LAND USE POLICIES IN A CITYPORT WITH SPECIAL REFERENCE TO ALEXANDRIA

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy

by

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بسم الله الرحمن الرحيم

TO MY PARENTS,
MY WIFE AND CHILDREN
WITH LOVE AND RESPECT

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ABSTRACT HAZEM M. EWAIS

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This research is an attempt to explore the land-use implications of the interdependent relationship between the port and city. Three main issues are investigated with the aim of, first, outlining the nature and extent of cargo handling techniques and other technological changes that have been introduced into maritime industry; second, to establish the extent to which this new technology has influenced port land-use patterns; and third, to identify the functions and activities of the port which place spatial demands on the city's land-use characteristics.

The main purpose of the research is to derive guidelines for the formulation of policy for the land-use planning system in Alexandria cityport. Reference is made also to Liverpool cityport in order to provide a sound understanding of the impact of new technology on both the port on the one hand and the city on the other.

The research is organised in such a way that advantage can be taken of theoretical materials, a case study approach and a comparative study approach. The theoretical context of the research provides the scientific framework in which the new technology, the various types of port land use and port related activities which place demands on city space are discussed and identified. The empirical work focuses upon two case studies in which the evolution of the waterfront of Alexandria and Liverpool ports is to be examined in order to investigate the consequential impact of new technology on the land use functions and activities of these two ports. The comparative study approach is used to highlight lessons of experience derived from the case of Liverpool in dealing with specific land use problems, and which could be relevant to the case of Alexandria.

Finally, the research arrives at some significant conclusions and provides some important recommendations within which the short and long term land use planning policy for Alexandria cityport should be formulated. The short term recommendations are mainly concerned with immediate proposals for dealing with urgent problems which face both the port and the city of Alexandria. These proposals are concerned with the restoration of port facilities, the modernisation and organisation of port operational management, and the transportation problems generated by the port traffic. Also within this short term planning horizon, recommendations have been made relating to the establishment of an organised wholesaling system as well as increasing emphasis being given to effective participation of local government. The longer term proposals include a comprehensive detailed study of the traffic generated by the port as a step towards the identification of a radical solutions to this chronic problem. In addition, recommendations are made for the establishment of a load centre in the port, to develop the concept of a MIDAs system and other features of a future development strategy for the port.

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CHAPTER ONE

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INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In recent years the subject of the interface between port and city has became a significant research theme. "The concept of the interdependent city-port and the port-urban interface as a research field of some considerable potential has been gaining ground in recent years" (Hoyle, 1982, p.10). The port, as a major element in this city-port relationship, has experienced considerable revolutionary changes in the last two decades. With the progressive introduction of new technology in the maritime industry in the late 1960s and early 1970s, so important modifications have occurred in ship design and cargo handling techniques. The character of many seaports has changed in response to this new technology. The increases in ship size emphasised the need for greater water depths in approach channels and alongside quays. Furthermore, the increased carrying capacity of vessels has necessitated the construction of extensive storage facilities at the dockside. These demands have been accentuated by the modernisation of techniques of cargo handling (Slack, 1980). Generally, the new technology has resulted in enormous changes in the size and structure of port employment and in the patterns of land use inside the port. Many ports have encountered a dramatic reduction in the numbers of employees required. Others have shrunk or expanded in size as a consequence of this new technology.

The inter-relationship between the port and the city has, therefore, been influenced directly by the introduction of new technology. These recent technological changes have greatly accelerated the phenomenon, loosening the spatial and functional ties between cities and ports and subverting the traditional land use characteristics of the urban waterfront (Hayuth, 1982a). The typical port oriented activities, which used to take place in the city centre waterfront close to the port, began to move to new places where the new technology became established. This locational shift has opened the waterfront to other urban oriented activities. Other activities operating within the cityport's system and influencing the relationships between ports and cities, such as economical, environmental and political activities, need to adjust their pattern of operation as a result of the spatial changes at the port/city interface.

Many studies have been devoted to exploring the impact of the new technology on the structure of port land use patterns. Others, have been concerned with the changing functions and activities of waterfront land uses. A few more studies have been dedicated to investigating the various and complex interaction between the port and the city in terms of industrial development, transportation systems and associated services, and economic impacts. However, little attention has been paid to research concerned with the impact of the port, as a sense of integrated functions and activities, on the land use characteristics of the city. The port as a vital element in the cityport interdependent relationship, can be expected to have a significant impact on the city land use patterns. The various activities generated by the port, which can be represented by labour requirements, transportation, commercial and other services, and the different types of port related industries, have imposed an enormous impact on the land use functions and activities of the city and the region in which the port is located.

