN PORT

YEAR	NO. OF TANKERS	NET REG. TONNAGE [in lakhs	NO. OF COLLIERS	NET REG. TONNAGE	NO. OF FOOD GRAIN VESSELS	NET REG. TONNAGE	NO. OF FERTLIZER VESSELS	NET REG. TONNAGE
1974	151	12.1	5	0.20	12	0.63	26	1.0
1975	186	16.4	9	0.44	19	0.90	32	1.6
1976	133	13.4	13	0.64	32	1.80	28	1.5
1977	154	15.7	22	1.10	12	0.86	34	1.7
1978	167	17.4	18	1.10	6	0.41	41	2.9
1979	179	21.3	11	0.50	7	0.53	55	4.1
1980	172	21.7	--	--	-	--	56	4.2
1981	189	21.9	--	---	-	--	58	4.1
1982	223	24.1	--	--	6	0.46	47	4.0
1983	211	24.0	--	--	5	0.31	43	3.3
1984	182	23.5	--	--	9	0.58	45	3.3
1985	160	16.6	--	--	3	0.21	67	5.9
1986	167	23.5	--	--	-	--	68	5.9

Table 4.2. continued.

YEAR	NUMBER OF GENERAL CARGO VESSELS	NET REG. TONNAGE [in lakhs]	NUMBER OF CONTAINER VESSELS	NET REGISTERED TONNAGE [in lakhs]
1974	659	22.31	-	-
1975	638	22.57	-	-
1976	686	25.68	-	-
1977	711	26.64	24	2.56
1978	737	28.62	23	1.90
1979	697	27.49	30	2.54
1980	573	22.33	57	3.72
1981	462	17.72	65	4.34
1982	522	19.98	113	6.76
1983	528	21.54	140	8.10
1984	398	18.28	114	5.17
1985	351	15.59	171	9.26
1986	312	12.82	227	11.67

Source: Administration Reports,Cochin Port, relevant years.

The flagwise[Country wise] analysis of ships(see table 4.3.) will clearly tell us the trends in the direction of trade from Cochin. The indicators used here are 'the number of ships called at Cochin of the respective country', 'the total traffic handled', and 'the percentage to total traffic handled by the respective country' in that particular year. In the case of coastal shipping the total traffic handled steadily increased from 6.9 lakh tonnes in 1973/74 to 40 lakh tonnes in 1985/86. Significantly the percentage to total traffic handled has also increased from 18.6 per cent in 1973/74 to 75.8 per cent in 1985/86. Clearly this shows a concentration of business at Cochin port to coastal trade revealing the declining importance of the port in international maritime trade. Corresponding to the growth of coastal trade one can note the declining importance of foreign vessels. As is clear from table the trade with all the major trade partners of India viz. U.S.A., U.K., U.S.S.R., and Japan has declined.

| Table4.3. | | FLAGWISE [COUNTRYWISE] ANALYSIS OF SHIPS CALLING AT COCHIN PORT | | | | | | | | | | |

YEARS	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
[1]	302	347	323	388	416	390	306	298	382	443	351	351	369
[2] INDIA	6.9	13.6	12.6	13.6	17	18.2	14.4	19	25.8	34	32.4	26.6	40
[3]	18.6	28.4	29.6	28.5	32.9	33.3	26.3	36.446	0.9	60.2	64.7	65.3	75.8
SINGAPORE	31	75	49	59	74	15	35	44	41	9	7	7	13
	4.7	13.5	10.5	15	19.9	2.7	0.3	5.8	6	0.4	0.05	0.4	0.8
	12.6	28.2	24.6	32.2	38.5	5	0.6	11	11	0.8	0.1	1.1	1.5
JAPANESE	70	51	72	59	48	51	49	26	37	37	30	32	31
	0.69	0.36	0.72	2.71	3.32	0.99	0.28	0.13	1.94	0.39	0.19	0.13	0.06
	1.9	0.8	1.7	5.7	6.4	1.8	0.5	0.2	3.5	0.7	0.4	0.3	0.1
BRITISH	60	51	45	35	38	42	54	41	35	39	41	68	44
	3.89	1.73	1.01	0.54	0.64	0.59	0.63	0.83	0.73	1.04	1.15	1.43	1.6
	10.5	3.6	2.4	1.1	1.2	1.1	1.2	1.6	1.3	1.8	2.3	3.5	3
GREEK	58	36	58	47	44	106	119	107	63	31	17	12	11
	5.34	3.48	7.19	4.19	2.8	23.45	19.18	7.88	1.45	0.82	1.62	1.08	
	14.3	7.2	16.9	8.8	5.4	42.9	59.6	36.7	14.4	2.5	1.7	3.9	2
LIBERIAN	55	48	18	40	48	50	25	11	37	61	40	30	26
	8.99	6.67	1.06	6.24	1.93	1.55	0.48	1	4.15	8.57	1.75	2.38	1.16
	24.2	13.9	2.5	13.1	3.7	2.8	0.9	1.9	7.5	15	3.5	5.8	2.2
YUGOSLAVIAN	42	31	33	38	38	26	22	27	24	23	22	17	26
	0.85	0.75	0.39	0.3	0.42	0.22	0.49	0.17	0.19	0.17	0.46	0.14	0.43
	2.3	1.6	0.9	0.6	0.8	0.4	0.9	0.3	0.3	0.9	0.3	0.8	
NORVEGIAN	36	25	36	39	31	27	34	16	10	4	41	14	14
	1.75	0.44	0.6	0.28	0.21	0.45	0.63	0.26	0.05	0.22	7.69	0.7	0.4
	4.7	0.9	1.4	0.6	0.4	0.8	1.2	0.5	0.1	0.4	15.4	1.7	0.8
RUSSIAN	36	45	54	53	68	65	46	47	61	64	48	51	44
	0.95	0.87	0.56	0.77	0.87	0.56	0.73	0.65	0.67	1.1	0.46	0.93	0.64
	2.6	1.8	1.3	1.6	1.7	1	1.3	1.2	1.2	1.9	0.9	2.3	1.2
U S A	34	43	53	56	37	35	33	36	32	23	11	6	6
	0.3	0.64	0.95	1.09	0.6	0.7	0.88	0.5	0.62	0.42	0.32	0.26	0.22
	0.8	1.3	2.2	2.3	1.2	1.3	1.6	1	1.1	0.7	0.6	0.7	0.4
O T H E R S	130	134	151	146	155	184	143	135	195	203	160	163	195
	2.78	5.98	6.97	2.62	3.98	5.23	3.24	4.8	6.96	8.92	4.76	6.13	6.38
	7.5	12.3	16.5	5.5	7.8	9.6	5.9	9.2	5.9	9.2	12.7	15.7	9.5

---

[1]= NUMBER OF SHIPS, [2]=TOTAL TRAFFIC HANDLED (IN LAKH TONNES), [3]= PER CENTAGE TO TOTAL TRAFFIC HANDLED.
Source: Administration Reports, Cochin Port Trust, relevant years.

Coming to the classification of traffic into stream and wharf, the stream traffic used to be encouraged at Cochin, but by the time the required wharf facilities were established the wharf trade began to overtake. The cargo handled at stream and wharf (coastal and foreign trade) can be observed in table 4.3., which clearly tells the importance of wharf cargo handling compared to stream handling at Cochin port. At wharf the vessels can anchor safely and handle cargo without much pilfrage, whereas the stream handling-using 'vallams' is risky and uneconomical. The trade at Stream which was 6.61 lakh tonnes, [48 per cent of the total trade] in 1951 got reduced to 0.41 lakh tonnes in 1986,[to 0.77 per cent of the total trade]. At the same time the trade at wharf flourished during this period.

Table4.4. STREAM & WHARF TRADE AT COCHIN PORT

YEAR	TOTAL	STREAM	% TO TOTAL	WHARF	% TO TOTAL
1951	13.69	6.61	48	7.08	52
1956	16.34	8.69	53	7.66	47
1961	20.09	4.52	22	15.56	77
1966	28.72	6.68	23	22.04	77
1975	48.13	3.24	7	44.89	93
1978	51.74	2.66	5	49.08	95
1981	52.34	1.91	4	50.43	96
1984	50.04	0.51	1	49.53	99
1986	52.78	0.41	0.8	52.37	99

Source: Administration Reports, Cochin Port, relevant years.

An explanation for the decline in the number of vessels visited and the slow increase in tonnage of cargo handled calls for a detailed and in depth analysis of efficiency parameters. This is done at two levels. Chapter V is exclusively devoted for a discussion of trends in productivity. Here we confine ourselves to certain broad but crucial efficiency indicators which directly influence the calculations of the shipping companies.

To begin with, we shall look into the Turn Round Time

97

[TRT], defined as 'the time spent by a ship in the process of entering port, discharging cargo, re-loading and leaving the port'. First we analyse the TRT with respect to all categories of vessels taken together and then for different categories separately. We then proceed to the analysis of the different components of the TRT, such as 'the Detention Time', and 'Stay in ports', which may be further divided into 'average time worked per ship', and 'average time lost per ship'. Also the indicators like 'average service time for 1000 tonnes of cargo', which may be further divied into total time worked and time lost are analysed.

The salient performance indicators for shipping such as the average service time per ship[in days] and the average service time for 1000 tons of cargo[in hours] are also analysed. Further the indicators such as 'average output of shore labour per gang shift[in tonnes]' and 'average output of shore labour per man hour[in tonnes]' give us the general idea on cargo handling efficiency. Also some of the important labour efficiency ratios, such as the average output per gang shift, average output per man shift, average output per berth day, labour strikes at the port and the divergence of cargo from cochin port the capacity utilisation trends of cargo handling and storage facilities are also analysed.

The Average TRT for Total vessels visited was about 4 to 5 days and that of the General Cargo vessels was 4.8 days in 1977/78 and it has increased up to 22 days in 1983/84 and it declined to 5.7 days in 1985/86. For Container vessels the TRT showed only a slight increase, from 1.7 days in 1977/78 to 2.7 days in 1985/86[see table 4.5].

YEAR	CATEGORY OF VESSELS	AVE.PRE-BERTHING WAITING TIME PER SHIP [HOURS]	TOTAL TIME AT BERTH AVE.TIME WORKED PER SHIP [DAYS]	AVE.TIME LOST PER SHIP [DAYS]	AVE. T.R.T. TIME [DAYS]	AVE.SER. TIME FOR 1000 TONS OF CARGO WORKED [HOURS]	LOST [HOURS	NO. OF GANGS EMPLOYED PER SHIP PER SHIFT PORT LABOUR	DOCK LABOUR	AVE. OUTPUT PER GANG SHIFT [TONN PORT LABOUR	DOCK LABOUR	AVE. OUT PUT/ MAN HOUR [TONNES] PORT LABOUR	DOCK LABOUR
1977\78		19.4	1	2.8	4.8	31.4	84	2.3	2.3	75.5	64.4	0.8	0.8
1978\79		23.4	1.2	2.9	5.2	31.2	74.2	2.2	2.0	77.8	74.9	0.8	0.9
1979\80		38.2	1.7	3.8	7.2	31.4	71.8	2.2	2.2	74.8	73.9	0.8	0.9
1980\81		27.4	1.4	3.3	5.9	30.2	70.8	2.2	2.1	74.9	75.8	0.8	0.9
1981\82	GENERAL	23.5	1.2	2.8	5.1	28.6	66.8	2.1	2.1	80.7	78.7	0.8	1.0
1982\83	CARGO	19.8	1.1	2.8	4.9	23.9	60.1	2.2	2.1	92.9	92.1	1.0	1.1
1983\84		36	9.2	11.1	22	15.2	18.2	3.5	2.9	93.1	135.7	1.0	1.2
1984\85		30.7	1.6	2.8	5.9	31.3	55.7	1.8	1.8	90.3	89.3	0.9	1.1
1985\86		22.4	1.6	3	5.7	34.5	67.7	1.8	1.8	90.3	87.9	0.9	1.1
1977\78		2	0.6	0.8	1.7	15.8	21.3	2.4	3.0	85.0	62.2	0.9	0.8
1978\79		9	0.6	0.8	1.9	17.4	21.3	2.3	2.4	72.9	61.9	0.7	0.8
1979\80		7.7	0.6	0.6	1.8	12.8	13.0	2.1	2.2	64.9	58.7	0.7	0.7
1980\81		4.8	0.7	0.8	1.9	11.2	12.9	2.7	2.6	60.7	61.5	0.6	0.7
1981\82	CONTAINER	6.2	0.9	0.6	1.9	15.4	10.5	2.4	2.4	61.7	61.3	0.6	0.8
1982\83	VESSELS	7.1	0.8	1.5	2	15.0	16.2	2.3	2.3	66.7	66.4	0.7	0.8
1983\84		8.5	1.1	2.1	2.6	14.8	15.5	1.3	1.3	206.8	205.9	2.1	2.6
1984\85		15.3	0.9	1	2.7	16.5	20.0	1.4	1.4	200.0	200.0	2.1	2.5
1985\86		11.6	0.9	1.2	2.7	19.1	24.8	1.2	1.2	219.1	219.1	2.3	2.7
1977\78		19.5	1.5	2.7	5.2	6.8	12.9	2.3	2.5	79.7	86.7	0.8	1.0
1978\79		25	1.7	2.9	5.8	7.7	13.3	2.2	2.2	80.9	98.3	0.9	1.1
1979\80		36.5	2	3.5	17.1	8.0	14.2	2.2	2.2	74.7	86.8	0.8	1.0
1980\81		32	1.9	3.1	6.5	6.8	11.4	2.2	2.3	72.7	91.7	0.8	1.0
1981\82	TOTAL	23.4	1.6	2.4	5.2	6.3	9.7	2.3	2.3	76.7	88.9	0.8	1.0
1982\83	VESSELS	19	1.4	2.2	4.6	5.5	9.0	2.3	2.3	85.9	101.3	0.9	1.1
1983\84		22	1.7	2.6	5.4	5.9	9.4	1.9	2.0	107.7	115	1.1	1.3
1984\85		40.9	2.2	2.8	6.9	9.8	11.9	1.7	2.0	109.5	108.7	1.1	1.1
1985\86		24.6	1.9	2.6	5.7	6.7	9.1	1.7	2.0	117.4	114.8	1.2	1.2

Source: Administration Reports, Cochin Port, relevent years

The Average Pre-berthing Waiting Time Per Ship, i.e., ships waiting at the outer roads for berths[which is also an important component of the TRT], for General Cargo vessels has increased from 19.4 hours to 22.4 hours, and for Container vessels it has increased from 2 hours to 11.6 hours, and for Total vessels the indicator has shown an increase from 19.5 hours to 24.6 hours over the period of analysis 1977/78 to 1985/86. This can be supported by the trend in number of vessels detained more than 8 hours and the trends in detention days of the category wise ships(table 4.6). This is important, since the number of vessels in that period has not shown an increasing trend(which may be partly explained by the technological changes in shipping as ships with huge DWT).

A further detail analysis of the TRT and Detention Time [DT] by Categorywise ships can be observed from table 4.6. The 'Average Detention Days' for Tankers [oil] was almost the same over the period, and their 'Average TRT' has increased from 1.69 days in 1964/65 to 3.47 days in 1985/86. This is very high, in view of the facilities acquired by Cochin port for bulk cargo (oil) handling. But the increase in the size of the ships is also an important factor for the rise of TRT and DT in the later periods. For Bulk cargo transport huge vessels of 40,000 GRT are being used and which may require more TRT. For Fertilizer Vessels the Average TRT and the Average Detention time show a steady increase from 6.83 days in 1964/65 to 18.13 days in 1985/86 and from 2.2 days to 4.29 days respectively. This rise in the TRT and DT can be reduced if the port introduces machanical bulk cargo handling facilities, such as conveyer belt system for fertilizer, etc. For Container vessels both the indicators show only a slight

TURN-ROUND TIME AND DETENTION TIME BY CATEGORY OF SHIPS AT COCHIN PORT

YEAR	CATEGORY OF SHIPS	NUMBER OF VESSELS	NO. OF VESSELS DETAINED > 8 Hrs.	DETENTION DAYS	AVERAGE DETEN-TION DAYS	STAY IN PORT [DAYS]	AVERAGE TURN ROUND TIME [DAYS]	TOTAL TONNAGE HANDLED [LAKHS TONNES]	AVERAGE OUTPUT/ BERTH DAY
1964/65		150	50	65	1.30	251	1.69	9.93	3958
1965/66		134	50	74	1.48	240	1.79	10.45	4352
1973/75		151	95	174	1.18	381	2.51	25.01	6564
1974/75		184	155	397	2.16	558	3.03	35.00	6345
1975/76	TANKERS	132	103	171	1.30	301	2.30	28.73	9545
1980/81		187	134	351	1.87	404	2.17	39.64	9812
1983/84		206	139	198	1.00	366	1.75	42.99	11747
1984/85		154	125	96	0.60	345	2.12	26.11	4990
1985/86		161	83	278	1.80	534	3.47	38.63	11197
1964/65		1083	247	330	1.34	3416	3.15	9.29	272
1965/66		825	323	640	1.98	2832	3.42	8.38	296
1973/75		594	232	309	0.56	3024	5.07	8.20	271
1974/75	OTHER	588	245	293	0.50	2465	4.18	7.80	318
1975/76	VESSELS	648	328	391	0.60	2411	3.17	6.38	265
1980/81		501	233	442	0.88	2277	4.54	6.07	267
1983/84		361	160	358	0.98	1933	5.30	5.43	281
1984/85		317	172	441	1.39	1519	4.84	4.44	292
1985/86		264	123	275	1.10	1400	5.30	4.26	304
1964\65		36	10	22	2.20	246	6.83	1.54	625
1973\74		26	12	21	0.82	440	16.92	2.12	483
1974\75		32	16	31	0.98	449	14.03	2.11	472
1975\76	FERTLIZER	28	19	74	2.65	472	16.87	2.79	591
1980\81		58	41	234	4.04	1167	20.12	6.64	567
1983\84		45	31	81	1.80	589	12.80	5.03	854
1984\85		67	42	384	5.73	1180	18.44	7.84	664
1985\86		68	47	291	4.29	1251	18.13	7.69	615
1981\82		113	37	29	0.26	184	1.62	1.47	799
1982\83		140	45	42	0.29	235	1.71	1.64	697
1983\84	CONTAINER	113	43	40	0.34	258	2.26	1.74	674
1984\85		171	74	109	0.64	342	2.03	1.87	547
1985\86		227	104	98	0.43	499	2.19	2.21	443

Source: Adminisration Reports, Cochin Port, relevant years.

increase, that is the 'Average TRT' from 1.62 days to 2.19 days, and the 'Average DT' from Ø.26 days to Ø.43 days over the period 1981/82 to 1985/86. These indicators reveals that there is wide scope for the improvement in container cargo handling at Cochin port with the introduction of modern equipments.

An examination of the causes for detention reveals some interesting results. Table 4.7 gives the details on the causes for detention of ships at the outer roads. It can be observed from the table that the 'Causes of detention due to ship', 'Lack of proper navigation' and 'Whether constraints' were negligible compared to the constraints like 'Berth not availlable', and 'Other reasons'. This supports our earlier results about the waiting tine and detention time.

Table 4. 7. PERCENTAGE CAUSES OF DETENTION TIME OF SHIPS AT OUTER ROADS

YEAR	CAUSES DUE TO SHIP	BERTH NOT AVA-ILABLE	TIDAL CONSTRA-INTS	WEATHER CONSTRA-INTS	LACK OF PROPER NAVIGATION	OTHER REASONS
1979	1.1	81.3	2.3	Ø.1	1.5	13.7
1980	NIL	79.6	2.1	NEG	Ø.8	17.5
1981	1.8	75.4	1.7	NIL	1.4	19.7
1982	1.4	65.4	3.8	Ø.1	Ø.5	28.8
1983	4.6	67.7	5.2	NIL	NEG	22.5
1984	Ø.9	59.6	4.5	NIL	NEG	45.Ø
1985	NIL	79.6	2.6	NIL	NEG	7.8
1986	NIL	87.9	6.2	NIL	NEG	5.9

Source: Administration Reports, Cochin Port, relevant years.