It is with all these aspects of cityport interrelationships in mind that this study attempts to overview the different technological changes that have contributed to the changing image of the traditional maritime transport and the cargo handling techniques. As pointed out by Pinder and Hoyle (1981), "Technology" is an umbrella term, and the importance of technological change can only be full appreciated if the roles played by its major components are considered separately. Therefore, it is one of the important tasks of the study to draw attention to and to outline the impact of this new technology on the structure of port land use.

The study attempts to bring together the different types of port related activities which have been placing demands on cityport land use and influencing its land use planning system. Identification of such activities make it possible to define the actual interdependent relationship between the port and its city. In addition to this, the study attempts to draw attention to the other significant factors which have a considerable impact on the land use planing system of the cityport.

The study is, in part, concerned with the land use policies of a particular cityport, namely, Alexandria. One of the main purposes of this study, is to derive guidelines for the formulation of policy for the land use planning system in Alexandria cityport. However, in the empirical work of this study reference is made also to Liverpool cityport for a number of reasons. Liverpool port is one of the major seaports of England. It has experienced the complete introduction of new technology over the last fifteen to twenty years. The consequences and effects of this new technology are very obvious and well reflected in the land use patterns of the city. Furthermore, data and information relating to both the port and city were relatively readily available.

The cityport of Alexandria, on the other hand, has been selected as a main case study for quite a number of reasons. The cityport of Alexandria is the second urban centre in Egypt after Cairo and its port is the first among all the Egyptian ports. The new technology has been introduced to the port very recently and the process of adoption is still continuing. The initial impacts of this technology on the port and the city land uses are clear and evident in the problems represented in the extreme congestion and accumulation of cargo inside the port, as well as the congestion of the road network outside the port. So, it is for all these reasons that Alexandria cityport is considered to be a good example for research purposes, and provides an appropriate environment in which to attempt to interweave the findings of an empirical study and the framework provided by the principles of land use planning policy. So is also hoped that it is reasonable to extend these findings to any cityport which operates under the same circumstances.

In the empirical work, the study attempts through the examination of the two case studies in question to evaluate and assess the evolution of the changing land use functions and activities of the two ports' waterfronts over the last twenty years. This specific period of time was chosen for two principal reasons. In Alexandria, this time span provides an opportunity to present a broad assessment of changes in waterfront activities during the periods of office of three different national government administrations. Meanwhile, in Liverpool, this specific period of time gives a good chance to evaluate the consequences of the complete and full introduction of new technology. The analysis of the case studies has enabled the identification of the actual impact of the technological changes on the land use characteristics of the two port waterfronts.

The materials obtained from the evolutionary analysis of the two case studies, have been employed together to provide the basis for a comparative study. The technique of comparative analysis has been adopted in order to find out whether or not there is a similarity in general patterns of land use and functional differentiation of the two ports and the urban space linked to these port systems.

Through this cross national comparison, the study attempts to derive some lessons from the experience of Liverpool port in dealing with particular land use problems. Such lessons may be more or less relevant to the case of Alexandria. Nevertheless, the study benefits from being able to at least draw on the philosophy and the guiding principles behind these lessons in a way which would be relevant to the Egyptian case.

1.2 THE AIMS AND OBJECTIVES

It is with clear understanding to this background of the study that the principal aims are:

1. To investigate the new technology introduced into shipping and cargo handling, as well as maritime transportation.

2. To explore the impact of this developing technology on port land use patterns.

3. To identify the functions and activities of the port which place a demand on city space and influence its land use patterns.

In order to fulfill the aims of the research, a number of related objectives can be identified as:

i. To identify and overview the revolutionary technological changes which have contributed to the changing image of the traditional marine transport and cargo handling methods.

ii. To define the different types of land use functions and activities that exist in the port waterfront.

iii. To illustrate the various impacts and requirements of the new technology on port land use characteristics.

iv. To define the types of port related activities which place a demand on the city land uses on the one hand, and to arrive at the different impacts imposed by these activities on patterns of these land uses on the other.

v. To discuss in general rather than in detail the various factors influencing the cityport land use planning system.

vi. To determine the different land use problems involved with the introduction of new technology in both Alexandria and Liverpool cityports, in order to identify features of the solutions adopted in Liverpool which could be relevant to Alexandria.

vii. To reach certain conclusions and recommendations which can help to establish an appropriate land use planning system in Alexandria cityport.

From the above aims and objectives it appears that the study comprises a number of areas of concern. It is concerned with outlining the main changes which have occurred in the maritime industry and cargo handling techniques as an outcome of the adoption of new technology. It attempts this through the identification of these technological changes which have affected the port land use functions and activities as a response to the new technology. The study focuses mainly on the interaction between the port related activities and how they influence the cityport land uses. However, the research attempts to draw attention to the different types of problems which may accompany this interaction. In order to illustrate this interaction, the research provides a variety of examples concerned with different cityports. Through the examination of two specific case studies, the research attempts to isolate the various land use problems resulting from the introduction of new technology to these ports. A final aim of this research is to set out guide lines for the formulation of land use planning policy for Alexandria cityport and, ideally, for any other cityports which shares similar circumstances.

1.3 RESEARCH METHOD

The method adopted in carrying out this study is selected to match with the nature of the research on one hand, and achieve its aims and objectives on the other. The research method involves two main approaches. It is a combination of the case study approach and the comparative study approach. The case study approach is adopted in order to carry out the empirical work on the two cityports Alexandria and Liverpool. It is necessary, as mentioned earlier in this chapter, to examine the evolution of the two waterfronts within specific periods of time, in order to identify the consequences of new technology applied to these two ports. The case study approach is employed to achieve the compilation of data and information related to the two ports. With the aid of the documentary and observation surveys, the case study approach provided a basis for the main findings of the study in which the principal land use problems were identified.

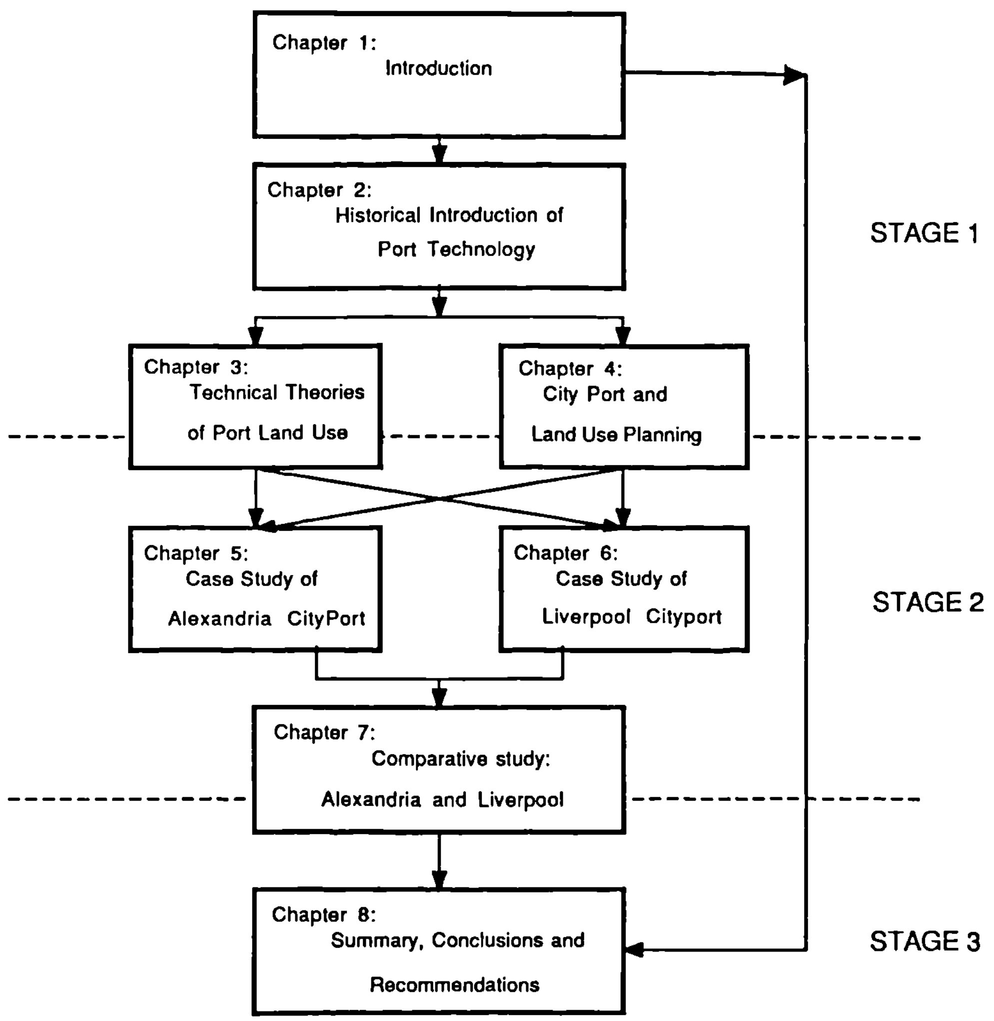
The comparative study approach is used to implement the cross national comparison between Alexandria and Liverpool ports. The adoption of this approach, in parallel with the case study approach, is intended to draw some lessons from the experience of Liverpool in dealing with specific land use problems.