In the case of General Cargo vessels the 'Average time worked per-ship' [in days], and the 'Average time lost per-ship' [days] were higher than that for the Container vessels over the period 1977/78 to 1985/86. Which tells us that the 'Average time worked per Container vessels is less,(the expected result, for the Container vessels), also the average time lost for General

cargo vessels is higher,(which in turn inflates the inefficiency of the port, see table 4.5).

Moreover there is hope that the 'Average time lost per-ship in the case of Container vessels is less than that of general cargo vessels. Which is an indication of the better performance of Container vessels. In the case of General Cargo vessels while the 'Average service time [worked]' for 1000 tonnes of cargo has increased from 31.4 hours to 34.5 hours, at the same time the 'Average service time [lost]' for 1000 tonnes of cargo shows a decline from 84 hours to 67.7 hours over the period 1977/78 to 1985/86, and in the case of Container vessels both these indicators show an increasing trend, from 15.8 hours to 19.1 hours and from 21.8 hours to 24.8 hours respectively over the same period. For Container vessels the time lost has shown a steady increasing trend ranging between 10.5 hours (1981/82) to 24.8 hours (1985/86). Which reveals the inefficiency of the port.

The total tonnage handled(table 4.6) in the case of Tankers has steadily increased from 9.93 lakh tonnes to 38.63 lakh tonnes, and that of Other Vessels decreased from 9.26 lakh tonnes to 4.26 lakh tonnes. For Fertiliizer Vessels the tonnage recorded a steady increase from 1.54 lakh tonnes to 7.69 lakh tonnes for the period 1964/65 and 1985/86. The Container vessels also have shown a steady increase in tonnage handled, from 1.47 lakh tonnes to 2.21 lakh tonnes over the period 1981/82 to 1985/86. This is the period when Cochin Port acquired most of the important cargo handling equipments. The 'Average output per berth day' [in tonnes] for Tankers has increased from 3,958 tonnes to 11,197 tonnes and for

'Other vessels' also it showed a slight increase from 272 tonnes to 304 tonnes. For Fertilizer vessels there was not much change over the period 1964/65 and 1985/86 respectively. In the case of Container vessels there is a significant decline as far as the 'Average output per berth day' is considered, from 799 tonnes to 443 tonnes over the period 1981/82 to 1985/86. The decline is mainly because of lack of cargo, as mentioned earlier the cargo began to divert to the nearby port(see table 4.8), also some of the important liners (the international container shipping companies) started quitting Cochin because of unhealthy labour problems(see table 4.9) in the latter period.

The table 4.8 gives the details of the cargo diverted from Cochin port to the other two ports. From the table it is clear the products like tea and coffee has shifted to the port of Tuticorin and New-Mangalore respectively(see table4.8). The shift is also clear in the case of marine products and cashew kernals. In the early eighties the shift of these cargo is mainly due to the labour problems at Cochin port(see table 4.9).

Table 4.9 gives the details of the of strikes launched during 1981-1987 at Cochin port. From the table the maximun man-days lost was during 1984, when the porterage labour and the staff went for strike. Also most of the strikes were for high renumeration. The porterage labour did the maximum number of srikes during the period 1981-1986.

Table 4. 8. DIVERGENCE OF TRAFFIC FROM COCHIN PORT

[in tonnes]

CARGO	PORT	1981/82	1982/83	1983/84	1984/85	1985/86
MARINE	TUTICORIN	510	3415	8810	12573	826
PRODUCTS	MANGALORE	3532	4166	3141	2718	138
CASHEW	TUTICORIN	5545	243	15	226	220
KERNALS	MANGALORE	1572	1286	597	480	.31
TEA	TUTICORIN	4534	4718	4844	20203	2881
	MANGALORE	-	-	-	-	
COFFEE	TUTICORIN	-	-	-	-	-
	MANGALORE	45201	46965	39489	32422	-

Source: M.J.Kurian, Port of Cochin, India; 'An Alternative Development
Model'.1986.

Table 4.9. DETAILS OF STRIKES LAUNCHED DURING 1981-1987.

Duration	Man days Lost	Category of Workers
1. 24-4-81 to 11-5-1981.	1035	Mobile Equipment Staff.
2. 28-4-1981.	300	Porterage Labour.
3. 12-6-81 to 16-6-1981.	323	Wharf Staff.
4. 27-9-1982.	1140	Porterage Labour.
5. 28-9-1982.	1140	Porterage Labour.
6. 28-10-1982.	480	Porterage Labour.
7. 2-2-1983 to 6-2-1983.	692	Mobile Equipment Staff.
8. 16-5-1983 to 22-5-1983.	752	Maintenance Staff.
9. 23-12-1983 to 4-1-1984.	5156	Porterage Labour.
10. 16-3-1984 to 31-3-1984.	80034	Port Staff & Labour.
11. 1-4-1984 to 10-4-1984.	47938	Port Staff & Labour.
12. 16-5-1985 to 23-5-1985.		
13. 23-5-1985 to 9-6-1985.	3436	Exe. Staff of Porterage

Source: Compiled by the P & R Section, Cochin Port .

The number of gangs employed per-ship, per- shift (table
4.5) in the case of port and dock labourers has decreased for
General Cargo and Container vessels for the period 1977/78 to
1985/86, for Total vessels also it shows a declining trend for
both port and dock labourers. This may be partly due to the reason
of adapting new cargo handling techniques such as containerisation
etc. and partly due to the lack of availability of cargo because

of the divergence of the traffic from Cochin, by the emergence of the major ports like Tuticorin towards the south and New Mangalore towards the north of Cochin(see also table 4.8).

The 'Average output per gang shift' for port and dock labour(table 4.5) for total vessels clearing from Cochin port has increased from 79.7 tonnes to 117.4 tonnes and from 86.7 tonnes to 114.8 tonnes respectively over the period 1977/78 to 1985/86. This is an encouraging trend, but this should be seen in view of the fact that the increase in output during this time was mainly in terms of bulk cargo, for which only fewer number of labourers are required. For General Cargo vessels this indicator has increased from 75.5 tonnes to 90.3 tonnes for shore labour and 64.4 tonnes to 87.9 tonnes for dock labour respectively, and for Container vessels also it has shown a steady increase from 85 tonnes to 219 tonnes and 62.2 tonnes to 219 tonnes in the case of shore and dock labour respectively for the same period. The rise was very high during the years 1983/84, 1984/85 and 1985/86. This is an encouraging result and later in the productivity analysis also we are getting a similar trend.

The 'Average output of shore and dock labour per man-hours' in the case of Container vessels(table 4.5) has increased from 0.9 tonnes to 2.3 tonnes and 0.8 tonnes to 2.7 tonnes respectively over the period 1977/78 to 1985/86. In the case of General cargo vessels the indicator has shown a stagnant trend around 0.8 tonnes for port labour and a slight increase for dock labour around 1 tonne on an average over the period 1977/78 to 1985/86. In the case of Total vessels there is a slight increase

in the indicator for both port and dock labour.

The salient performance indicators in shipping such as the Average Service Time Per Ship, [that is, total time in berth days] and Average Service Time Per 1000 tonnes of Cargo [in hours], of Cochin Port, shows that there was not much changes in both these indicators over the period 1977/78 to 1985/86 [see table 4.10]. The Average Service Time Per Ship in 1977/78 was 4.2 days and it was the highest in 1979/80 [5.5 days], and was lowest in 1982/83 [3.6 days], and in 1985/86 it recorded 4.5 days.

Table4.10.SALIENT PERFORMANCE INDICATORS(shipping &traffic)

YEAR	SHIPPING		TRAFFIC	
	AVE.SERVICE TIME/SHIP TOTAL TIME IN BERTH(Days)	AVE.SERVICE TIME/1000 TONS OF CARGO (Hours)	AVE.OUTPUT OF SHORE LABOUR/ GANG SHIFT (Tonnes)	AVE.OUTPUT OF SHORE LABOUR/ MAN HOUR (TONNES)
1978	4.2	19.2	79.7	0.8
1979	4.6	21.0	80.9	0.9
1980	5.5	22.2	74.7	0.8
1981	5.0	18.2	72.7	0.8
1982	4.0	16.0	76.7	0.8
1983	3.6	14.5	85.9	0.9
1984	4.3	15.3	107.7	1.1
1985	5.0	21.7	109.5	1.1
1986	4.5	15.8	117.4	1.2

Source: Administration Reports, Cochin Port, relevant years.

In the case of the Ave. Service Time for 1000 tonnes of Cargo the time taken in 1977/78 was 19.2 hours, and the lowest during the period was recorded in 1982/83 [14.5 hours], the highest time taken was in 1979/80 [22.2 hours]. In 1985/86 the Ave. service time per 1000 tonnes of cargo was 15.8 hours, it showed a decline from the previous year 1984/85 [21.7 hours]. In the case of traffic handled, the average output of shore labour per gang-shift has increased from 79.7 tonnes to 117.4 tonnes, and the

average output   of   shore   labour   per   man-hour   also   has   also
increased from Ø.8 tonnes to 1.2 tonnes.

Now we   shall dicuss   the adaptation   of new   type of cargo
handling at   Cochin. Cargo Unitization refers   to various methods
where by a number of small items of cargo can be put together and
handled on a number of standard size, with the use of mechanised
equipment.   The   objective   in   unitizing   cargo   is to reduce and
simplify handling processes by eliminating break-bulk handling and
thus reduce overall cost of transport. Unitized cargo is handled
mechanically, and thus reduces the amount of labour required and
speeds up the process of cargo handling.

The two methods of cargo unitization currently going on at
Cochin are 'Palletization' and 'Containerization'. Palletisation
is a process involving the use of a wooden or metal platform
(pallet) on which boxes, bags, or other goods are strapped for
transport as a single unit. In the case of palletization the
tonnage handled was not shown much increase. In 1975/76 through
Palletization Ø.43 lakh tonnes of cargo was handled at Cochin
Port, and by 1986 it increased up to Ø.52 only, and the highest
quantity of palletized cargo was handled in 1982/83 [1Ø.88 lakh
tonnes]. For Containerization, the total cargo handled at Cochin
Port increased from Ø.27 lakh tonnes in 1975/76 to 2.21 lakh
tonnes in 1985/86, at the same time the total traffic handled
[less oil and fertilizer] at Cochin was steadily decreasing over
the period 1975/76 to 1985/86. Of this total traffic the unitized
cargo handled was only 6.3 per cent in 1975/76, but by 1985/86, it
increased to 42 per cent [see table 4.11].

Table 4.12. gives the detailed picture of the important Palletized and Containerized commodities that were handled through Cochin Port. In the case of tea pallets there was not much fluctuation in tonnage handled. The lowest tonnage of 'tea palletised' was in 1978/79 [17560 tonnes],and the highest was in 1982/83 [47009 tonnes], and in 1985/86 it has come down to 20902 tonnes. In the case of Containerized tea cargo the tonnage handled has increased from 2240 tonnes in 1975/76 to 27668 tonnes in 1979/80 and then decreased to 7388 tonnes. The tonnage of cashew pallets were not showing much fluctuations over the period 1976 to 1986, but for containerized cashew kernals there was a steady increase during the period, this is true in the case of containerized coffee tonnage also, but at the same time the palletized coffee tonnage was showing some fluctuations, it increased from 2244 tonnes in 1976 to 12510 tonnes in 1986. From the above details it is clear that there is an increasing trend towards unitization of cargo at Cochin Port and the unitization is much in favour of containerisation & palletisation.

Table 4.11. PALLETISED AND CONTAINERISED TRAFFIC AT COCHIN PORT
in lakh tonnes

YEAR	PALLETISED CARGO(1)	CONTAINERISED CARGO(2)	TOTAL CARGO LESS(1)&(2)=(3)	PER CENTAGE OF (1)&(2) TO (3)
1976	0.43	0.27	11.05	6.33
1977	0.67	0.38	9.80	10.71
1978	0.40	0.21	8.61	7.08
1979	0.38	0.35	9.60	7.60
1980	0.41	1.16	9.10	17.25
1981	0.73	1.38	6.10	34.59
1982	0.50	1.47	7.90	24.94
1983	0.88	1.64	8.70	28.97
1984	0.65	1.74	8.20	29.15
1985	0.50	1.87	6.60	35.91
1986	0.52	2.21	6.40	42.66

Source: Administration Reports, Cochin Port, relevant years.

Table 4.12.UNITISATION OF CARGO: PALLETISATION AND CONTAINERISATION [tonne

YEAR	TEA		CASHEW KERNALS		COFFEE	
	PALLETS	CONTAINER	PALLETS	CONTAINER	PALLETS	CONTAINER
1976	20871	2240	10312	10598	2244	3359
1977	46026	9628	6730	3587	2353	1300
1978	18496	4633	1850	446	6462	1997
1979	17560	5552	3785	3020	2057	1432
1980	22290	27668	7680	10443	3397	4713
1981	44053	22184	6154	8052	10510	8511
1982	27866	13721	2906	5955	9675	17311
1983	47009	11675	9620	14592	12100	21973
1984	29687	12466	8121	23924	10143	15935
1985	20902	18252	10110	26629	6445	17452
1986	19818	7388	4650	28412	12510	24435

Source: Administrative Reports, Cochin Port, relevant years.

The per centage utilization of berth facilities at Cochin Port wer given in table 4.13. In the case of wharf berths the per centage utilizatio has decreased over the period 1974 to 1986. In 1974 of the total available 84.4 per cent of the berths were utilized, and it has gone up to 87.7 pe cent in 1977 and it has come down to 62.7 per cent in 1983, and in 1986 th per centage utilization of wharf berth was only 69.1 per cent. The over al utilisation was fluctuating between 55 per cent and 65 per cent for th period 1974 to 1986.

Table 4.13. UTILISATION OF BERTHS AT COCHIN PORT [% utilisation]

YEAR	WHARF BERTHS	TANKER BERTHS	OIL TERMINAL	STREAM MOORINGS	OVER ALL UTILISATION	OPEN BERTH Q 9
1974	84.4	61.3	-	32.1	57.1	-
1975	78.3	74.5	-	33.5	59.3	-
1976	87.7	57.9	-	33.7	64.2	-
1977	77.3	54.2	-	33.0	62.1	-
1978	80.3	39.1	-	33.0	59.0	75.2
1979	85.6	49.7	-	49.7	64.6	86.9
1980	82.7	45.3	-	39.1	61.8	81.6
1981	65.9	49.7	-	32.5	54.7	76.9
1982	65.3	52.3	-	38.9	54.8	71.2
1983	62.7	46.7	-	50.7	54.6	65.6
1984	70.2	46.0	6.1*	43.0	55.4	72.6
1985	71.0	56.2	26.00	60.0	61.4	77.2
1986	69.1	25.0	38.90	62.3	59.5	77.9

* commissioned on 12/1/1984.
Source: Administration Reports, Cochin Port, relevant years.

110

The utilization of the open berth Q 9 [Container berth] was also increased from 75.2 per cent[in 1978] to 86.9 per cent[in 1979] and after that it declined to 65.6 per cent[in 1983], and the rest of the years the utilization was more than 70 per cent.

In the case of tanker berths the per centage utilization shows decline over the period 1974 to 1986, in 1974 the per centage tanker berth utilization was 61.3 per cent and by 1986 it has declined to 25 per cent. The per centage utilization of the stream moorings shows an increase from 32.1 per cent in 1974 to 62.3 per cent in 1986. The utilization of the oil terminal berth, which was commissioned only in 1984 has steadly increased from 6.1 per cent in 1984 to 38.9 per cent in 1986.

The per centage availability of cargo handling equipments, that is the availability of the equipments to total time work, such as the wharf cranes, mobile cranes and fork lift trucks etc. were declined over the period 1974 to 1986 [see Table 4. 14].In the case of Wharf cranes per centage availabilty was drastically declined from 83.7 per cent in 1974 to 20.1 per cent in 1986, and that of the Mobile cranes and Forklift trucks were also shown a decline from 76.5 per cent to 31.04 per cent and from 48.1 per cent to 27.8 per cent respectively over the same period.

Table 4.14.   AVAILABILITY OF CARGO HANDLING EQUIPMENT [% availability]

YEAR	WHARF CRANES	MOBILE CRANES	FORK LIFT TRUCKS
1974	83.7	76.5	48.1
1975	88.3	72.4	57.2
1976	84.8	74.3	58.4
1977	87.8	82.4	71.5
1978	80.9	80.5	84.1
1979	92.8	64.1	71.6
1980	90.3	71.8	65.8
1981	80.9	68.6	68.6
1982	89.9	70.8	63.1
1983	30.1	37.4	47.1
1984	30.1	29.3	41.6
1985	25.8	21.8	26.8
1986	20.1	31.1	27.7

Source: Administration Reports, Cochin Port, relevant years.

The average utilization of storage facilities [in sq. mtrs.] at Cochin Port was always much less than the available facilities in the case of Mattancharry wharf, Ernakulam wharf, and in transit shed [see table 4.15]. In 1974 the total available facility was 66441 sq. mtrs. but only 52448 sq. mtrs. were utilized, by 1986 the available facilities has increased up to 72053 sq. mtrs. but of it only 59165 sq. mtrs. were utilized.

Table 4.15. AVERAGE UTILISATION OF STORAGE FACILITIES AT COCHIN PORT

[in square metres]

YEAR	MATTANCHERY WHARF		ERNAKULAM WHARF		TRANSIT SHED		GRAND TOTAL	
	AVAILABLE FACILITY	UTILISED FACILITY	AVA. FAC.	UTILI. FAC.	AVA. FAC.	UTILI. FAC.	AVA. FAC.	UTILI. FAC.
1974	38410	31134	29959	20264	2072	1050	66441	52448
1975	38410	27408	29959	20662	2072	1145	66441	49215
1976	38244	32276	29300	23723	1759	1750	69303	57749
1977	36973	29750	29300	22734	1750	1750	68023	54234
1978	38863	34245	29300	23481	1750	1750	69913	59476
1979	38592	32395	29300	25100	1750	264	69642	57759
1980	38592	32110	33850	26353	1750	564	74192	59027
1981	38492	37604	33850	27069	743	380	73085	65053
1982	34921	29579	33850	27813	743	250	69514	57642
1983	38476	33987	33850	27998	743	580	73075	62565
1984	36106	29025	33856	30858	1764	638	71726	60521
1985	36106	30300	33856	28426	1764	1008	71726	59734
1986	36433	31766	33856	26200	1764	1199	72053	59165

Source: Administation Reports, Cochin Port, relevant years.

Conclusion:

The above analysis permits us to arrive at some important conclusions on the operational performance of Cochin port. On the whole the operational performance of the port was not satisfactory in the period of analysis (1971-1986). The total number of vessels clearing at the port, especially the general cargo vessels has shown a declining trend, this can have long term implications regarding the future prospects of the port. The Net Registered Tonnage (NRT) of the general cargo vessels cleared at the port also recorded a decline (implying that only smaller vessels visited the port during the period). The slight increase in the NRT of the container vessels also reveals that, the container vessels cleared were also smaller in size. This leads us to the conclusion that Cochin had already became a feeder to port of Colombo. The container vessels sailing from Cochin hand over the

cargo to larger vessels at Colombo, because of the modern cargo handling facilities there.

Both the number and their tonnage handled of ships visting at Cochin from different countries has declined drastically, only for coastal shipping there seem to an improvement in both number and tonnage over the period. The average turn round time of ships clearing from Cochin, did not improve over time, especially for container vessels. Also the average service time lost has increased from 21.8 hours to 24.8 hours in the case of container vessels for the period 1977 to 1986. This poor performance of the port has forced the international liners, (shipping conferences concentrating on container freight transport) to pull out from Cochin.

The introduction of container facilities (such as transfer cranes, trailers etc.), in cargo handling has resulted in increase in tonnage handled of shore labour per gang shift. But this is not adequate. The divergence of cargo to other ports, the reduction in the unitised cargo traffic through Cochin, and the less utilisation of the facilities at Cochin port together supports this argument.

II. **FINANCIAL PERFORMANCE INDICATORS OF COCHIN PORT:**

Cochin Port has started a new system of accounting in the year 1969. The trends in the important financial indicators such as the operating income, operating expenditure, the operating ratio, and the net surplus etc. will help us to analyse the sound financial background of the port.

(1).Income and Expenditure of Cochin port.