1.4 STRUCTURE OF THE THESIS

The structure of the thesis has been built on the idea of interrelated stages. Each stage depends on the other in order to provide a consistent framework in which the aims and objectives of the research can be fulfilled. Three main stages have been considered. The first is concerned with the theoretical context of the research. This stage provides the scientific material which discusses and defines the new technology introduced into the maritime industry and the cargo handling techniques. In addition, it defines the various types of port land use according to their functions and activities. Finally, this stage explores and discusses the types of port related activities which influence the city land use patterns. The second stage mainly deals with empirical work as well as the comparative analysis between the two case studies. The third stage brings together the main findings derived from both the theoretical context and the empirical work, in order to draw out the conclusions relating to the main key issues of the research.

The general framework of the entire thesis consists of eight chapters, and the sequence of these chapters follows the chronological development of the research as indicated in the diagram Figure 1.1.

Figure 1.1: The structure framework of the thesis



The first introductory chapter, deals with the general background of the study, the aims and objectives of the research, the methods adopted to carry out the research, and the main structure framework of the research. The second chapter, is mainly concerned with the description of the new technology introduced in the maritime industry and cargo handling techniques. The chapter begins with a brief historical review of the new technology and its introduction. The technical terms which are often employed in the discussion of maritime subjects are defined. Then the four revolutionary changes that have occurred in the shipping industry are reviewed with reference to their impacts and provisional requirements on the port land uses. The third chapter, is dedicated mainly, to the land use planning of the port zone. The chapter starts with discussion of the issues and different views involving the definitions of port hinterland and foreland. This is followed by general description of the various uses of land within the port boundaries. Detailed explanations for each individual use of the land are presented. The fourth chapter focuses on the inter-relationship between the port and city with special reference to the city land use planning system. The chapter provides an outline of the port related activities which are placing demands on city land use. The chapter employs certain examples, extracted from the literature review, to illustrate the interaction between some of these port related activities and their cities and regions. In this chapter close attention is paid to the different issues involving the cityport as an integrated system in relation to the economic context, environmental problems, and political influences affecting the land use planning process. Chapter five is the first of two chapters concerned with the case studies. It deals with the case study of Alexandria cityport. The chapter starts by introducing the methodology adopted in conducting the two case studies. This is followed by an introduction to the case study in question including the historical background, the role of the city in relation to the country, the physical features of the city, and the various dimensions determine the environmental issues related to Alexandria. A detailed land use analysis of the port waterfront is carried out with the main aim of evaluating the changing patterns of port land use over the last twenty years as a response to the new technology. This is followed by another analytical study concerned with the port throughput. The relationship between the increasing land areas and volume of traffic has then been assessed. The proposed new port El Dekheila is presented with concise discussion of its purpose, location, stages of execution, environmental problems, employment impacts, and traffic forecasts. This chapter is ended with an overview of the impact of the two ports on Alexandria city land use.

Chapter six is the second of the empirical studies, and it deals with Liverpool cityport. The chapter provides a clear description of the port and its associated activities, as well as the different stages of its development. A critical assessment of the impact of new technology on the port land use patterns is provided through the analytical study of the port waterfront over the last twenty years. The impact of the port related activities on city land use is highlighted with respect to the principal port related activities identified earlier in the theoretical part. Chapter seven focuses on the comparative analysis of the two case studies. Similarities and differences between the two ports are identified. The lessons of experience derived from this comparative study are outlined. The extent to which these lessons could be relevant to the development of Alexandria is discussed. Chapter eight, the final chapter, summarises the main theoretical and empirical findings of the research. It outlines the important conclusions and gives the recommendations within which it is recommended that the short and long term land use planning policies for Alexandria cityport should be formulated.