The income, expenditure and surplus details of Cochin Port are shown in table 4.16. The operating income of the port has shown a steady increase from Rs.370.06 lakhs to Rs.3072.68 lakhs over the period 1970 to 1986. the operating expenditure also has shown a steady increase from Rs.281.73 lakhs to Rs.1974.71 lakhs over the same period. If we look at the graph of trends in operating income and and expenditure[see graph 4.2], it is clear that except in the years 1973, 1974 and 1975 the operating income was above the operating expenditure, in 1983, both operating income and expenditure coincides. Also in 1985 there was a sudden decline in operating expenditure of the port.

The miscelleneous income and expenditure is important as it accounts for a ports other financial matters. In the case of the miscellaneous income and expenditure, the latter was always greater in the period of analysis compared to the former. The graph of the trends in miscellaneous income and expenditure[graph 4.3] reveals that the miscellaneous expenditure was above the miscellaneous income. In the late 70s and early 80s the increase in the miscellaneous expenditure was steady, in the year 1986 it was the highest.

GRAPH. 4.2. TRENDS IN OPERATING INCOME &EXPENDITURE

INDEX 1969—70 =100

YEAR

□   OPERATING INCOME   +   OPERATING EXPENDITU
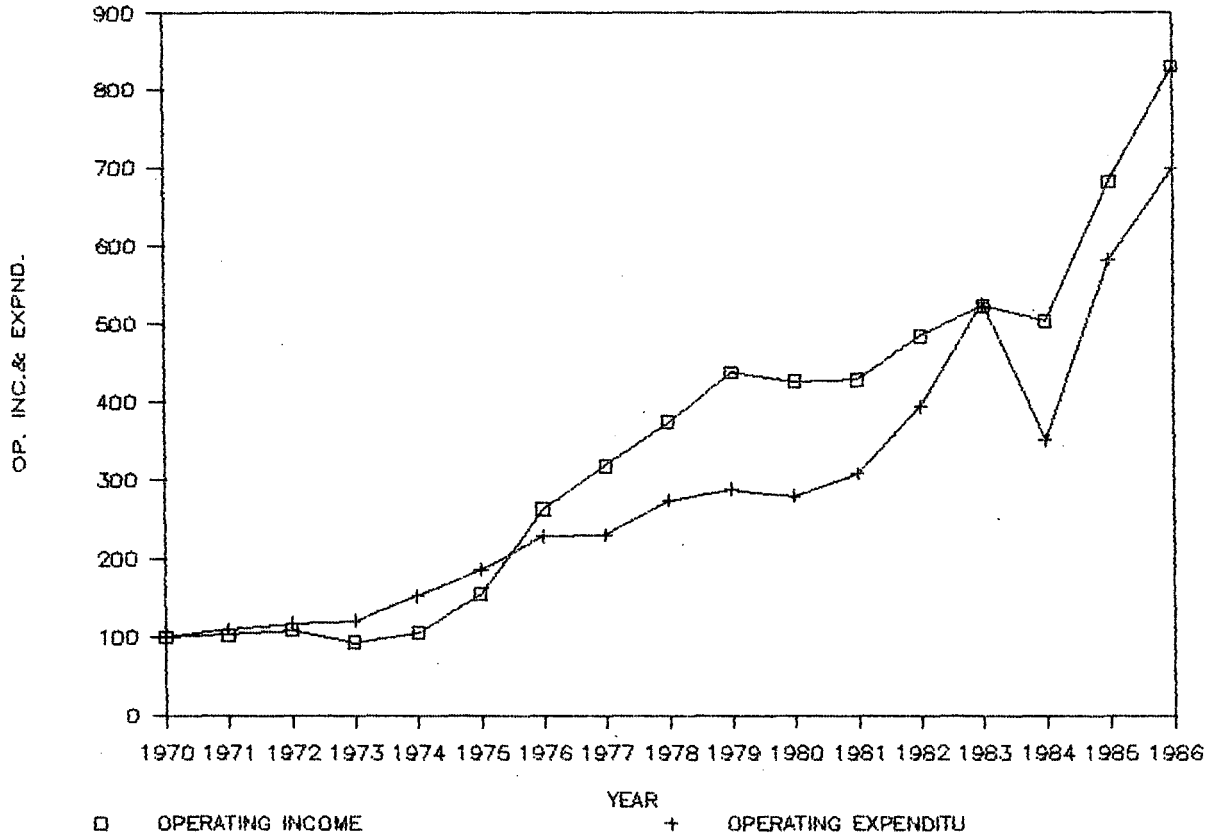
GRAPH. 4.3 TRENDS IN MISCLL. INCOME &EXPENDITURE

INDEX 1969—70 =100

YEAR

□   FIN&MISCL INCOME   +   FIN&MISC EXPD.
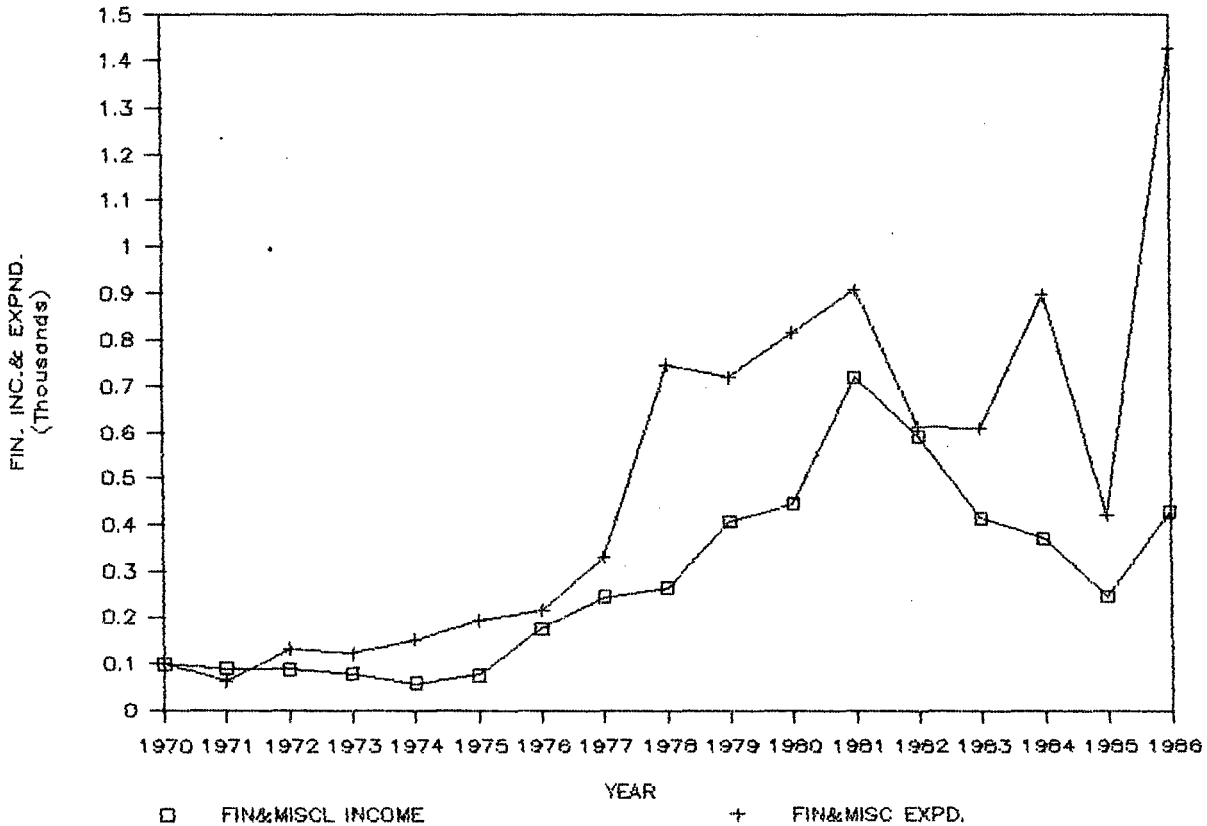
Table 4.16.

INCOME, EXPENDITURE AND SURPLUS AND DEFICIT OF COCHIN PORT
(Rs. in Lakhs)

YEAR	OPERATING INCOME	OPERATING EXPENDI-TURE	FINANCE & MISCEL. INCOME	FINANCE MISCEL. EXPEN.	TRANSFER FROM RESERVE	TRANSFER TO RESERVE	TOTAL SURPLUS(+) DEFICIT(-) SIGN
1970	370.06	281.73	44.49	83.92	0.29	32.42	27.13 (+)
1971	381.72	312.03	40.22	52.32	0.40	35.79	32.48 (+)
1972	404.49	333.71	39.50	112.74	0.00	98.99	90.80 (-)
1973	348.17	341.77	35.31	103.48	0.00	73.28	129.85 (-)
1974	391.15	431.49	25.80	128.67	0.00	6.31	143.78 (-)
1975	575.51	527.22	33.95	163.48	0.00	8.21	82.01 (-)
1976	972.27	645.80	79.04	182.37	0.00	56.21	222.38 (+)
1977	1180.35	651.74	109.55	278.85	0.00	300.88	149.30 (+)
1978	1387.85	774.77	118.14	626.48	52.00	156.74	113.36 (+)
1979	1623.13	815.50	181.80	602.93	11.14	222.69	321.05 (+)
1980	1580.90	790.99	198.68	683.64	175.49	202.19	146.43 (+)
1981	1589.05	870.65	320.35	762.82	0.00	216.82	30.93 (+)
1982	1791.72	1112.91	263.54	514.20	0.00	225.47	208.84 (+)
1983	1934.05	1481.82	185.04	512.00	0.00	298.42	555.08 (-)
1984	1864.06	990.35	166.11	752.46	145.15	232.94	214.03 (-)
1985	2528.56	1640.46	110.36	335.35	0.00	427.57	321.94 (-)
1986	3072.68	1974.71	191.78	1197.45	0.00	254.57	652.64 (-)

Source: Administration Reports, Cochin Port Trust, relevant years.

The 'transfer from reserve' which is a revenue to the port was negligible compared to the 'transfer to reserve', an expenditure item, which was always showing an increasing trend for the port. But in the years 1980 and 1984 the transfer from reserve reported was noticeable amounts. The transfer to reserve has increased from Rs.32.42 lakhs [in 1970] to Rs.254.57 lakhs [in 1986]. The lowest amount was recorded in the year 1974 [Rs.6.31 lakhs] and the highest amount was in the year 1985 [Rs.427.57 lakhs].

If we look at the surplus or deficit of the port, we can observe that the port was making surplus and deficit alternatively over the period of analysis. In the early 70s and mid 80s the port was making deficit and during late 70s the port was consecutively

117

making surpluses. In the latter years the deficit that the port acquired was cumulative. This is not an encouraging trend for the sound development of the port in the coming years.

A detailed revenue account of Cochin port is given in table 4.17. From the income side we can observe that cargo handling and storage income and the port and dock charges including the pilotage fees and the estate rentals which are the major components of the operating income have shown an increasing trend over the period 1971 to 1986. The income on cargo handling and storage charges has increased from Rs.292 lakhs to Rs.2001 lakhs and the income on the port and dock charges including the pilotage fees has shown a steady increase from Rs.52 lakhs to Rs.800 lakhs and the estate rentals also has shown a rise from Rs.34 lakhs to Rs. 262 lakhs, but the railway rentals has not shown much increase, even though it has shown a marginal rise, over the period. The total income of the port which is a sum of operting income and financial and miscellaneous income has increased from Rs.422 lakhs to Rs.3265 lakhs over the period of analysis.

On the expenditure side the cargo handling and storage expenditure, the expenditure on port and dock facilities for shipping and that on the rentable land and buildings has shown a minor increase only over the period 1971 to 1984 compared to the increase in the latter period. The cargo handling and storage expenditure has increased from Rs. 107 lakhs to Rs.511 lakhs and the port and dock facilities also has shown an increase from Rs. 116 lakhs to Rs.983 lakhs over the period 1971 to 1983, and in 1984 it has come down to Rs.555 lakhs and again in 1985 and in 1986 it increased steadily to Rs.1086 and Rs.1371 respectively.

Table 4.17.

DETAILED REVENUE (INCOME AND EXPENDITURE) ACCOUNT OF COCHIN PORT
INCOME (Rs. in lakhs).

YEAR	CARGO HANDLING & STORAGE CHARGES	PORT&DOCK CHARGES +PILOTAGE FEES	RAILWAY EARNINGS	ESTATE RENTALS	TOTAL OPERATING INCOME	FINANCE & MISCELL. INCOME	TOTAL INCOME	OPERATING SURPLUS/ DEFICIT	NET SURPLUS/ DEFICIT.
1971	292	52	4	34	382	40	422	70	58
1972	309	56	4	36	404	40	444	71	(-)3
1973	253	55	4	37	348	35	383	6	(-)62
1974	292	52	4	44	391	26	417	(-)48	(-)143
1975	460	64	6	46	576	34	610	48	(-)80
1976	655	250	5	83	993	60	1053	343	230
1977	762	309	6	104	1180	110	1290	529	360
1978	903	367	8	110	1388	118	1506	613	185
1989	1079	436	7	102	1623	182	1805	808	386
1980	1027	425	7	123	1581	199	1780	486	2
1981	1097	355	7	140	1589	320	1909	336	(-)107
1982	1163	475	8	146	1792	264	2056	267	17
1983	1295	473	9	157	1934	185	2119	55	(-)382
1984	1255	453	7	149	1864	166	2030	341	(-)246
1985	1567	714	12	236	2529	110	2639	165	(-)80
1986	2001	800	9	262	3073	192	3265	339	(-)667

EXPENDITURE (Rs. in lakhs).

YEAR	CARGO HANDLING & STORAGE	PORT&DOCK FACILITIES FOR SHIPPING	RAILWAY WORKING	RENTABLE LAND & BUILDINGS	MANAGEMENT & GEN. ADMINIS- TRATION	TOTAL OPERATING EXPENDITURE	FINAN. & MISC EXPD.	TOTAL EXPENDI- TURE.
1971	107	116	6	24	59	312	52	364
1972	119	113	5	23	74	334	113	447
1973	114	121	5	22	79	342	103	445
1974	141	161	5	22	102	431	129	560
1975	174	194	7	28	124	527	163	690
1976	203	247	7	29	165	650	165	815
1977	191	244	7	32	179	652	278	930
1978	228	287	9	40	211	775	626	1401
1979	244	299	8	37	222	816	603	1419
1980	279	454	8	58	303	1094	684	1778
1981	331	425	56	59	382	1253	763	2016
1982	365	637	59	52	412	1525	514	2039
1983	390	983	58	51	507	1989	512	2501
1984	382	555	7	46	533	1523	753	2276
1985	471	1086	12	72	723	2364	355	2719
1986	511	1371	12	81	759	2734	1198	3932

Source: Administration Reports, Cochin Port Trust, Relevant years.

The striking feature in the expenditure side of Cochin Port is the steady growth of the management and general administration expenditure, which in 1971 was only Rs.59 lakhs and has increased upto Rs.759 lakhs by 1986. This can be explained by the growth in the structure of the port as whole. the total operating expenditure of the port has increased from Rs.312 lakhs in 1971 to Rs.2734 lakhs in 1986. The financial and miscellaneous expenditure has shown some fluctuations over the period. It increased from Rs.52 lakhs to Rs.278 lakhs over the period 1971 to 1977 and suddenly in 1978 it shot upto Rs.626 lakhs and increased upto Rs.763 lakhs in 1981, and it came down to Rs.514 lakhs and Rs.512 lakhs in the following two years and again increased to Rs.753 lakhs, and drastically come down to Rs.355 in the year 1985, and shot upto Rs.1198 in the year 1986.

The total expenditure has steadily increased from Rs.364 lakhs to Rs.3932 lakhs over the period 1971 to 1986. The operating income has shown deficit only in two years, in 1974 [Rs. 40 lakhs], and in 1983 [Rs.55 lakhs], and in all the other years the port has shown a significant amount of operating surplus. It was the lowest in the year 1973 [Rs.6 lakhs], and the highest was in the year 1979 [Rs.808 lakhs]. But the net income of the port has shown some fluctuations. In the beginning till the mid 1970s the port was showing deficit, but in the latter half of the 1970s the surplus of the port has increased from Rs.238 lakhs to Rs.386 lakhs. Again in the beginning of the 1980s the port started accumulating deficit and by 1986, the deficit of Cochin Port has come upto Rs.667 lakhs.

Table .4.18

TOTAL COST AND TOAL REVENUE OF COCHIN PORT (RS. IN LAKHS)				
YEAR	TOTAL COST	TOTAL REVENUE	SURPLUS/ FEFECIT	OPERATIONG SURPLUS / DEFECIT
1970	398.07	414.55	+16.48	+88.33
1971	400.15	422.35	+22.28	+69.69
1972	445.25	303.48	-61.77	+70.78
1973	560.16	416.96	-143.20	+6.40
1974	566.29	44.95	-124.34	-40.34
1975	698.91	609.46	-89.45	+48.29
1976	884.38	1051.32	+166.94	+342.78
1977	1230.67	1289.90	+59.23	+528.61
1978	1557.99	1557.99	00.00	+613.08
1979	1641.12	1804.99	+115.01	+807.63
1980	1980.29	1954.60	-25.70	+486.45
1981	2332.08	1909.40	-422.68	+336.65
1982	2264.29	2055.26	-209.04	+267.37
1983	2799.18	2119.09	-680.09	-54.60
1984	2508.51	2175.32	-333.19	+342.20
1985	3146.58	2638.92	-507.67	+165.00
1986	4185.94	3264.38	-921.56	+339.00

Total Revenue = Income on cargo handling & Storage Charges + Port and Dock charges (+pilotage) + Railway Earnings + Estate Rentals + Finance & Miscellaneous Income + Transfer from Reserve.

Total Cost = Expenditure on Cargo Handling and Storage + Port and Dock Facilities for Shipping(+Pilotage) + Railway Workings + Rentable land & Buildings + Management & General Administration + Finance & Miscellaneous Expenditure + Transfer to Reserve.

Source: Adminstration Reports of Cochin Port Trust, relevant years.

The total cost and total revenue of Cochin Port for the years 1970 to 1986 are given in table 4.18, the total cost includes the expenditure on cargo handling and storage, port and dock facilities for shipping including pilotage, management and general administration, finance and miscellaneous, and transfer to reserve. The total cost has increased from Rs.398 lakhs to Rs. 4185 lakhs over the period 1970 to 1986. At the same time the

total revenue which includes the income on cargo handling and storage, port and dock charges including pilotage, railway earnings, estate rentals, finance and miscellaneous, and transfer from reserve. The total revenue in most of the years was less than the total cost, which resulted in deficit for most of the years especially in the early part of the 1970s and 1980s. At the same time the operating surplus in almost all the years showed surplus except in 1974 and 1983, the only two years in which the port experienced an operating deficit.

Table 4.19. gives the details of the financial factors of Cochin Port over the period 1974 to 1986. The gross income has increased from Rs.416.96 lakhs to Rs.3264 lakhs, the gross expenditure has increased from Rs.560 lakhs to Rs.3931 lakhs over the period. The gross income & expenditure include the finance and miscellaneous income and expenditure. The 'Mean capital at charge' also has increased from Rs.1790 lakhs to Rs.10345 lakhs in the same period. The 'Operating ratio', which is the ratio of operating expenditure to operating income has shown some fluctuations over the period. The performance of the operating ratio was 110 percent in 1974 and has come down to 50 percent by 1979 and in 1986 it increased only up to 89 percent.

The capital expenditure (plan and non-plan) and the loan from the government and the capital debt of Cochin Port is given in table 4.22. The capital expenditure (plan and non-plan) of Cochin Port was Rs.240.13 lakhs in 1974 and it increased up to Rs.1907 lakhs in 1984 and has come down to Rs.565 lakhs in 1986. In 1979 the capital expenditure of the port was only Rs.62.84 lakhs. The loan from the government has also kept in phase with the capital

expenditure of the port showing the the highest amount of loan in the year 1984 (Rs.1578 lakhs). The capital debt of the port has shown a steady increase since 1979. In 1986 the capital debt of the port has come up to Rs.6663 lakhs.

Table 4.19. FINANCIAL FACTORS OF COCHIN PORT [Rs. lakhs].

YEAR	GROSS INCOME	GROSS EXPERDITURE	MEAN CAPITAL AT CHARGE	OPERATING RATIO [OPER.EXP./OPER INCOM]
1974	416.96	560.16	1789.87	110
1975	609.46	690.70	1917.30	92
1976	1051.32	828.17	2326.00	66
1977	1289.90	929.79	2781.32	55
1978	1505.99	1401.25	2959.30	56
1979	1809.99	1418.43	3061.25	50
1980	1779.58	1778.10	3301.14	69
1981	1909.40	2015.26	3626.95	79
1982	2055.25	2038.83	4289.60	85
1983	2119.00	2501.00	5624.00	103
1984	2030.00	2275.00	7337.00	82
1985	2639.00	2719.00	8986.00	94
1986	3264.00	3931.00	10345.00	89

Source:Administrative Reports, Cochin Port, relevant years.
Table 4.20. CAPITAL EXPEND. [PLAN & NON-PLAN] AT COCHIN PORT
[Rs. in lakhs]

YEAR	CAPITAL EXPENDITURE [PLAN AND NON-PLAN]	LOAN FROM GOVERNMENT	CAPITAL DEBT
1975	240.13	203	1150.96
1977	207.93	100	1496.33
1978	133.53	46	15.90
1979	62.84	62	1589.00
1980	310.76	255	1775.00
1981	452.34	366	2061.63
1982	1384.04	1175	3464.86
1983	1561.00	1023	4186.00
1984	1907.00	1578	5888.00
1985	1136.00	672	6358.00
1986	565.00	305	6663.00

Source: Administrative Reports, Cochin Port, relevant years.

The total liabilities of the port has increased from Rs.8114 lakhs to Rs.16004 lakhs and the total assets also has increased from Rs.8113 lakhs to Rs.16005 lakhs (Table 4.21). The total capital reserves of the port has shown a steady increase from

Rs.1774 lakhs to Rs.3324 lakhs over the period from 1971 to 1986.

The revenue reserves at the same time has declined over the period from Rs.1520 lakhs to Rs. 6 lakhs. The Capital assets over the period has shown an increase from Rs.3764 lakhs to Rs. 10959 lakhs and the Current assets has not shown any noticeable increase, in fact it declined from Rs.4263 lakhs in 1982 to Rs. 3248 lakhs by 1986 (see Table 4.21).

Table 4.21.		SUMMARISED BALANCE SHEET						
LIABILITIES [Rs. in lakhs]								
YEAR	CAPITAL RESERVES	GRANT FROM GOVERNT. TO F.H.P.	REVENUE RESERVE	DEPRECI- ATION PROVSION	CAPIT- AL DEBT	P.F.& PENSION	CURRENT LIABIL- ITIES	TOTAL LIABILI TIES.
1981	1774	378	1520	732	2062	258	1390	8114
1982	2079	430	1336	790	3455	266	1201	9557
1983	2432	460	1283	850	4186	273	1597	11081
1984	2659	460	7	909	5888	283	2096	12302
1985	3078	460	7	969	6358	287	2210	13369
1986	3324	460	6	1027	6663	297	4227	16004

ASSETS [Rs.in lakhs]					
YEAR	CAPITAL ASSETS	GRANT FROM GOVERNMENT TO FISHARIES HARBOUR PROJ	INVEST- MENTS	CURRENT ASSETS	DEFICIT TRANSFERRED TO REV. A/C.	TOTAL ASSETS
1981	3764	2	27	3972	348	8113
1982	4815	2	26	4263	452	9558
1983	6434	2	25	3489	1132	11082
1984	8241	2	24	3702	333	12302
1985	9731	-	25	2773	841	13370
1986	10959	-	35	3248	1763	16005

Source: Administration Reports, Cochin Port Trust, relevant years.

The total capital assets [capital work in progress] of Cochin port as on 31st march 1971 was Rs.721 lakhs and by the end of 31st march 1986 it has grown up to Rs.8696 lakhs and at the same time the total capital assets at original cost has increased from Rs.1517 lakhs to Rs.10958 lakhs over the same period. The net book value of Capital assets also has increased from Rs.1320 lakhs to Rs.9931 lakhs (see Table 4. 22).

The capital debt position of the port over the period of analysis was not satisfactory. It has steadily increased from Rs.737.47 lakhs to Rs.6662.54 lakhs over the period from 1971 to 1986. The loans from the government has increased from Rs.955.25 lakhs to Rs.7469.25 lakhs in the same period. The port also borrowed money from other sources and which stopped after 1979 [see table 4.23.].

Table 4.22.   TOTAL CAPITAL ASSETS [COSTS] OF COCHIN PORT [Rs. in lakhs]

YEAR	AS ON 1ST APRIL	ADDITIONS DURING THE YEAR	DELITIONS DURING THE YEAR	CAPITAL WORK IN PROGRESS	AS AT 31ST MARCH 1971	TOTAL CAPITAL AT ORGI-NAL COST	NET BOOK VLAUE OF CAPITAL ASSETS
1971	546	250.19	–	721	796	1517	1320
1972	–	–	–	850	838	1689	1467
1973	–	–	–	870	842	1744	1497
1974	–	–	–	892	869	1836	1564
1975	869	3.32	–	1025	873	1999	1701
1976	873	48.14	–	1607	921	2654	2331
1977	921	52.00	2.49	171	970	2909	2561
1978	970	618.93	76.14	1267	1513	3009	2528
1979	1513	26.46	–	1300	1540	3113	2560
1980	1540	264.36	–	1357	1804	3490	2834
1981	1804	0.29	1.15	1603	1803	3764	3032
1982	1803	–	18.81	2620	1801	4815	4025
1983	1801	–	0.86	4221	1800	6434	5584
1984	1800	–	–	5989	1800	8241	7341
1985	1800	–	–	7471	1800	9731	8761
1986	1800	–	–	8696	1800	10958	9931

Source:Administration Reports, Cochin Port, relevant years.

Table 4.23. CAPITAL DEBT OF COCHIN PORT
[Rs. in lakhs]

YEAR	LOANS FROM GOVERNMENT	TOTAL PAID	BALANCE	LOANS FROM OTHER SOURCE	TOTAL PAID	BALANCE	TOTAL CAPITAL DEBT
1971	955.25	257.9	697.25	65.22	25.00	40.92	737.47
1975	1457.25	321.2	1136.04	95.00	80.08	14.92	1150.96
1976	1787.25	363.6	1423.70	95.00	77.98	17.02	1440.72
1977	1887.25	404.4	1482.82	95.00	86.49	8.51	1491.33
1978	2033.25	447.1	1586.00	95.00	90.75	4.25	1590.39
1979	2095.25	506.5	1588.71	95.00	95.00	-	1588.71
1980	2350.25	575.1	1775.17	-	-	-	1775.17
1981	2716.25	654.6	2061.63	-	-	-	2061.63
1982	4208.25	753.4	3454.86	-	-	-	3454.86
1983	4992.25	806.7	4185.54	-	-	-	4185.54
1984	6694.25	806.7	5887.54	-	-	-	5887.54
1985	7164.25	806.7	6357.54	-	-	-	6357.54
1986	7469.25	806.7	6662.54	-	-	-	6662.54

Source: Administration Reports, Cochin Port, relevant years.

Details of the Capital Assets in Cochin Port:

The details of the Capital Assets in Cochin Port over the period 1971 to 1986 is given in Table 4.24. The land share in the capital assets has not shown much increase, it was Rs.29.74 lakhs in 1971 and has increased only up to Rs.33.42 lakhs in 1982 and by 1986 it declined to Rs.33 lakhs. The assets on capital dredging also has not shown any noticeable increase over the period even though the cost of dredging was one of the major component of cost accruing to the port. It was Rs.65.28 lakhs in 1971 and has increased up to only Rs.88 lakhs by 1986. The buildings and other structure assets has increased from Rs.105.71 lakhs to Rs.232 lakhs. Also in the case of wharves, roads and boundaries the capital assets has increasd only a small amount. In 1971 it was 146.94 lakhs and by 1986 it increased only upto Rs.161 lakhs.

TABLE_ 4.24   DETAILS OF CAPITAL ASSETS OF COCHIN PORT
[Rs. in Lakhs]

YEAR	LAND	CAPITAL DREDGING	BUILDING & OTHER STRUCTURES	WHARVES ROADS & BOUNDARIES	FLOTING CRAFTS	RAILWAY & ROLLING STOCK	DOCKS SEAWALLS PIERS & NAVIGATIONAL AIDS	CRANES & VEHICLES	PLANT & MACHINERY	WATER,FIRE, ELEC;PIPE, & OTHER INSTALLETIONS	OIL PIPE LINE INSTELLATION	MISCELLA-NEOUS	TOTAL CAPITAL ASSETS	CAPITAL WORK IN PROGRESS	FISHERIES HARBOUR PROJECT	TOTAL CAPITAL ASSETS [AT ORGINAL COST]	TOTAL DEPRE-TIATION	NET BOOK VALUE OF CAPITAL ASSETS
1971	29.74	65.28	105.71	146.94	319.26	48.09	5.73	53.71	5.05	16.36	0	0.02	795.9	720.89	0	1516.79	196.45	1320.34
1972	29.74	65.28	109.14	148.1	355.84	48.10	5.73	53.71	5.05	17.71	0	0.02	838.48	850.29	0.19	1688.90	221.75	1467.15
1973	29.74	65.28	110.6	148.67	355.84	48.10	5.73	53.71	5.71	18.62	0	0.02	842.03	870.05	31.6	1743.68	247.05	1496.63
1974	29.74	65.28	137.33	148.67	355.84	48.39	5.73	53.71	5.70	18.96	0	0.02	869.39	891.61	75.05	1836.05	272.35	1563.69
1975	29.74	65.28	139.2	148.67	355.84	48.39	5.73	53.71	5.71	18.96	0	1.47	872.71	1024.73	101.1	1998.54	297.65	1700.88
1976	29.74	87.76	158.95	149.74	355.84	48.48	7.92	53.71	6.07	20.12	0	2.52	920.85	1606.95	125.97	2653.77	322.35	2330.82
1977	29.74	87.76	200.56	154.02	355.84	48.48	10.14	54.28	6.60	20.28	0	2.65	970.35	171.11	167.39	2908.86	348.25	2560.6
1978	30.19	87.76	203.93	155.06	886.66	52.80	15.30	54.28	6.13	20.17	0	0.86	1513.14	1267.49	229.11	3009.74	481.46	2528.28
1979	33.42	87.76	229.13	154.13	886.66	52.82	13.97	54.72	7.30	15.98	2.64	0.86	1539.60	1300.20	272.95	3112.76	552.36	2560.39
1980	33.42	87.76	232.74	159.93	1104.39	53.23	13.97	54.72	7.30	52.99	2.64	0.86	1803.96	1357.35	328.21	3489.52	655.03	2834.49
1981	33.42	87.76	231.92	160.77	1104.39	53.22	13.97	54.60	7.30	53.09	2.64	1.06	1803.09	1603.35	357.93	3794.38	732.25	3032.14
1982	33.42	87.76	231.92	160.77	1102.50	53.22	13.97	53.57	7.30	53.09	2.63	1.06	1801.22	2619.50	394.11	4814.82	790.08	4024.74
1983	33.00	88.00	232.00	161.00	1103.00	53.00	14.00	54.00	7.00	53.00	3.00	0	1801.00	4221.00	412.00	6434.00	849.79	5583.75
1984	33.00	88.00	232.00	161.00	1103.00	53.00	14.00	54.00	7.00	53.00	3.00	0	1801.00	5988.00	452.00	8241.00	909.45	7341.33
1985	33.00	88.00	232.00	161.00	1103.00	53.00	14.00	54.00	7.00	53.00	3.00	0	1801.00	7471.00	459.00	9731.00	969.06	8761.45
1986	33.00	88.00	232.00	161.00	1103.00	53.00	14.00	54.00	7.00	53.00	3.00	0	1801.00	8696.00	462.00	10959.00	1027.4	9931.37

In the case of floating crafts the capital assets has increased from Rs.319.26 lakhs to Rs.1103 lakhs over the period 1971 to 1986. The capital assets on railway and rolling stock remained almost unchanged from Rs.48.09 lakhs in 1971 to Rs.53 lakhs by 1986. The investment on seawalls, piers and navigational aids of the port has increased from Rs.5.73 lakhs to Rs.14 lakhs over the period of analysis. The capital assets of Cochin port on cranes and vehicles and plant and machinery has not shown much increase. In the case of cranes and vehicles the assets has increased from Rs.53.71 lakhs to Rs.54 lakhs and for plant and machinery the assets has increased from Rs.5.05 lakhs to Rs.7 lakhs over the period 1971 to 1986.

The capital assets on water, fire, electricity, pipe and other installations has increased from Rs.16.36 lakhs to Rs.53 lakhs over the period of analysis. The assets on oil pipe line installations which started only in 1979, has increased from Rs.2.64 lakhs to Rs.3 lakhs by 1986. The total capital assets of Cochin Port in the period of analysis has increased from Rs.795.9 lakhs in 1971 to Rs.1803.96 lakhs by 1980 and by 1986 it has decreased to Rs.1801 lakhs. The capital work in progress assets has increased from Rs.720.89 lakhs to Rs.8696 lakhs by 1986.

The investment in the Fisheries Harbour Project (F.H.P),has increased from Rs.0.19 lakhs in 1972 to Rs.462 lakhs by 1986. The total capital assets of the port at original cost has increased from Rs.1516.79 lakhs to Rs.10959 lakhs over the period 1971 to 1986, and the total depreciation of the port has increased from Rs.196.45 lakhs to Rs.1027 lakhs in the same period. Finally the

net book value of the port's capital assets, which is the difference between the total capital assets at original cost and the total depreciation, has increased from Rs.1320.34 lakhs to Rs.9931 lakhs over the period from 1971 to 1986.

Conclusion:

The financial performance of Cochin port during the period of this analysis was not satisfactory. Most of the years the port was making deficit. But except for the years 1974 and 1983, the operating income of the port was more than the operating expenditure, that is, the port was making operating surplus in the period of analysis. The financial burden of the port was very high during the period, the loan from government increased, and the capital debt of the port has increased from Rs.1150.96 lakhs (in 1975) to Rs.6663 lakhs (in 1986).

The capital work in progress at Cochin port during the period has increased from Rs.721 lakhs to Rs.8696 lakhs over the period 1971 to 1986. The total capital assets at original cost of the port increased from Rs.1517 lakhs (1971) to Rs. 10959 lakhs (1986). The total capital at original cost constistuted of Rs.8696 lakhs as loan capital (79 %), Rs.462 lakhs as grand-in -aid (4%) and Rs.1801 lakhs from internal resources (17%).

On the expenditure side, the operating expenditure has increased from Rs.281 lakhs (in 1971) to Rs.1974.71 lakhs (in 1986), and the dredging expenditure, one of the crucial expenditures, has increased from Rs.65.28 lakhs (in 1971) to Rs.88

lakhs (in 1986). The financial burden of the port can be eased, if they can reduce the dredging expenditure. This can be done by acquring dredging vessels, instead of depending of agencies like the Dredging Corporation of India.

Notes and References

1. Despite the decline in the total number of ships cleared at the port, there has been a marginal increase in the number of ships per day. this may be explained in the form of delays in cargo handling.

2. The decline in number of Tankers and the increase in the NRT in the latter period is mainly due the the technological changes in shipping, ships with huge Dead Weight Tonnage(DWT), [The DWT is the weight in long tons of cargo, passengers, fuel and stores which a ship carries, when fully loaded down to the load line. It represents the actual carrying capacity of a ship.] were introduced as bulk carriers. The 'The Net Registered Tonnage'[NRT] is defined as the cubic capacity of a ship intended for revenue carrying. Another measure of ships size is The Gross Registered Tonnage'[GRT], which is the entire internal cubical capacity of a ship reckoned in weight. (100 cubic feet is taken as equal to one ton).

3. Container vessel is a ship designed to carry containers, a container is a box like equipment fairly large capable of carrying several tonnes of cargo, now widely used in transport systems, sea, road, rail and air. The containerisation, that is, a form of unitisation, combining of the small components or units of a load into a single larger unit. A Sea-Container is a metal box, most commonly 8'x8'x20' and 8x8x40' [that is a metal box with 8 feet height, 8 feet breadth and 20 feet length.].

CHAPTER V

TRENDS IN PRODUCTIVITY OF COCHIN PORT

In this chapter we shall discuss the trends in productivity, both partial and total of Cochin port. The main focus of the analysis is to look into the efficiency of the port. The partial productivity indices are simply the output per unit of the respective inputs, and they will not give a clear picture of the efficiency of the port. But the efficiency of the port in combining the various inputs according to the factor prices can be captured using the total factor productivity. Here also the aggregation of the factors of production and the fluctuations in the output affect the normal measure of productivity.

The standard measure of labour productivity as far as a port is concerned is the average productivity of labour per hook-hour. In the case of Productivity of Shore Labour, the trends in 'average produtivity of shore labour per effective hook-hour' (for import and export cargo) will give us some idea about their performance. Also we can look in detail for the productivity of shore labour and casual labour with respect to types of Cargo, such as General Cargo etc.

An attempt is also made to measure the productivity of capital. For calculating the capital productivity, we have to calculate the physical capital stock of Cochin port. The measurement of capital is one of the difficult problems as far as a port is concerned.(the details of which is discussed in the third chapter). The trends in capital productivity of the port

132

will give the productive efficiency of capital.

We are also looking at the Total Factor Productivity Growth [TFPG], of the port, for the partial productivities will not provide an exact productivity trend of the respective factors of production. The Total Factor Productivity (TFP) explains the unexplained factor conducive to the overall growth in efficiency, other than physical measures of capital and labour. TFP may be defined as the difference between the rates of growth of output and the rate of growth of inputs, appropriatily weighted. Here one of the most important things to be taken care of is the technological changes that have taken place in the port over the last one and a half decade, which will have a major impact on costs, factor proportions and productivity.

In section one of this chapter we shall dicuss the different measures of productivity concerning the port. The general measures of productive efficiency of the port is analysed in the sub-section by looking into the port efficiency indicators such as the average productivity per effective hook-hour, average output per man-shift, and turn round time etc. The partial productivity indices of labour and capital are estimated in the following section. We are also looking into the relationship between wage rate and labour productivity and the trends in capital intensity. Finally the total factor producivity indices is also estimated using the three general measures, namely Kendrick, Solow and Translog.

I. MEASUREMENT OF PRODUCTIVITY AT COCHIN PORT:

(a) Measures of Productive Efficiency

Productive efficiency of port and dock worker can be judged by looking at (i) port efficiency (direct measure), (ii) rate of cargo handling per gang-shift or man-shift (indirect measure). Productivity in general terms is defined as output per unit of input, and has often been equated with labour productivity. But in the case of a port, the measurement of conventional labour productivity is more difficult due to the nature of the port work. The conventional concept of labour productivity, that is output per worker, can not be applied in ports because the average daily employment is different due to the difference in the output handled. The usual measure of labour productivity in ports is the 'average productivity per effective hook-hour'. A more valid concept of labour porductivity would be 'output per gang-shift' or 'output per man-shift', than 'output per worker'. In the case of Cochin Port the average productivity per effective hook hour for the period 1973/74 to 1985/86 is given in table 5.1. Over the period(1974 to 1986), the indicator is giving an almost

Table 5.1.AVERAGE PRODUCTIVITY PER EFFECTIVE HOOK HOUR[in tonnes]

YEAR	IMPORTS TRADE	EXPORTS TRADE	TOTAL TRADE
1973/74	23.40	17.50	19.80
1974/75	27.00	22.00	24.60
1975/76	26.80	23.30	25.60
1976/77	23.00	22.40	22.70
1977/78	16.70	22.10	19.65
1978/79	20.50	21.60	20.90
1979/80	19.80	19.20	19.50
1980/81	20.40	19.70	20.00
1981/82	20.90	21.10	21.00
1982/83	23.50	21.70	22.60
1983/84	20.10	19.60	19.90
1984/85	17.10	19.20	18.30
1985/86	17.30	18.10	17.70

Source: Administration Reports Cochin Port, relevant years.
the period has taken according to the availability of data.

stagnant trend. That is, overall the productivity of the port is not encouraging. The performance seems to be better for export trade compared to import. This may be due to the fact that the container handling facilities are more used in the export trade.