CHAPTER TWO

CHAPTER TWO

HISTORICAL INTRODUCTION OF PORT TECHNOLOGY

2.1 INTRODUCTION

Some thirty years ago the maritime industry and specifically the marine transport system had to face radical changes in the structure of technology. Ten years later, cargo unitization as well as handling techniques were the subject of other revolutionary changes which have contributed to an enormous development in the efficiency of ports.

In this chapter an attempt is made to review the historical introduction of the technology in the maritime industry in general and the marine transport and its handling techniques specifically. Aspects which contributed to these technological changes are identified, including the problems that have arisen and the solutions that have been proposed.

Some terms which are often used in describing maritime subjects require to be defined. Concise definitions are given to these terms which include deep and short sea, and the types and classification of cargo including bulk, semi-bulk, and break bulk general cargo.

The final part of this chapter focuses on the revolution that has occurred in the shipping industry. The factors that gave rise to this revolution are reviewed and defined. These definitions comprise the introduction of mechanical equipment and the idea and the objectives of cargo unitization. The four principal techniques which have beem used to achieve such unitization are reviewed including palletisation, containerisation, roll on - roll off system and barge-carrying vessels. However, the detailed description of these four techniques is beyond the scope of this chapter.

Moreover, it will be apparent that the nature and the scale of the changes in the use of technology in the maritime industry was so accentuated that the demand for port land or space to accommodate the new methods of cargo handling and storage also changed dramatically. The nature of these changes will be discussed in more detail in the forthcoming chapter.

2.2 THE CHANGES OF THE STRUCTURE OF TECHNOLOGY IN MARITIME TRANSPORT BEFORE 1960

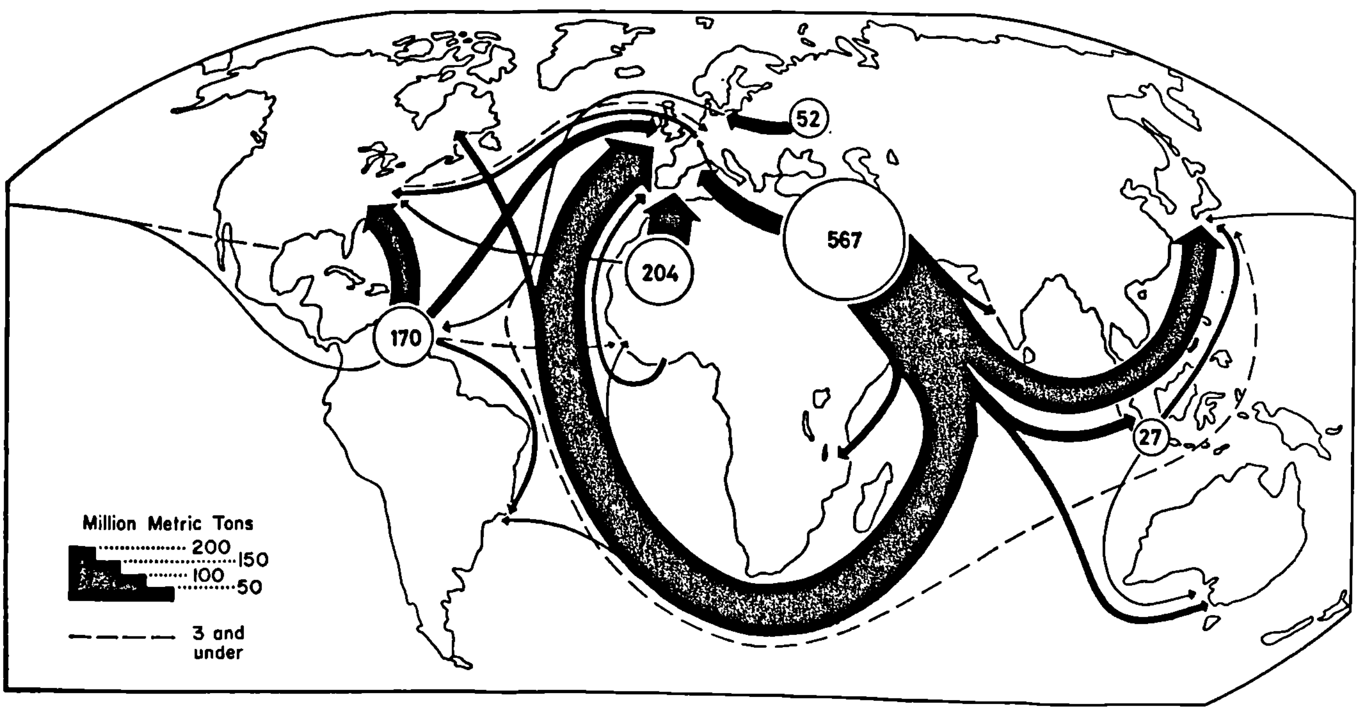
The term "Technology" was introduced in relation to the maritime industry during the Second World War. At that time, the persistent need to transport large quantities of war material and ammunition, together with food products, contributed to the emergence of new attitudes towards ship design. Then the post-war period saw radical changes in the world seaborne trade. The amount of world trade doubled between the 1948 and 1958, and expanded at a similar rate for some time (Oram, 1965, p.2-4).