A more meaningful measure of labour productivity is the average output per man-shift of category A & B workers. (table 5.2). The output per man-shift has only slightly increased over the period of analysis. In 1974 the output per man-shift was only 2.77 tonnes and by 1981 it was the highest about 5.03 tonnes and in 1986 it has come down to 4.89 tonnes. This is a highly appreciable improvement in labour productivity.

Table 5.2. AVERAGE OUTPUT PER MAN-SHIFT OF CATEGORY A & B WORKERS

YEAR	TOTAL TONNAGE HANDLED [in lakh tonnes]	TOTAL MAN-SHIFTS WORKED [in lakhs]	OUTPUT PER MAN-SHIFTS [in tonnes]
1974	3.72	1.34	2.77
1975	4.81	1.18	2.67
1976	4.26	1.29	3.30
1977	4.77	1.01	4.72
1978	5.18	1.19	4.35
1979	5.49	1.23	4.45
1980	5.23	1.39	3.79
1981	5.23	1.04	5.03
1982	5.40	1.34	4.03
1983	5.71	1.29	4.43
1984	5.00	1.37	3.65
1985	4.08	1.16	3.52
1986	5.28	1.08	4.89

Source:Complied from Administration Reports, relevant years.

Another feature of port work which affects measurement of labour productivity is the 'Idle Time' that the booked dock labourers might have spent due to reasons like, non-availability of cargo, non-working of cranes, late arrival of ships, unfavourable weather conditions, etc. Johri and Agarwal(1968),

studied the labour productivity trends of the major ports of India[1]. According to them, in general, the proportion of 'idle hours' to 'total shift hours' varies from 25 to 40 percent. This leads us to the concept of effective time worked by the port labour or the dock labour.

The port work is mainly cargo handling operations, so the efficiency of the port can be observed from how fast the ships are being cleared from the port, that is by looking at the 'turn round time'[TRT] of the ships calling at the port. Even though the TRT is influenced by many other factors like, the berthing and mechanical facilities available, coordination and supervision within the port, etc., labour efficiency is its most important determinant. So the trends in TRT can be taken as an indication of the trend in labour efficiency in cargo handling operations. Table 5.3. gives the turn round of category wise ships called at Cochin.

Table 5.3. TURN ROUND TIME OF SHIPS AT COCHIN PORT [in days]

YEAR	TANKERS	COLLIERS	FOODGRAIN VESSELS	FERTILISER VESSELS	CONTAINER VESSELS	OTHER VESSELS	TOTAL VESSELS
1976	2.30	12.69	14.59	16.87	--	3.71	4.50
1977	1.61	11.14	11.25	12.63	--	3.05	3.45
1978	1.87	15.39	9.67	16.56	--	3.76	4.27
1979	2.17	22.21	7.71	18.16	--	4.33	4.96
1980	2.13	--	--	21.33	--	5.29	5.67
1981	2.17	--	--	20.12	--	4.54	5.17
1982	1.88	--	25.38	17.83	1.62	4.16	4.12
1983	1.75	--	20.71	14.50	1.71	4.16	3.83
1984	2.01	--	25.26	12.80	2.26	5.30	4.67
1985	3.47	--	46.20	18.44	2.03	4.84	5.34
1986	2.12	--	----	18.13	2.19	5.30	4.83

Source: Administration Report of the CPT., relevant years.

The turn round time [TRT] of total vessels(see table 5.3) has remained around 4 to 5 days on an average over the period 1976 to 1986. The high TRT of the fertilizer vessels is most noticeable.

136

In the latter months of 1986 the fertilizer berth had mechanised for cargo handling techniques, with the assistance of the Fertilizers and Chemicals Travancore Limited [FACT]. FACT is also now paying compensation for the workers (whom the machine had replaced) at the fertilizer berth. The TRT of the Container Vessels has also remained more or less constant (almost two days) from 1984 onwards. This can be further reduced by inroducing modern cargo handling equipments. In the case of Other Vessels also the TRT has increased from 3.71 days to 5.30 days, that is the efficiency of the port has deteriorated. This increase in TRT in the case of Other Vessels is the sign of the port's traffic diversion, these Other Vessels must be the feeder vessels operating between Cochin and its nearby ports.

Now we can specifically look into the details of the output per gang-shift, and output per man-shift of dock and shore labour separately of Cochin port for two different periods, that is, for april 1978 and april 1987 respectively. The period has been selected with the view to capture the impact of the technological changes that the port has undergone. The data along the row are collected from ships calling at Cochin during the months of april 1978 and april 1987. The interesting inferences from table 5.4. are, the output per gang-shift has virtually doubled in the period for both shore labour and dock labour. The output per man-shift also has increased in the second period for both the labourers compared to the first period. The output per man-shift for the dock labour has more than doubled compared to the shore labour. That is, thare is a clear indication of increase in labour productivity.

Table 5.4. OUTPUT PER GANG SHIFT & OUTPUT PER MAN SHIFT AT COCHIN PORT

| In April 1978 | | | | In April 1987 | | | |
| OUTPUT PER GANG-SHIFT [in tonnes] | | OUTPUT PER MAN-SHIFT [in tonnes] | | OUTPUT PER GANG-SHIFT [in tonnes] | | OUTPUT PER MAN-SHIFT [in tonnes] | |
S.L.	D.L.	S.L.	D.L.	S.L.	D.L.	S.L.	D.L.
71	53	6	5	131	131	11	13
48	50	4	5	166	166	14	17
191	106	16	11	194	194	16	19
69	62	6	6	303	303	25	30
52	52	4	5	129	129	11	13
43	49	4	5	216	216	18	22
89	95	7	9	173	173	14	17
45	45	4	4	161	161	13	16
88	47	7	5	133	133	11	13
100	70	8	7	178	178	15	18
140	86	12	9	167	167	14	17
153	87	13	9	137	137	11	14
47	47	4	5	140	140	12	14
86	86	7	9	357	357	30	36
128	128	11	13	213	213	18	21

S.L. = Shore Labour, D.L. = Dock Labour.

Source: Collected from ship files, R & P Division Cochin Port.

(b) The Measurement of Partial Productivity

The partial productivity indices are simply the average products of the respective factors of production(labour and capital). Both W.E.G. Salter[2] and J.W. Kendrick[3], have started their analysis by drawing attention to the very limited usefulness of the time honoured but 'Partial'(Kendrick's term) productivity ratio of output per unit of labour input (in terms of either man-days or man-hours). The partial, labour(or other factor), productivity ratio can be useful in measuring the saving in that input which is achieved over time. If we invert the partial productivity ratio, we get the 'factor input per unit of output', a decline of this ratio over time indicates a saving in the use of the factor input concerned.

The volume of output, which is the numerator of the productivity ratio is dependent upon the quantities of factor inputs of labour and capital employed, the state of technical knowledge and its availability, organizational characteristics, the scale of operations, the manner in which the factors are utilised, the degree of capacity utilisation and, more generally, the efficiency with which the entire production process is organised over time in relation to changes in demand, competition, relative factor prices, technical knowledge, organizational practices and external factors of various kinds.

We have the partial indices,

(1). Average Productivity of Labour(APL) = Output/Labour, or (O/L).

(2). Average Productivity of Capital(APK)= Output/Capital, or(O/K).

where O,L,K, are respectively the aggregate level of output, total number of labourers and total Capital stock.

(1) Measurement of Labour Productivity

Conceptually labour productivity is a ratio between output and labour input. Here both output (O) and Labour (L), are measured in physical terms(output is measured as cargo handled in lakh tonnes and labour input is measured in terms of number of labourers, and change in productivity between two periods $\emptyset$ and 1, is given by $\ln([(O_1/L_1)/(O_\emptyset/L_\emptyset)])$.

We have calculated the labour productivity of Cochin port using the aggregate data of output and labour. That is, output we have taken as the total tonnage handled (here it is in lakhs tonnes) through Cochin port and labour input as the total number of labourers employed in different activities. In the year 1971

139

the output per unit of labour of the port was 748.99 tonnes and it

decreased to 595.28 tonnes in 1974, and again has shown an

increasing trend. If we look at the three year averages of labour

productivity starting from 1971, for the first three years it was

706 tonnes and it increased to 804 tonnes for the period starting

from 1978, and further it declined to 688 tonnes for the period

1979-'86. The average growth rate of labour productivity for the

period 1972 to 1986 is only +0.05 per cent. For the periods 1972

to 1979 and 1980 to 1986 the average growth rate of labour

productivity was +1.20 per cent and -2.60 per cent respectively

(see table 5.5). The decline in productivity in the second period

is mainly due to the decline in output. This method of

productivity measurement is not fully dependable mainly due to the

aggregation of the labour input.

Table 5.5 TRENDS IN LABOUR PRODUCTIVITY					
YEAR	NO. OF LABOUR	OUTPUT l.tons	OUTPUT LABOUR	INDEX	GROWTH RATE
1971	6462	48.40	748.99	100	
1972	6574	47.00	714.94	95	-0.05
1973	6451	42.10	652.61	87	-0.09
1974	6266	37.30	595.28	79	-0.09
1975	6339	48.10	758.79	101	0.24
1976	6383	42.60	667.40	89	-0.13
1977	6395	47.70	745.90	100	0.11
1978	6581	51.80	787.11	105	0.05
1979	6640	54.70	823.80	110	0.05
1980	6818	54.70	802.29	107	-0.03
1981	7321	52.30	714.30	95	-0.12
1982	7021	54.00	769.12	103	0.07
1983	6901	57.10	827.42	110	0.07
1984	6903	50.00	724.32	97	-0.13
1985	6980	40.80	584.53	78	-0.21
1986	6999	52.80	754.39	101	0.26

Avrage   Growth Rate (1972/79)   = +1.20%
Average Growth Rate (1980/86)   = -2.68%
Average Growth Rate (1972/86)   = +0.05%

Source:Administration Reports CPT. relevant years.

A more meaningful picture of the trends in labour productivity
can be obtained from the trends in the labour productivity of the shore
and casual labour with respect to general cargo(in lakh tonnes).(see
table 5.6).

Table 5.6. LABOUR PRODUCTIVITY OF SHORE AND CASUAL LABOUR

YEAR	TOTAL TR-ADE(L.T)	NO.OF S & C LABOUR	OUTPUT/ C&S LABOUR	GENERAL CARGO(L.T	GENERAL CARGO/ S & C. LABOUR
1971	48.4	1625	2978	10.09	621
1972	47.0	1609	2921	10.62	660
1973	42.1	1428	2948	10.57	740
1974	37.3	1234	3022	10.05	814
1975	48.1	1228	3916	9.81	799
1976	42.6	1185	3595	11.05	932
1977	47.7	1136	4199	9.80	863
1978	51.8	1024	5059	8.60	840
1979	54.7	1137	4811	9.60	844
1980	54.7	1054	5190	9.10	863
1981	52.3	1106	4729	6.06	548
1982	54.0	929	5813	7.90	850
1983	57.1	880	6489	8.70	989
1984	50.0	720	6944	8.20	1139
1985	40.8	641	6365	6.60	1030
1986	52.8	660	8000	6.40	970

Source: Calculated from data provided by the CPT.(S=shore & C=casual)

From the table it is clear that, the labour productivity of the
shore and casual labour in the case of general cargo (that is the
total cargo less oil and ferlizer cargo together) has increased
from 621 tonnes in 1971 to 970 tonnes in 1986. But the number of
shore and casual labour declined steadily from 1982 onwards, but
their per unit output has increased in the period. As we see from
the table, both the number of labours and the output have declined
in the same period. That is the labour productivity of shore and
casual labour together for 'general cargo' has shown a clear
improvement in the period of analysis. The labour productivity of
shore labour and casual labour in the case of 'total trade' also
has increased from 2978 tonnes to 8000 tonnes over the period of
analysis. For the first three years, the average labour

productivity of the shore and casual labour was 2949, and for the next three years starting from 1978, the average labour productivity increased to 5070, and for the last three years it further increased to 7103. In the case of general cargo also the average labour productivity increased from 674 to 849 to 1046 in the respective periods as above. Also from table 5.5 we can observe that there is a considerable fluctuation in labour productivity.

(2) Measurement of Capital Productivity

The definition and measurement of capital productivity is analogous to labour productivity. It is the average product per unit of capital input. Both conceptually and statistically, the measurement of capital presents difficult problems. The important ones are regarding the pricing, depreciation and obsolescence of the capital assets of different age. We have discussed the procedure that we followed for the capital stock estimation at Cochin port in the earlier chapter (see chapter iii). We shall now present our estimates of the capital productivity measure at Cochin port (see table 5.7.). The average growth rate of Capital productivity at Cochin port for the period 1972 to 1986 declined sharply(-2.5 percent). The capital productivity growth rate for the period 1972 to 1979 and 1980 to 1986 was also negative, that is -2.8 percent and -2.2 percent respectively. On the whole the capital productivity of the port was not satisfactory in the period of analysis. Table 5.7. will give details about the capital productivity, its index and growth rates for the period 1971 to 1986.

Table 5.7	CAPITAL PRODUCTIVITY AT COCHIN PORT			CAPITAL STOCK (Rs.lakhs)	OUTPUT IN lakh.tns
YEAR	OUTPUT/CAPITAL	INDEX	GROWTH RATE		
1971	0.031	100.000	--	1574.23	48.40
1972	0.029	93.194	-0.070	1640.34	46.90
1973	0.025	82.196	-0.126	1665.93	42.01
1974	0.022	71.026	-0.146	1708.11	37.00
1975	0.028	90.652	-0.244	1725.81	48.13
1976	0.024	78.448	-0.145	1766.23	42.58
1977	0.026	85.864	0.090	1806.89	47.67
1978	0.024	77.493	-0.103	2174.16	51.74
1979	0.025	80.088	0.033	2221.40	54.70
1980	0.023	74.945	-0.066	2373.91	54.64
1981	0.022	70.707	-0.058	2405.81	52.33
1982	0.022	72.358	0.023	2427.33	55.01
1983	0.023	75.876	0.047	2447.69	57.10
1984	0.020	65.944	-0.140	2466.12	50.04
1985	0.016	53.432	-0.210	2483.58	40.74
1986	0.021	68.718	0.252	2499.10	52.78

AVERAGE GROWTH RATE (1972/79) = -2.8 %
AVERAGE GROWTH RATE (1980/86) = -2.2 %
AVERAGE GROWTH RATE (1972/86)   =   -2.5 %

Calculated from data provided by the CPT.

The trends in capital and labour productivity is given in graph 5.1. From the graph it can be observed that the labour productivity is showing a higher trend than that of the capital productivity, throughout the period. The capital productivity in the 1980s has shown a declining trend, but during 1985/86 it has shown improvement. The graph 5.1 also gives the trends in output growth. The details about the categories of labour productivity is given in graph 5.2. From the graph it is clear that while the labour productivity of the shore and casual labour has shown an increasing trend, that of the fixed labour[4], has shown a stagnant or a decreasing trend over the period 1971 to 1986. The labour productivity of the total labour has shown a fluctuating trend over the period.

143

(c) Wage Rate and Labour Productivity

The wage rate of the labourers in Cochin port has increased from Rs.3197.93 to Rs.5466.22 over the period 1970/71 to 1985/86. The average growth rate of wage rate(in current prices) for the period 1972 to 1986 is 3.6 per cent. In the first period(1972-1979), the average growth rate in wages was 6.9 per cent and in the second period(1980-86), it was only 0.2 per cent(see table 5.8.)

Table 5.8.	TRENDS IN WAGE RATE AT COCHIN PORT		
YEAR	WAGE RATE	INDEX	GROWTH RATE
1971	3197.926	100.000	--
1972	3297.694	103.120	0.031
1973	3461.019	108.227	0.048
1974	3120.856	97.590	-0.103
1975	2949.380	92.228	-0.057
1976	3729.059	116.609	0.235
1977	3971.681	124.195	0.063
1978	4533.458	141.762	0.132
1979	5540.956	173.267	0.201
1980	5239.130	163.829	-0.056
1981	5249.216	164.144	0.002
1982	4885.888	152.783	-0.072
1983	6117.869	191.307	0.225
1984	4536.325	141.852	-0.299
1985	5512.279	172.370	0.195
1986	5466.228	170.930	-0.008

```
AVERAGE GROWTH RATE (1972/79)  =  6.9 %
AVERAGE GROWTH RATE (1980/86)  =  0.2 %
AVERAGE GROWTH RATE (1972/86)  =  3.6 %
```

Source: Calculated from data provided bt the CPT.

GRAPH. 5.1 TRENDS IN OUTPUT& CAPT.&LBR.PRDTY.

INDEX'S 1971 =100

YEAR

| □ | OUTPUT | + | OUTPUT/CAPITAL | ◇ | OUTPUT/LABOUR |
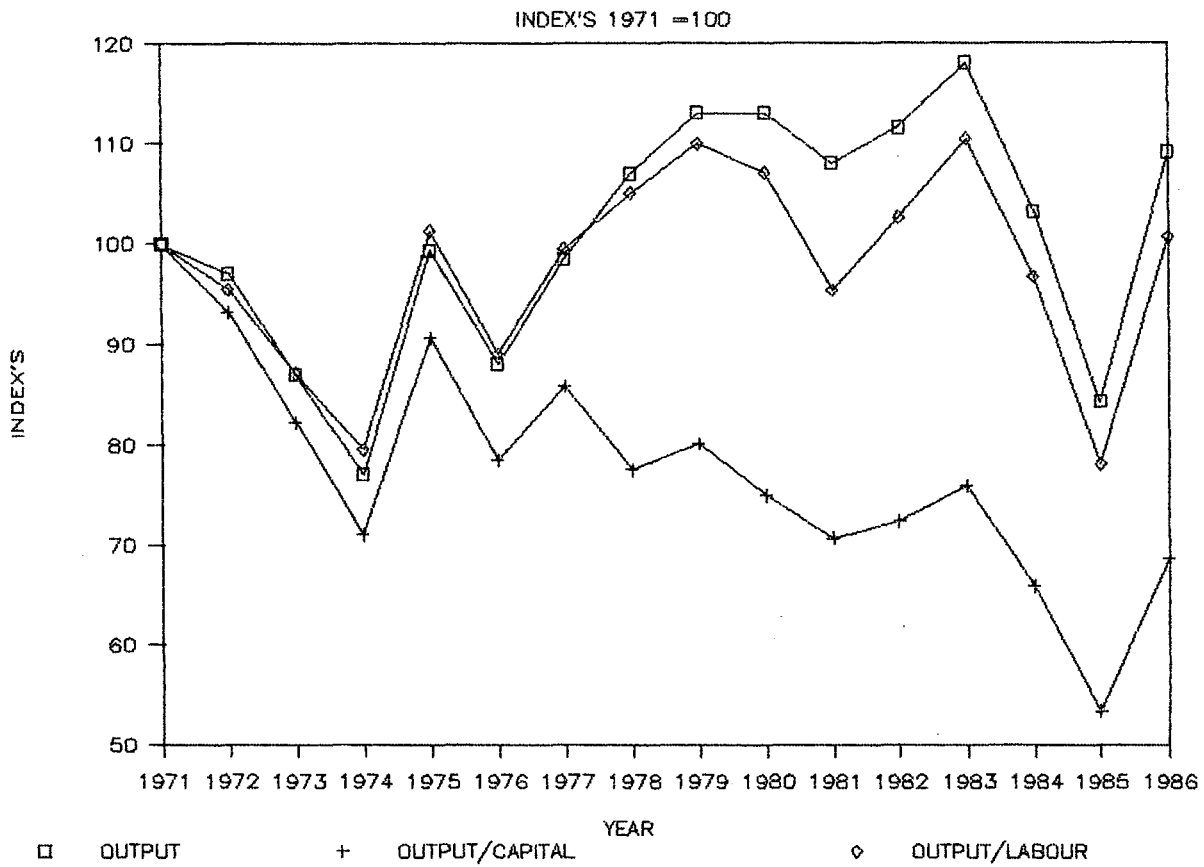
GRAPH_5.2 TRENDS IN CATOGORYWISE LBR.PDTY.

INDEX'S 1971 =100

YEAR

I CLS.1&2 PL.   ◇   CLS.3&4 PL.   △   S&C. LBR. PL.   + TOTAL

145
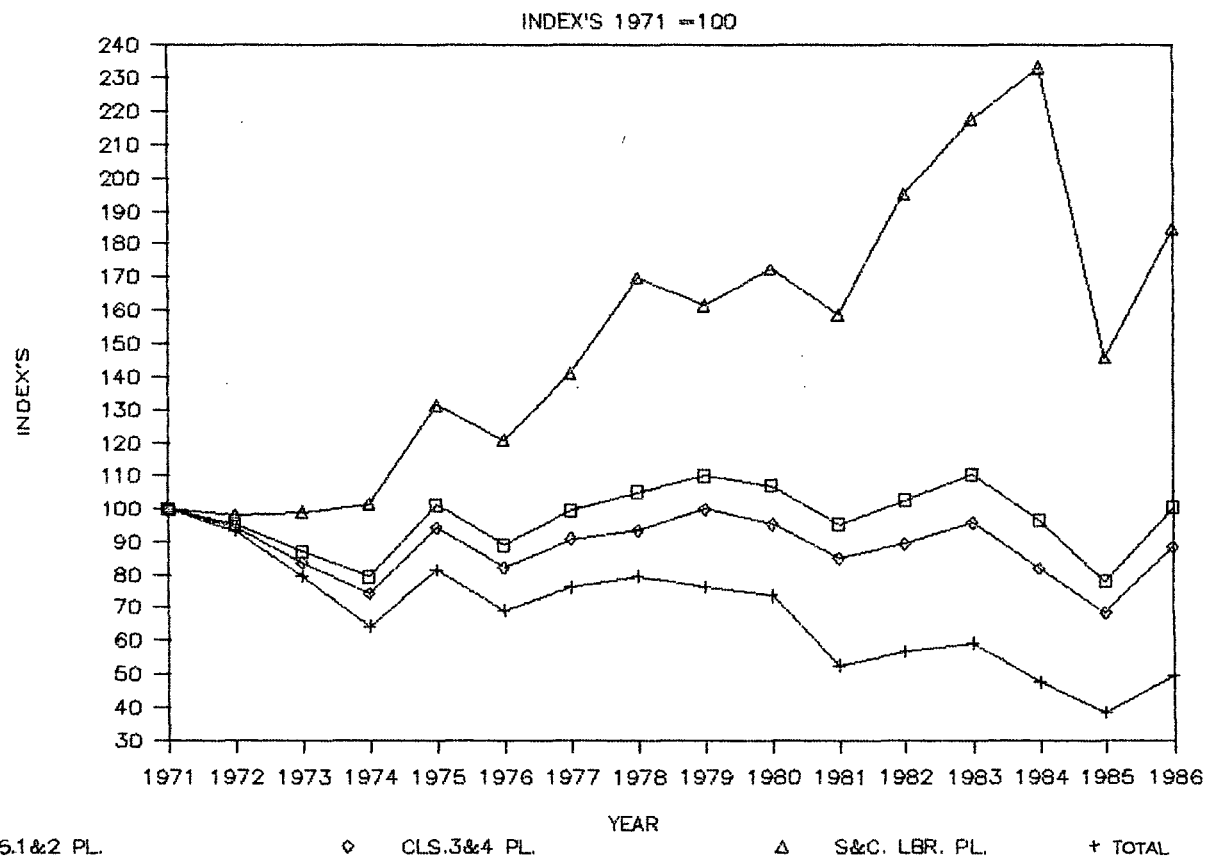
Graphs 5.3 to 5.6. gives the trends in the wage rate and labour productivity of class I & II, class III&IV, shore and casual labour and total labour of Cochin port. From graph 5.3 it is clear that the wage rate and labour productivity of the shore and casual labour shows a similar increasing trend. The two most striking points in the graph is the year 1978, where the wage rate was the highest (mainly because of the decline in labour especially of a sudden decline in the number of shore and casual labour), and in 1985, where the labour productivity declined drastically (which is mainly because of the decline in output).

In the case of class I & II employees(graph 5.4), the wage rate shows almost a stagnant trend, in the later part the decline in wage rate is due to the increase in the number of class I & II labourers, and their labour productivity show a declining trend. For class III & IV labourers(graph 5.5) the wage rate shows a steadily increasing and the labour productivity shows almost declining trend.

At the aggregate level, trends in wage rate and labour productivity show different directions(graph 5.6). The wage rate of the total labourers in Cochin port shows a steadily increasing trend, where as the labour productivity has shown an almost stagnant trend.

GRAPH.5.3 TRENDS IN WAGE RATE &LBR.PDTY.(S&C.LBR.

INDEX'S 1971 =100

YEAR

□   WAGE RATE SHR&CSL.   +   LBR.PDTY. SHRE&CSL.
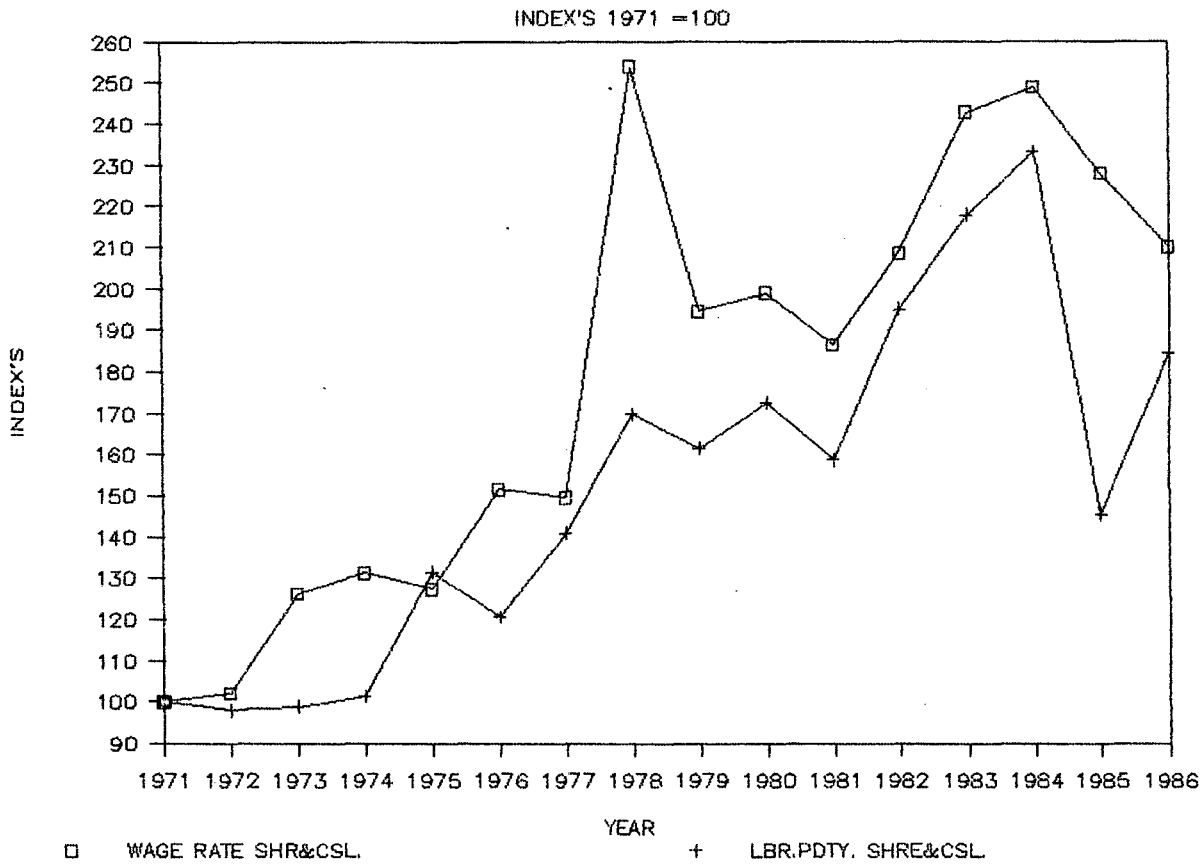
GRAPH.5.4 TRENDS IN WAGE RATE &LBR.PDTY.(CLS.1&2)

INDEX'S 1971 =100

YEAR

□   WAGE RATE CLS 1&2   +   LBR.PDTY. CLS 1&2
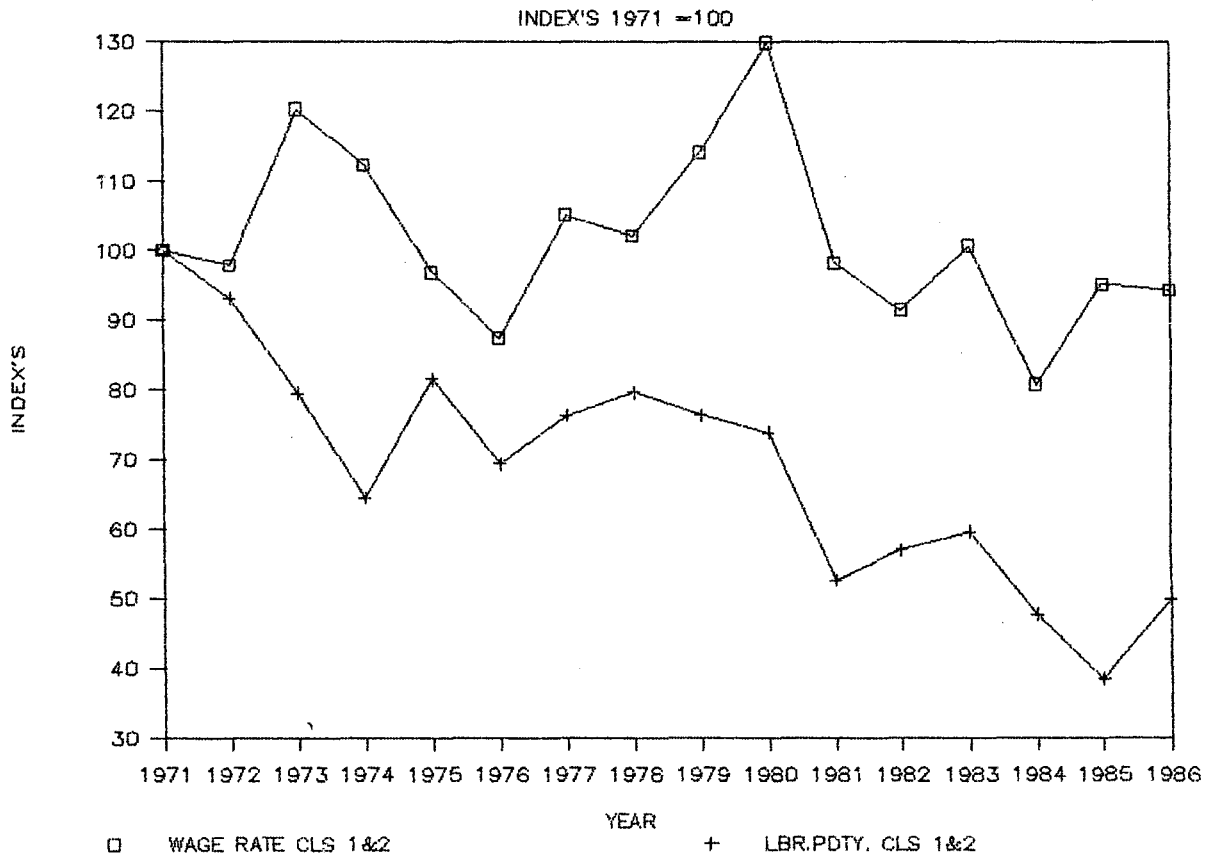
GRAPH.5.5. TRENDS IN WAGE RATE &LBR.PDTY.(CLS.3&4)

INDEX'S 1971 =100

YEAR

□   WAGE RATE CLS.3&4   +   LBR.PDTY. CLS 3&4
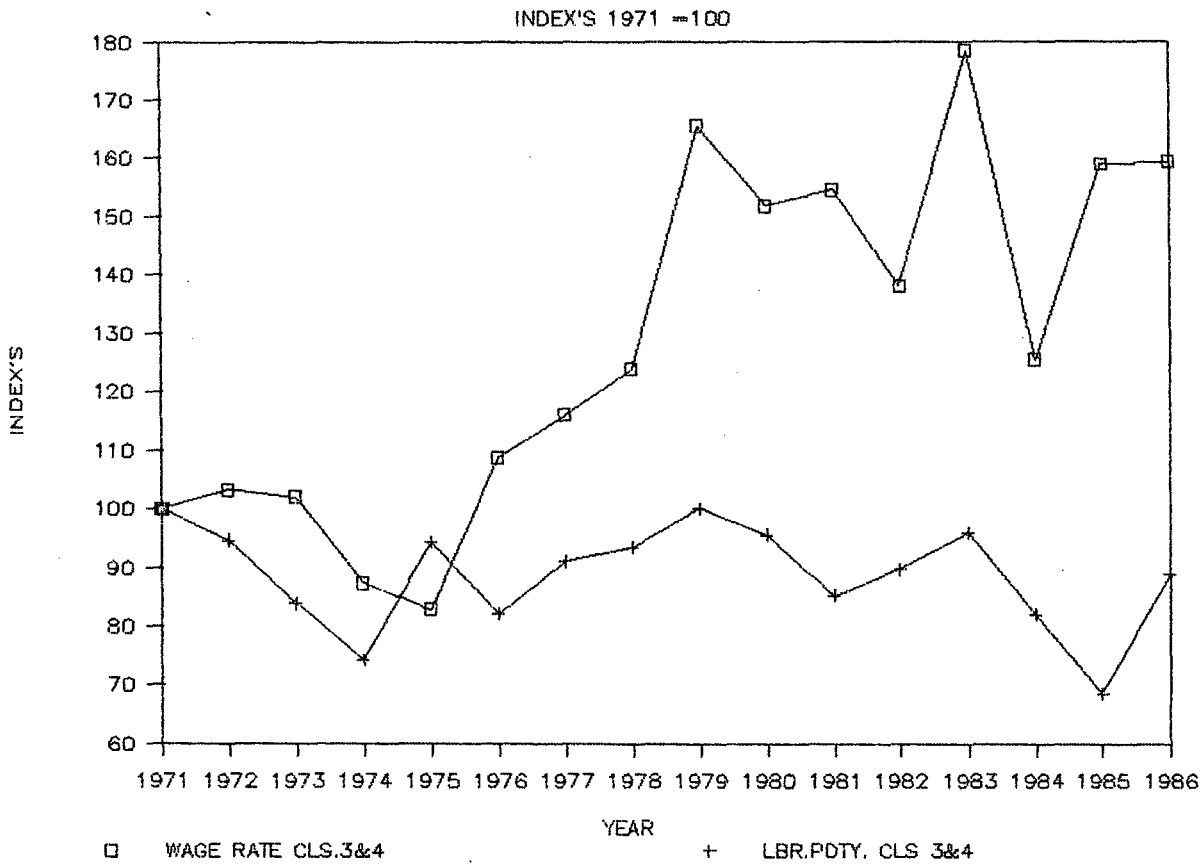
GRAPH.5.6 TRENDS IN WAGE RATE &LBR.PDTY.(TOTAL)

INDEX'S 1971 =100

YEAR

□   WAGE RATE TTL.   +   LBR.PDTY. TTL.
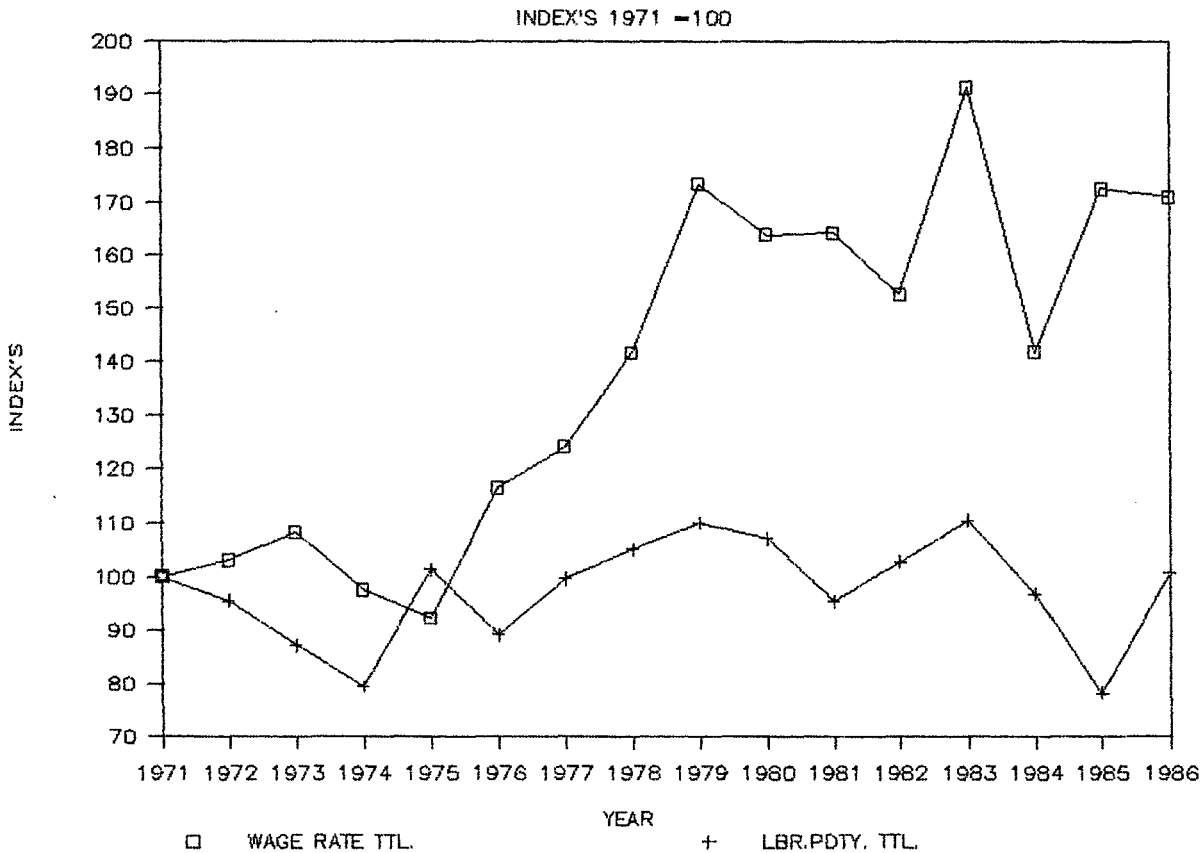
(d) Measurement of Capital Intensity

The capital intensity of Cochin port is given in table 5.9. The average growth rate of capital intensity over the period 1972 to 1979 was 2.5 per cent, and for the period 1972 to 1979 it went up to 4.0 per cent. and for the period 1980 to 1986, the average growth rate was only 0.9 per cent. The decline in the growth rate of capital intensity in the later period is mainly due to slowdown of investments in the port.

The trends in capital intensity and capital and labour productivity is given in graph 5.7. From the graph it can be observed that, while there is an increasing trend for capital intensity, the labour poductivity has shown an almost stagnant or declining trend. The negligible growth in capital intensity in the eighties indicates the very limited possibility of substitution among the factors of production. It can be seen from the graph(5.1 and 5.7) that both capital and labour productivity has declined during the period after 1980. This suggests that Cochin port has not gone for new technological improvements. That is, the addition to capital in the port has not increased the labour productivity during this period. The inference we can make from this is that the marginal increase in the total number of employees in the period is the main cause of decline in both labour productivity and capital intensity. The capital stock and the output during the period was almost stagnant.

GRAPH 5.7 TRENDS IN LABOUR PRDTY. & CAPTL. INTSY.