After the Suez Canal crisis, and the blocking of the canal in 1956, there was enforced use of the longer route round the Cape of Good Hope, which meant that more ships had to be employed to carry the same amount of trade. On the other hand, major problems faced the industrialised countries concerning the regular supplies of crude oil coming from the Gulf area (Figure 2.1).

The preceding Suez Canal and oil problems provided a further politico-economic stimulus to technological changes, particularly in the case of oil and the oil tanker (Pinder and Hoyle, 1981, p.323).

In order to meet the oil transport needs of the industrial countries a constant growth has taken place in the world fleet of specialised oil carriers as well as the size of the transport units involved. Table 2.1 indicates the changes that occurred in the world tanker fleet from the beginning of this century. The considerable increase in the total deadweight tonnage should be compared with the corresponding modest increase in the number of ship units.

Figure 2.1
Main inter-regional movements of oil sea (1969)



Source: Couper, 1972, p.111

Table 2.1: The growth in world tanker fleet 1900-69

	No. of ships		Total dwt
1900	109	above 2,000 dwt	531,000
1919	467	above 2,000 dwt	3,681,000
1939	1,571	above 2,000 dwt	16,600,000
1955	2,693	above 2,000 dwt	39,015,000
1961	2,671	above 10,000 dwt	60,616,000
1966	2,814	above 10,000 dwt	88,585,000
1969	2,991	above 10,000 dwt	121,016,000

Source: Couper, 1972, p.112

However, shipbuilding technology was well developed to deal with the rapid changes in shipping tonnages. Especially in Japan, the shipyards already had advanced solutions available, namely supertankers constantly plying routes from the Gulf to the Mediterranean and the North Sea. Circumnavigation of Africa was no more than an additional factor to take into account in planning. In terms of cost, the difference was offset by the greater quantities transported (Persello, 1986, p.3).

The introduction of supertankers opened a new era in shipping technology, not only in the crude oil field, but also in all the specialised and non-specialised types of cargo. The examples of the cellular container ships, ro-ro ships, lash, multipurpose carriers and bulk carriers serve to illustrate the variety of such changes. In brief, the main target was towards specialisation which exemplifies, and responds to, the increasing capital intensity of cargo movements.

On the other hand, the characteristics of the seaborne trade were defined according to the distance between the origin and destination, as well as the type of cargo. The definition of the latter will now be attempted in some detail, under the headings of deep and short sea trade and other types of cargo noted above.

2.2.1 The Deep Sea Trade

In a description of the geography of sea transport, the term deep sea transport is often used to refer to cross-ocean transport. However, according to the definition in the dictionary the word deep sea means "a deep part of a body of water, especially an ocean channel over 3,000 fathoms"(Longman Dictionary). From the previous definitions the term deep sea trade can be defined as the seaborne trade which has to cross an ocean between its origin and destination.