INDEX'S 1971 =100

INDEX'S

YEAR

□　LABOUR PRDTY.　　　　+　CAPITAL INTENSITY
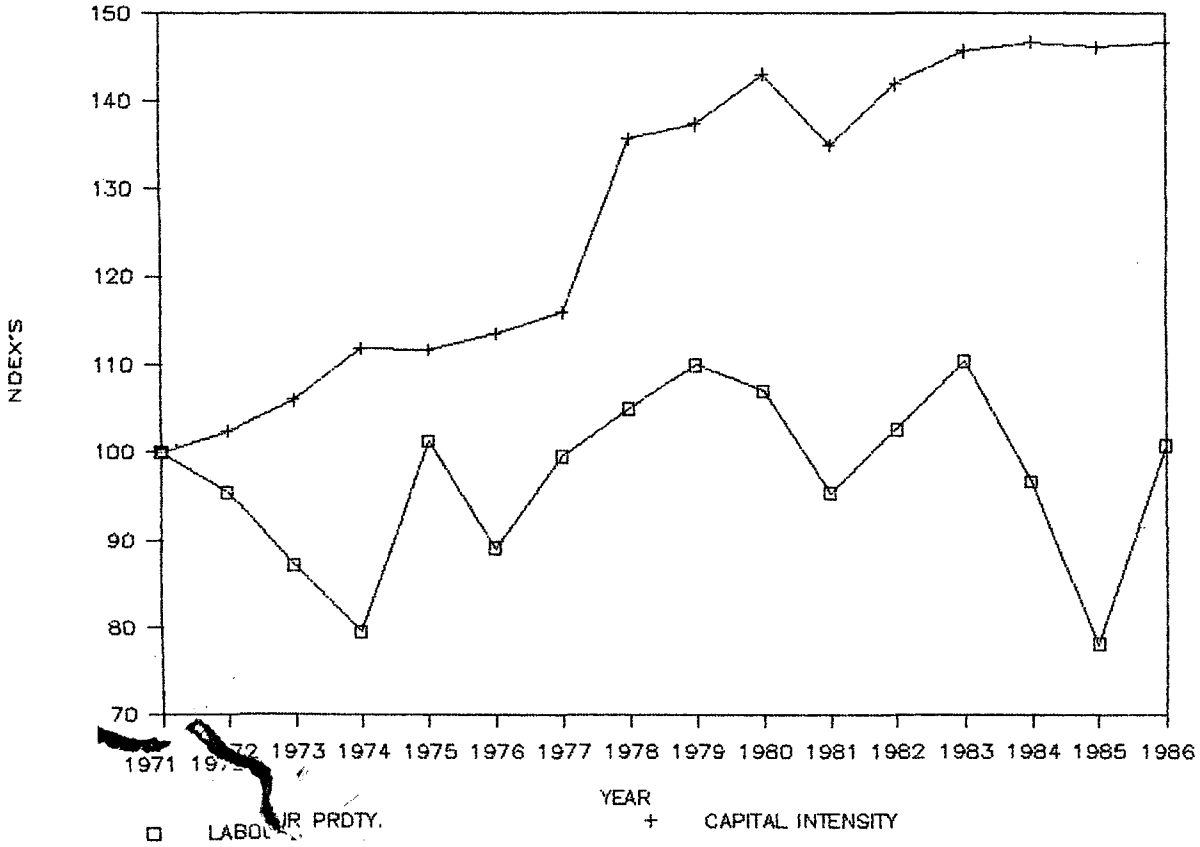
Table 5.9. TRENDS IN CAPITAL INTENSITY AT COCHIN PORT			
YEAR	CAPITAL INTENSITY	INDEX	GROWTH RATE
1971	0.244	100.000	--
1972	0.250	102.424	0.024
1973	0.258	106.005	0.034
1974	0.273	111.898	0.054
1975	0.272	111.756	-0.001
1976	0.277	113.585	0.016
1977	0.283	115.982	0.021
1978	0.330	135.612	0.156
1979	0.335	137.332	0.013
1980	0.348	142.925	0.040
1981	0.329	134.893	-0.058
1982	0.346	141.916	0.051
1983	0.355	145.594	0.026
1984	0.357	146.648	0.007
1985	0.356	146.057	-0.004
1986	0.357	146.571	0.004

```
AVERAGE GROWTH RATE (1972/79)    =    4.0 %
AVERAGE GROWTH RATE (1980/86)    =    0.9 %
AVERAGE GROWTH RATE (1972/86)    =    2.5 %
```

Source: Calculated from data given, CPT.

To sum up, the Productivity growth in a port is particularly important since the port services are used by almost every sector of the economy. In the above section we have discussed the productive efficiency of the port by looking at the some of the important indicators like, 'Average Output per Effective Hook-hour', 'Average Output per Man-shift of Category A & B Workers', 'The Categorywise TRT of Ships', 'Output per Gang-shift' and 'Output per Man-shift'. The average productivity per effective hook hour for total trade has not increased over the period 1973 to 1986. On an average it was around 21 tonnes in the period of analysis. In the phase of technological developments this trend is rather discouraging. This is mainly because Cochin port does not have any cranes capable of handling the containers (the ship's cranes are used to hanlde the container traffic at Cochin). The average output per man shift of category A & B (shore

& casual) workers in the period of analysis has improved. But the categorywise TRT of the vessels has not improved much in the period, especially in the early eighties it did not improve for container vessels, resulting in the pull out of certain famous liners from Cochin. The two other productivity indicators, output per gang-shift and output per man-shift has improved a lot for the two different time periods (april 1978 and 1987).

We have also looked into the partial productivity indices. This has been done with lot of limitations, such as the aggregation problem (for capital and labour) and the estimation of the capital stock. In the case of labour productivity indices we have separatily looked into the details of the shore and casual labour and also for general cargo.(Since a major portion of the total output consists oil and fertlizer). In the case of total output and total number of labourers, the labour productivity over the period has not improved much. The average growth rate of labour productivity over the period(1972-1986) was only 0.05 percent, and for the first period (1972-1979) it was+1.20 per cent and in the second phase(1980-1986) it declined -2.68 per cent. The decline in the second phase is mainly due to the decline in output and also to the stagnant nature of the fixed labour force in the port. But the labour productivity of the shore and casual labour for total output has increased over the period. This is an encouraging result. In the case of general cargo also the labour productivity of the shore and casual labourers has improved much in the same period.

The capital productivity of the port over the period was

not satisfactory. The average capital productivity for the period 1972 to 1986 was -2.5 per cent. For both the sub perids the indicator was showing a declining trend (-2.8 per cent and -2.2 per cent for the periods 1972-79 and 1980-86 respectively). The decline in the capital productivity of the port was mainly due to the slow growth in capital stock during the period of analysis, i.e. there was no new technological absorption in the port.

The wage rate of the labourers has increased in the period of analysis. The average growth rate of the wage rate in the period 1972 to 1986 was 3.6 per cent. The first period(1972-1979) has shown a very high growth rate(6.9 per cent) compared to the second period(1980-1986),(only 0.2 per cent). We have also looked into the relationship between the wage rate and the labour productivity. While the wage rate of the total number of labourers has shown an increasing trend, their labour productivity has declined. In the case of the shore and casual labour both the indicators has shown an increasing trend, and for class one and two and for class three and four both the indicators has shown opposite trends. That is, while the wage rate has shown an increasing trend the labour productivity has shown a declining trend.

The capital intensity of the port has not shown a steady increasing trend over the period of analysis. For the period 1972 to 1986, the average growth rate of capital intensity was 2.5 per cent, and for the first period(1972-79), it was 4.0 per cent and for the second period(1980-86), it was only 0.9 per cent. That is, in the initial years of the analysis the capital intensity of the

port was increasing steadily whereas in the second period the increase in the capital intensity was negligible, reflecting the very little change in the technology of the port.

(e) Measurement of Total Factor Productivity

There has been a steady flow of literature since 1950 about technical change, which suggest that a substantial part of output growth was attributable to technical progress, and the forces shaping this technological progress simply related to advancement of knowledge. Technical change transforms the production of goods and services and improves the efficiency of production processes.

The use of new technologies in production processes frequently reduces the labour and other resources needed to produce a unit of output: these reductions in turn lower the costs of production and the employment requirements for a fixed output level. According to Dennison (1961)[5], improvements in the quality of labour, economies of scale or greater utilisation of capacity may lead to substantial gains in total factor productivity (TFP), without strictly involving an advance in knowledge. The gains in Total Factor Productivity (TFP), is defined as, 'a ratio of output to a weighted combination of inputs' and it only captures the effect of technological progress on the 'efficiency' in factor use. According to Solow(1957)[6], technological change was any kind of shift in the production function. Goldar observes that, " TFP growth would capture only one dimension of technological progress, it's effect on the overall efficiency of factor use"[7].

Increase in 'productive efficiency' over a period of time implies net saving in all the inputs taken together in producing a given level of output or getting more output per unit of total input. The increase in TFP is attributable to the contributions of the productive forces whose measurement is not possible. TFP hence is identified with the resiudal or an unexplained part of the total output.

Estimates of TFP are to provide an indication of the change in output per unit of input. In a multi-factor, multi product case, TFP growth is defined as the difference between the rate of growth of output and the rates of growth of inputs, appropriatily weighted. Value shares or income shares can be used as weights, which involves assumptions like 'competitive equilibrium' and 'constant returns to scale.'

Here we have taken tonnage handled as our output and the factors of production are labour and capital. The total factor productivity is measured as the difference between the growth rate in output and the sum of the growth rates of the inputs, that is, labour and capital, weighted by the shares of the respective factors of production. The weight of labour is the share of labour in value added. We have calculated the value added by adding the wages and salaries, surplus or deficit of the port and the depreciation values given by the port authorities. Here we have taken the share of capital as one minus the share of labour, that is, we have assumed constant returns to scale in the production process. The details of the formulas used in the calculation of the total factor productivity using three different measures is

155

given in the Appendix-II at the end of this chapter.

Table 5.10. GROWTH OF TOTAL FACTOR PRODUCTIVITY

PERIOD	KENDRICK	SOLOW	TRANSLOG
1972/79	-0.583 %	-0.745 %	-0.778 %
1980/86	-1.673 %	-1.615 %	-1.550 %
1972/86	-1.091 %	-1.151 %	-1.138 %

Source: Estimated using given data, CPT.

Table 5.10. gives details about the TFP growth of Cochin port over the period of analysis, using three different indiices, namely Kendrick, Solow and Translog. The differences between these measures is that, they follow different weighting techniques. The Kendrick method uses the base year weights of the shares of the factors of production throughout the analysis, where as the Solow measure uses the time series shares in the respective years, and the Translog measure uses the average weights of the shares for weighting the growth rates of the inputs. All the three measures give almost similar results.

The TFP growth using Kendrick, Solow, and Translog measures for the period 1972 to 1979 is -1.091, -1.151, -1.138. and that period 1972 to 1979 is given by -0.583, -0.745, and -0.778 respectively. And for the period 1980 to 1986 is given by -1.673, -1.615, -1.550.

Conclusion

The total factor productivity growth of the port has shown a declining trend using all the three different measures in all the periods. The second sub-period(1980-86) has shown a sharp decline compared to the first sub-period and even the overall period. From our earlier analysis it was clear that the labour productivity of the port was stagnant or increasing in a slow pace (average growth rate for the period 1972-86 was 0.05 per cent), and the capital productivity of the port was declining (average growth rate over the period was -2.5 per cent) over the same period. Now the total factor productivity of the port is also declining(average growth rate of the total factor productivity for the period 1972 to 1986 is -1.673 percent, -1.615 per cent and -1.550 per cent for Kendrick, Solow and Translog measures respectively). The notable point here is that declining capital productivity swamps the productive trend in labour productivity. The low total factor productivity also calls for the urgent need for technological changes in the port.

MEASUREMENT OF CAPACITY UTILISATION IN COCHIN PORT

As the Total Factor Productivity(TFP) has given a very discouraging result in all the three phases of the productivity of Cochin port, the causes for which should be throughly analysed. The underutilization of capacity may be one of the causes for low productivity growth. The capacity utilisation index is one of the important indicators for measuring the efficiency of the port. Many attempts have already been made with varying approaches to measure 'Capacity Utilisatiion' in industry[8]. Sastry admits that, "no single measure appears entirely satisfactory, it is both necessary and desirable to consider alternative measures and evaluate them before forming a judgement on the extent of capacity utilisation". Here we are following the method of 'minimum capital output ratio measure. The measure of 'minimun capital output ratio', which dispenses with the use of physical capacity data but uses instead fixed capital figures along with output series.

Minimum Capital Output Ratio Measure:

The National Conference board of the US estimates capacity on the basis of minimum Capital Output Ratio [COR]. Fixed COR are estimated in terms of constant prices. A bench mark is selected on the basis of the observed lowest COR. The lowest observed COR is considered as ASSOCIATED WITH Capacity Output. The estimate of capacity output is obtained by dividing real fixed capital stock by minimum COR. The utilisation rate is given by actual output as a proportion of the estimated capacity.

Thus, we have, $U = (O/C^\wedge)*100$

$$C^\wedge = [C/(c/o)min.]$$

where U= Capacity Utilisation
        O= Real Output(in tonnage)
        C^= Estimate of Capacity
        C = Real Fixed Capital [gross block]
        (c/o)min. =Minimum Capital Output Ratio.

The usefulness of this method depends critically on the

accuracy of the measurement of capital. The capital stock in this method is calculated using the prepetual inventry method.(the details of this is discused in chapter II]). From table 5.11 we can observe that the capital stock indices increased from 100(1971) to 159 (1986).

Table 5.11.   TRENDS IN CAPACITY UTILISATION AT COCHIN PORT
[mimum capital/output method]

YEAR	[CAPITAL/ OUTPUT] (minimum)	CAPITAL STOCK INDICES	CAPITAL STOCK/ [CAPITAL/OUTPUT] (minimum)	OUTPUT INDICES	CAPACITY UTILISATION (percent)
1971	100	100	100	100	100.
1972	102	104	102	97	95
1973	105	106	101	87	86
1974	108	109	101	77	76
1975	110	110	100	99	99
1976	111	112	101	88	87
1977	115	115	100	99	99
1978	116	138	119	107	90
1979	117	141	121	113	93
1980	119	151	127	113	89
1981	121	153	126	108	86
1982	125	154	123	112	91
1983	129	155	120	118	98
1984	131	157	120	103	86
1985	135	158	117	84	72
1986	142	159	112	109	97

Source: Calculated from given data, CPT.

The capital stock by the minimum capital/output ratio indices has increased from 100(1971) to 127 (1980) and by 1986 it declined to 112. The output indices also has not increased much over the period. The capacity utilisation of the port in the period of analysis was satisfactory. In the initial phase of the 70s the capacity utilisation has shown an increasing trend and later in the beginning of the 80s it started declining. On an average the capacity utilisation of the port was around 90 per cent. Thus we can conclude that, the main cause for the low productivity of the port is not the underutilisation of its capacity.

159

Here we shall briefly discuss the technical details about the estimation of the total factor productivity (TFP) index, using the three different measures namely Kendrick, Solow, and Translog. These indices vary only in terms of the weighting scheme involved.

1. The Kendrick (1961) Index

Let our homogeneous output be Y, and the two factors of production denoted by labour (L), and capital (K), and w_0 and r_0 denote the factor rewards (earnings) of labour and capital respectively in the base year of the study (here it is 1971). We have the Kendrick index for the year t as

$$A_t = \frac{Y_t}{w_0 L_t + r_0 K_t}$$

Under the assumptions of constant returns to scale, perfect competition and payment to factors according to their marginal product, the total earnings of labour and capital in the base year will be exactly equal to the output of that year; so that A_0 is equal to unity by definition.

Kendrick index may be interpreted as the ratio of actual output to the output which would have resulted from increased inputs in the abscence of technological change. Since the index is based on a linear production function, it fails to allow for the possible diminishing marginal productivity of factors.

2. The Solow Index

The Solow index of TFP is based on the Cobb-Douglas production function, which assumes unitary elasticity of substitution. According to Nelson(1965) this is not a series draw back. He has shown that the fact of non-unitary elasticity of substitution is unlikely to make significant difference to the estimates of total factor productivity. Therefore under the assumption of competitive equilibrium the Solow index and the Kendrick index are equivalent for small changes in output and inputs.

Under the asumptions of constant returns to scale, autonomous Hicks-neutral technological progress and payment to factors according to marginal product, we have the equation,

$$\frac{\dot{A}}{A} = \left[\frac{\dot{Y}}{Y}\right] - \left[(1-\alpha)\frac{\dot{L}}{L} + (\alpha)\frac{\dot{K}}{K}\right] \quad --------(2).$$

Where Y denotes output, L, labour, K, capital and α, the share of labour in value added. Dot stands for the time derivative. From (2) the discrete form is obtained as

$$\frac{A}{A} = \left[\frac{Y}{Y}\right] - \left[(1-\alpha)\frac{L}{L} + \alpha\frac{K}{K}\right]$$

Once the computation of A/A is done with the help of equation (2), the solow index is obtained using the identity,

$$A(t + 1) = A(t)\left[1 + A/A\right].$$

Here we are taking $A(\emptyset)$ as unity.

3. The Translog Index

The translog index is a discrete version (developed by Tornquist) of the continuous Divisia Index. Translog index numbers are symmatric in data of different time periods and also satisfy the factor reversal test approximately. The translog index of technological change is based on a translog production function, characterised by constant returns to scale. It allows for variable elasticity of substitution and does not requie the assumption of Hicks-neutrality.

For appication to data at discrete points of time, an approximation to the continuous Divisia index, knoow as translog index, may be used, which assumes a translog function(Christensen, Jorgenson and Lau (1973)), describes the relationships between the Output(Y), Capital(K), Labour(L), and Technology(t), and also the ralationship between the aggregates and the components. Constant returns to scale is assummed for all the factors.

Notes and References

1. Johri and Agarwal(1968), op.cit.

2. Salter, W.E.G., Productivity and Technical Change, 1960.

3. J.W. Kendrick, Productivity trends in the United States, NBER, 1961.

4. The fixed labour force at cochin port includes the number of class one, two, three, and four labour.

5. Dennison, E.F. "Measurement of Labour Input: Some Questions of Definition and Adequacy of the Data", in Output, Input and Productivity Measurement, NBER, 1961.

6. Solow, R.M.,'Technical change and Aggregate Production Function' Review of Economics and Statistics, August, 1957.

7. Goldar, B.N.,Productivity growth in Indian Industry, 1986.

8. Details of the problem of measurement of capacity and its utilisation and the identification of the factors influencing capacity utilization are given by Sastry, D.U.'Capacity Utilisation of Cotten Textile Industry in India, 1984.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In this chapter we are presenting the summary of findings. The port of Cochin with its natural locational advantage and conducive polity of the region from time to time, emerged as one of the important stop-overs of both coastal and international trade from the early days of history. Both these factors together with the export potentials of its hinterland helped the port to flourish in its trade activities. But as the nature of transportation network and the modes changed with the introduction of modern technological innovations for reducing both cost and time duration in transportation, traffic through Cochin port began to decline. The other factors responsible for this are the lack of investment in modern cargo handling equipments such as gantry cranes, etc., in pace with the changes in the international maritime transport, and the uncompramising labour relations that existed in the beginning of the 80s. As a result Cochin port declined to a mear feeder port to Colombo in the international maritime trade, and significant shift in the traffic to other nearby ports.

The share of Cochin port in the total traffic of all Indian ports shows a drastic decline during the period of analysis 1970/71 to 1985/86. In fact the share has declined from 8.67 per cent in 1970/71 to 3.85 per cent in 1984/85. Though the share has declined during the period, the traffic (absolute) through Cochin has increased marginally over the period. In 1970\71 the total traffic handled through Cochin port was 48.40 lakh tonnes and by

164

1985/86 it increased only up to 52.80 lakh tonnes. An increase of 0.6 per cent during the period 1971 to 1986 and for the period 1971 to 1980 the average growth rate in output was 1.4 per cent and that for the period 1981 to 1986 was -0.6 per cent. Eventhough there is an increase in traffic a decomposition analysis shows that certain components of trade sich as (a) foreign vs coastal, (b) Export vs Import and (c) Bulk vs Break-bulk cargo have drastically declined over the period of analysis.

The percentage of Coastal trade to total trade through Cochin has gone up from 18.54 per cent (1974) to 56.40 per cent(1986), whereas the foreign trade's share has come down steadily from 81.46 per cent to 43.60 per cent during the same period. The export trade through has come down from 29.79 per cent (1970) to 13.64 per cent (1986) to total trade(that is from 13.92 lakh tonnes to 7.19 lakh tonnes), where as the import trade has slightly increased from 70.21 per cent to 86.36 per cent(that is from 34.47 lakh tonnes to 45.59 lakh tonnes, this is mainly because of the increase in the oil traffic), over the same period.

The major finding about the composition of trade through Cochin port is that the general cargo traffic through the port was alarmingly declining throughout the period of analysis, which is crucial since the modern technological changes such as containerization can only be done on this type of cargo. The bulk cargo traffic(oil, etc.) through the port increased from 80 per cent to 89 per cent to total traffic over the period 1974 to 1986, whereas the break-bulk cargo traffic(that is general cargo), has declined from 20 per cent to 11 per cent over the same period.

The increase in the bulk traffic through Cochin points to the emerging specialization at the port. The main components of trade through Cochin port are oil, fertlizer and general cargo's. The oil trade has been the major component in both export and import trade through Cochin port. Next comes fertlizer trade. Both oil and ferlizer trade occupy the major portion of the trade through Cochin port. The General trade, that is the total trade minus the oil and ferlizer trade has come down from 10.09 lakh tonnes to 6.44 lakh tonnes over the period.

A detailed discussion of the container traffic through Cochin port, reveals that the Container traffic, has increased from 0.03 lakh tonnes(in 1974) to 2.21 lakh tonnes by 1986. The export container traffic has increased from 0.02 lakh tonnes to 1.78 lakh tonnes and the import traffic has increased from 0.01 lakh tonnes to 0.43 lakh tonnes over the same period. In the case of commoditywise container traffic through Cochin, the main export items through Cochin port were cashew, coir, pepper, fish, tea, coffee, turmeric, chemicals, etc. The container traffic through Cochin port will improve in the future with the facilities like the inland container depot(ICD) at Coimbatore, and the new facilities at Cochin port etc.

The fluctuation in the annual growth leads us to the growth rate estimation using linear regression. This method assumes that there exists a discontinuity in the growth rate between the two periods. Since Boyce(1986), this discontinuity can be eliminated by a linierization at the break point. We have used a kinked exponential model suggested by Boyce to estimate the periodwise

estimates of growth rates. For the overall period(1971-1986) we have estimated the growth rate as +1.10 per cent, and for the two sub periods, it was +2.67 per cent (1971-1979), and -1.197 (1980-1986)per cent respectively. The decline in the second period is disturbing, this is partly because of lack of facilities in the port and the labour problems prevailed in the 80s.

The capital input category of Cochin port consists of details of land, transport equipments, cranes, etc. In order to estimate the stock of capital at Cochin port, we have grouped the capital input category into three main groups, such as construction, plant and machinary and transport equipments. Further for preparing a price deflater we grouped them into two groups as 'construction' and 'transport equipment'. The Capital stock estimated using the 'Perpetual Inventry Method' has increased from Rs.1298.74 lakhs to Rs.2499.10 lakhs over the period from 1970 to 1986. The average annual growth rate of capital stock over the period 1971 to 1986 is calculated as +3.10 per cent(3.63 per cent using the linear regression method). For the two sub-periods, 1972-80 and 1981-86 the growth rates are 4.6 per cent (4.73 per cent using regression) and 0.9 per cent (2.0 per cent using the regression) respectively. This finding also confirms that the growth rate of capital in the second period was almost stagnant.

The total labour input category of Cochin port has not shown much fluctuations during the period of analysis. The total number of labourers increased from 6462 (1971) to 6699(1986). Of these the significant increase was in the number of fixed labour

167

(that of class I,II,III, and IV), from 4837 (1971) to 6039(1986). The decline was evident in the case of shore labour (from1625 in number in 1971 to 660 in 1986)and casual labour(from285 in 1974 to 10 in 1986).

The strength of category A&B(shore & casual) workers average during 1974 was 956 and it declined to 606 by 1986. Also the effective strength of workers has decreased from 801 in 1974 to 507 in 1986. The concept of effective strength of workers is obtained by eliminating the time lost by the workers. The number of man-shifts worked also has declined from 1,34,425 to 1.08,009 over the period from 1974 to 1986. The man-shift lost has decreased from 54324 to 36476 man shifts. over the same period, which is an encouraging trend. The total wages of the labours in 1970/71 was Rs. 206.65 lakhs and by 1986 it has gone up to Rs.1283 lakhs. The major increase in wages was found in the case of class I and II labourers. The average earnings per month per worker of the category A & B workers has increased from Rs.296 to Rs.1950 over the period from 1974 to 1986.

The annual average growth rate of labour for the period 1971 to 1986 was found to be +0.5 per cent (+0.76 per cent in the case of the regression) and for the two sub-periods, it was found to be +0.6 per cent (1971/80), (0.74 in the case of the regression) and -0.6 per cent (1981/86), (+0.79 in the case of the model) respectively. That is, in the second period the growth rate in labour was negligible.

The performance of Cochin port is measured in terms of

certain important port performance indicators. We have considered certain important operational and financial indicators. The important operational performance indicators of the port does not show any encouraging trend. In the case of the total number of vessels calling at cochin port, there was a noticeable declining trend [from 1158 (1951) to 814 (1986)]. But the increase in the net registered tonnage(NRT) recorded [from 23.56 lakh tonnes(1951) to 54.04 lakh tonnes(1986)], is mainly attributale to the increase in the ship sizes. But this can't over rule our conclusion that, over time the traffic through the port has declined, in the sense that, the average NRT over the period remained more or less the same. The decline in the number [from 659 (1974) to 312 (1986)] and tonnage [from 22.31 lakh tonnes(1974) to 12.82 lakh tonnes(1986)] of the general cargo vessels supports our conclusion. The encouraging trend can be observed only in the case of the container vessels, number of vessels from 24(1978) to 227(1986) and NRT from 2.56 lakh tonnes (in 1978) to 11.67 lakh tonnes (in 1986).

The flagwise (country wise) analysis of ships over the period(1974 to 1986) showed that only the coastal shipping, both in number of ships and percentage to total traffic handled has shown an increasing trend. There has been a systamatic decline in the international traffic through Cochin port. The tendency, clearly is to specialise in coastal shipping.

The most crucial indicator of the operational performance of a port is the turn round time. The average turn round time for all the vessels, and general cargo vessels in particular has been

showing an increasing trend. This is an indication of inefficiency in the different port activities. In the case of general cargo vessels the average turn round time was 4.8 days in 1977/78 and it has increased upto 5.7 days in 1985/86. For container vessels the average turn round time has shown only a slight increase over the period from 1.7 days (1977) to 2..7 days in 1985/86. Another crucial performance indicator is the detention time of ships. The average detention time(days) for container vessels has also shown an increasing trend from Ø.26 days to Ø.43 days over the period 1981/82 to 1985/86. There are a number of items which influence the detention time, in our analysis the main item(almost 8Ø to 9Ø per cent) for the casue of high detention time was bertht not available. But the overall utilisation of the berths was only about 6Ø per cent over the period 1974 to 1986. This is because of the lack of equipments for each berth group. The percentage availability of the cargo handling equipments also has shown a declining trend. The percentage availability of the wharf cranes has declined from 83.7 per cent(1974) to 2Ø.1 per cent, and that for mobile cranes from 76.5 per cent(1974) to 31.1 per cent(1986), and that for fork lift trucks from 48.1 per cent (1974) to 27.7 per cent(1986).

The average service time lost for 1ØØØ tonnes of cargo for general cargo vessels showed a decline from 84 hours(1977) to 67.7 hours(1986). The decline in the time lost is an encouraging trend. But in the case of container vessels the indicator has shown an increase from 21.8 hours(1977) to 24.8 hours(1986). This increase in the time lost generally reveals the inefficiency in the working of the container vessels operation at cochin port. The average

service time worked for 1000 tonnes of cargo for both general cargo and container vessels has shown an increase from 37.4 hours(1977) to 34.5 hours(1986) and from 15.8 hours(1977) to 19.1 hours(1986) respectively. The divergence of cargo, mainly commodities such as cashew kernals, tea, marine products and coffee, etc. to other nearby ports like Tuticorin and Mangalore in the early 80s is the result of the poor performance of these indicators. The increase in the average output per gang shift of port and dock labour is mainly due to the introduction of new equipments in cargo handling and the exogeneous factors such as containerisation which has changed the whole of internatinal maritime transport.

An analysis of the financial performance of Cochin port also reveals that for the past one and a half decade most of the financial performance indicator were not showing satisfactory trends. The operating ratio, which is the ratio of operating revenue to operating expenditure, was showing an increasing trend. The operating income has increased from Rs.370.06 lakhs(1970/71) to Rs.3072.68 lakhs(1985/86), and the operating expenditure has also increased from Rs.281 lakhs to Rs.1974.71 lakhs over the same period. But the miscellaneous expenditure of the port was higher than the miscellaneous income over the period of analysis. The transfer to reserve, that is an expenditure item, increased from Rs.32 lakhs to Rs.254 lakhs. Most of the years the port was making deficit (total cost-total revenue). The cost of dredging was the most significant part of total costs, it has increased from Rs.65.28 lakhs(1971) to Rs.88 lakhs(1986). In the case of operating surplus, except for the years 1974 and 1983, all the

other years in the period the port was making operating surplus.

A detailed analysis of the indicators such as the capital expenditure, loan from government and capital debt show that they all show a similar trend leading to a poor financial performance of the port. In the case of capital expenditure, it increased from Rs.240.13 lakhs(1974) to Rs.1907 lakhs(1984), and then it has come down to Rs.565 lakhs(1986). The loan from government also has shown a similar trend, that is from Rs.203 lakhs (1975), to 1578 lakhs(1984) and then declined to Rs.305 lakhs in 1986. Also the capital debt of the port has increased steadily from Rs.1150.96 lakhs(1975) to Rs.6663 laks(1986). The total capital debt of the port has increased form Rs.737.47 lakhs(1971) to Rs.6662.54 lakhs(1986).

Even though the capital reserve of the port has increased from Rs.1774 lakhs(1971) to Rs.3324 lakhs(1986), the revenue reserve has shown s steady decline from Rs.1520 lakhs(1971) to Rs.6 lakhs(1986). The capital assets at Cochin port over the period has increased from Rs.3764 lakhs to Rs. 10959 lakhs, but at the same time the current assets has declined from Rs.4263 lakhs(1982) to Rs.3248 lakhs(1986). There was a steady increase in capital work in progress from Rs. 721 lakhs(1971) to Rs.8696 lakhs(1986). The increase in the capital work in progress may lead to improvement in the facilities of the port in the near future. The capital assets at orginal cost has increased from Rs.1517 lakhs(1971) to Rs.10958 lakhs(1986), and the net book value of capital assets has also increased from Rs.1320 lakhs(1971) to Rs.9931 lakhs(1986).

The productivity of labour at Cochin port, measures the net savings in factor use, was almost the same throughout the period. The average productivity per effective hook-hour was around 19 to 20 tonnes, and the output per man-shift has increased from 2.77 tonnes(1974) to 4.89 tonnes(1986). Another indicator of labour efficiency, that is the turn round time, was also observed to be around 4 to 5 days on an average over the period 1976 to 1986. This is actually an inefficient trend. Also the turn round time of the container vessels has increased from 1.62 days to 2.19 days over the period 1982 to 1986. As compared to april 1978, both the output per gang-shift and output per man-shift of april 1987 has doubled through Cochin port mainly because the improvement in the cargo handling facilities.

The labour (capital) productivity can be useful in measuring the saving in that input which is achived over time. Here we have calculated labour productivity of total labour and that of shore and casual labor using total output and general cargo separatly. The labour productivity at Cochin port has declined from 748.99 tonnes(1971) to 595.28 tonnes(1979), and to 584.53 tonnes(1986). The productivity of the shore and casual labour in the case of 'general cargo' has increased from 621 tonnes(1971) to 970 tonnes(1986). The average growth rate of labour productivity(total output) for the period 1972 to 1986 was only 0.05 per cent, and for the first sub-period(1972-79) it was +1.2 per cent and in the second period(1980-86) it declined to-2.68 per cent.

The average growth rate of capital productivity for the period 1972-1986 was only -2.5 per cent, and for the sub-period

1972-79 it declined to -2.8 per cent, and for the sub-period 1980-86 it slightly increased to -2.2 per cent. The average growth rate of capital intensity at Cochin port for the period 1972 to 1986 was only 2.5 per cent and in the first sub-period(1972-1979) it was 4 per cent and, for the second sub-period(1980-1986) it declined to 0.9 per cent.

We have also measured the impcat of technical knowledge in the growth of the output. This we have obtained through measuring the total factor productivity(TFP). The TFP is considered as a residual or the unexplained part other than that of capital and labour which contributed to the growth of output. That is, the increase in TFP is attributable to the contributions of the productive forces whose measurement is not possiible. We have calculated the TFP growth index's using three commonly used measures, namely Kendrick, Solow, and Translog. All these methods gives similar results for the respective periods.

The TFP growth for the period 1971 to 1986 is calculated as -1.09 per cent, -1.15 per cent, and -1.13 per cent for the Kendrick, Solow, and Translog measures respectively. That is, for the period as a whole the contribution of technology for output growth was almost negligible. For the first sub-period 1972 to 1979, the three measures are -0.58 per cent, -0.74 per cent, and -0.77 per cent, and for the second sub-period(1980-86) the three measures are -1.67 per cent, -1.6 per cent, and -1.5 per cent respectively. The decline in the second sub-period is a clear indication of a fall in the total efficiency of the port.

An attempt to explain the decline in TFP growth lead us to the measurement of Capacity Utilisation of the port. We have calculated the capacity utilisation using the minimum capital output ratio method and found that the capacity utilisation is found to be fluctuating around 70 to 90 per cent on an average over the period at Cochin port, leads us to the fact that it was not the underutilization of capacity that led to the decline in productivity of the port.

To conclude, the performance of Cochin port was generally unsatisfactory in the period 1971 to 1986. The main reason that can be pointed out for this is the lack of investment in modern cargo handling equipments. If the port authorities or the government of India had decided to invest on the latest techniques in cargo handling, the port would not have sliped into a state as it is now, that is a mere feeder port to Colombo. The unhealthy labour relations existed during the early 80s was also another important factor for the decline of the traffic through the port. The present state of affairs may be improved if the port authorities together with the government of India decides to invest at Cochin port on the latest cargo handling equipments,(such as gantry cranes et.),. Also improving the conscience of the trade union leaders as well as the workers on the matters regarding the 'fear of displacement of work force' due to the technological or any kind of mechanisation will to an extent solve the labour problems that are prevailing at cochin port. Cochin port can regain its past glory and compete with any other port in the region if the adequate investments are made.

BIBLIOGRAPHY

Arasaratnam   'India and Indian ocean 1500-1800, 1987

Ashin Das Gupta,   Malabar in Asian Trade' 1740-1800, 1967.

Ashin Das Gupta and   India and Indian Ocean 1500-1800,
    Pearson (Edited)   1987.

Baldeo Sahai,   The Ports of India, 1986.

Banerji, A.,   'Capital Intensity and Productivity in
                                Indian Industry, 1975.

Boyce,J.K.   'Kinked Exponential Models for Growth
                                Rate Estimation', Oxford Bulletin of
                                Economics and Statistics, 48, 1986.

Bristow, Robert,   Cochin Saga, 1967.

Chandok. H.L.   Whole Sale Price Statistics, India, 1978.

Cochin Chamber of Commerce   Administration Reports Various Years.

Denison, E.F.,   'Measurement of Labour Input:
                                Some Questions of Definition and Adequacy
                                of data'in Output, Input and Productivity
                                Measurement, NBER, 1961.

Dharmasena.K.,   The Port of Coloumbo, 1860-1939, 1980.

Evans, A.A.,   Technical and Social Changes in the
                                in the Ports' , ILO,1969.

Genevieve Douchon,   Sixteenth Century Malabar and the Indian
                                Ocean, in India and Indian Ocean 1500-
                                1800, 1987.

Genevieve Bouchon and
Denys Lombard,   The Indian Ocean in the Fifteenth
                                Century, in 'India and Indian Ocean
                                1500-1800', 1987.

Goldar, B.N.,   'Productivity Growth in Indian Industry'
                                1985.

Government of India   'Basic Port Statistics', Transport
                                Research Division 1984/85

Government Press
Trivandrum   'The Interportal Trade Convention
                                    (1858-1925) 1927.

Jean Deloche,   Geographical Considerations in the
                                    Localisation of ancient Sea-ports of
                                    India',in The Indian Economic and Social
                                    History Review,Oct.- Dec.1983, Vol. XX,
                                    No.4.

Harris.A.Norman   Factor Controlling Port-Sites with
                                    respect to Western India' 'Geography',
                                    vol.18.

Hans Schenk,   Views on Alleppey 1986.

Hashim, B.R. and Dadi,M.M.   'Capital Output relations in Indian
                                    Manufacturing(1946-64). 1973.

John Fryre,   A New Account of East India and Persia,

Kannan, K.P. and   'Agricultural Stagnation in kerala: An
K.Pushpangadan   Explanatory Analysis., CDS Working
                                    Paper, 1988.

Kendrick, J.W.   'Productivity Trends in the United States
                                    NBER, 1961.

Krishna Iyer, S.   'Travancore - Dutch Relations.1729-1741,
                                    Unpublished Ph.D.thesis, University of
                                    Kerala, 1984.

Lal, R.N.,   'Capital Formation and Its Financing in
                                    India, 1977.

Michael E. Eliot Hurst (ed.)   'Transport Geography Comments and
                                    Readings' 1974.

Moshe Kim and   'Structure of Production Productivity and
Arie Sachish   Technological Change in a port',"Journal
                                    of Industrial Economics", 1987.

Mridula Krishna,   Survey of Research in Economics,
                                    Infrastructure', Vol.VI,'Economics of
                                    Transport, Indian Council of Social
                                    Science Research, 1975.

Nadiri, M.I,   "Some Approaches to the Theory and
                                    Measurement of Total Factor Productivity:
                                    A Survey", Journal of Economic Literature
                                    Vol. VIII, 1970.

Nagam Aiya, V.   'The Travancore State Manual' 1906.

Natesan .S.,   A Geographical Survey of Early European
                              Trade and Trade Centres in Malabar, in
                              The Journal of the Madras Geographical
                              Association , Vol.VI., No. 3 & 4,Oct.
                              1931, Jan. 1932.

National Council of
Applied Economic Research   'The Traffic Survey of Cochin Port'1969

Padmanabha Menon, K.P.   'History of kerala' 1924 p.181-182.

Pankajakshan.T.,   An Economic Study of the Port of Cochin,
                              Its Trade Traffic and Working ,PhD.Thesis
                              University of Poona, 1963.

Pearson, M.N.,   India and Indian Ocea in the Sixteenth
                              Century, in 'India and Indian Ocean,1500-
                              1800 '.1987.

Periplus Maris   Aerithrane   An unknown Greek Auther, Eng. Trns. by
                              Schoff. W.H.,' Periplus of the Erythraean
                              Sea', 1881.

Pliny   'Natural History',VI 26.

Ptolemy,   'Geography', Edited by, Mc Crindle.

Reserve Bank of India   Report on Currency and Finance, Various
                              Years(1978/79 to 1985/86).

Rosen,George.,   'Industrial Change in India',1959.

Salter, W.E.G.   'Productivity and Technical Change , 1960

Sastry, D.U.,   'Capacity Utilisation in Textile Industry
                              1980.

Solow, R.M.   'Technical Change and the Aggregate
                              Production Function', Review of Economics
                              and Statistics, August 1957.

Sreedhara Menon, A.   'A Survey of Kerala History' 1967.

Stravorinus.J.S.,   -   Voyage to the East India, Vol.3, 1789.

Thomas, P.J.,   - Roman Trade-Centres on the Malabar Coast
                                                The Journal of the Madras Geographical
                                                Association, vol. VI., No. 3 & 4, Oct.
                                                1931 Jan.1932.

Thomas Issac   'Class Struggle and Industrial Structure:
                                                A Study of coir weaving Industry at
                                                Alleppy ,Unpublished Ph. D thesis,
                                                JNU,1985.

Thomas Issac. T.M. and
Michael Tharakan. P.K.   'An Enquiry into the Historical Roots
                                                of Industrial Backwardness of kerala
                                                A Study of Travancore Region'   CDS
                                                working paper.

United Nations Economic   Economic Comission for Africa, A Report
and Social Council   on a Preliminary Survey of Factors
                                                Contributing to Level of Freight
                                                Rates in the Sea-borne Trade
                                                of Africa, 1965.

United Nations Conference
on Trade and Development,   Port Performance Indicators,1976.

Velu Pillai.T.K.,   Travancore State Mannual Vol.IV., 1940.