Two main issues have to be considered when speaking about deep sea trade, the economic factor and the port provisions. The economic factor is considered to be the most crucial factor accounting for this type of trade. The long routes between deep water ports characterise to a certain degree the type and the size of ships as well as the amount of traffic carried on board. Mainly oil tankers, the dry bulk carriers and general cargo vessels are the more common types of ships serving in this line. It should be mentioned that between 1960 and 1971, the average size grew from 28,000 to 130,000 dwt, and that of dry bulk carriers, from 20,000 up to 55,000 dwt (Lawrence, 1972, p.5).

In fact these increases in the size of ships led to enormous changes in the methods of loading and discharging the cargo and the facilities of the ports. On the other hand, many ports faced the changes in the shipping industry by providing berths for bigger vessels at an earlier date.

2.2.2 Short Sea Trade

There is no particular universal definition for the term short sea trade, except one that determines that in some cases the ships are legally obliged to operate within certain prescribed limits (Couper, 1972, p.159). Thus, the short sea trade for any country depends entirely upon the country's own definition for trading with its immediate neighbours. However, sometimes the term short sea can be used to describe the coastal trade between two ports of the same country, or what is known as home trade.

British home trade for example, is restricted to voyages between ports of the United Kingdom and both the Irish Republic and the continent of Europe. However, the operational areas of the so-called short sea trade for Britain include the areas of home trade with some extending to western Norway, the Baltic, Iberia, and the western Mediterranean (Couper, 1972, p.159 and Garratt, 1980, p.2).

From the above example, it can be noticed that there is some sort of overlap between the home and the short sea trades for Britain, and it must be mentioned that the distinctions between the two cannot always be made.

"Prior to the mid 1960's the short sea trade was typically moved in small ships of perhaps 600 - 1000 dwt through berths which might handle than 400 tonnes per day and probably less" (Garratt, 1980, p.145).

After the introduction of new technology in the shipping industry the short sea trade played a vital role only in the economy of Europe. "Over 41 per cent by value and almost 60 per cent by volume of British overseas trade was carried by ships to Europe" (Britain's Overseas Trade, 1971, p.2).

The modern technology of short sea trade is well identified through the types of ships serving in this line. Mainly there are four types of ships operating in the short sea trade line, the passenger-vehicle ferries, the tramp ships, the cellular container ships, and some specialised carriers such as liquefied gas carriers. The tonnage of these types is typically approximately between 14,500 and 25,000 dwt respectively.

2.2.3 The Bulk Cargo

The word "bulk" could be used in two different senses. Traditionally this expression has been used to indicate that a commodity was loaded or discharged in mass or fluid condition, e.g. grain and petroleum. However, in the contemporary time there has been a tendency to talk about "bulk shipments" in the sense of shipments by the full shipload or substantial part-load whether or not the commodity in question is handled by bulk cargo methods in the traditional sense (UNCTAD, 1978, p.155).

The traditional definition for bulk cargo was "the homogeneous cargo carried without any form of packaging and not capable of being handled by sling" (Oram, 1965, p.118). However, for definition purposes the bulk cargo has been divided into three main groups: liquid bulk cargo, the dry bulk cargo, and semi-bulk cargo.

The first group comprises all of the commodities that are transported in liquified form. Oil (crude and refined products) is the most important single commodity carried in ships, exceeding in volume the combined total of all other commodities entering international trade. "crude oil tankers are now the largest ships afloat with deadweight capacity of up to 550,000 tones" (Buxton, Daggitt, King, 1978, p.29). In recent time the liquid bulk carriers have been adopted to carry liquified gas and other liquid chemicals.

The second group, which is dry bulk, is subdivided into two main categories, the "major bulk and minor bulk cargoes". The major bulks consist of a group of five commodities which almost invariably move by non-liner methods in full shiploads (UNCTAD, 1978, P. 155). These are iron ore, coal, grain, bauxite/aluminium, and phosphate rock. The majority of these commodities are transported in specialised bulk carriers and combined carriers, but general cargo ships are also used to some extent.

The minor bulk cargoes, in contrast are often transported in small shiploads such as other agricultural products, ores and minerals (chrome, nickel, copper, etc.), fertiliser and various manufactured products (iron/steel, cement, etc.). Most of this latter trade is carried as break-bulk cargo parcels aboard bulk carriers, such as general cargo ships, or as unit loads on cellular barge or ro/ro tonnage, or on other specialised vessels (e.g. cement carriers) (Gilman, Maggs, and Ryder, 1977).

The third group which is semi-bulk is a combination of the first and second group, and it can be defined as dry or liquid commodities moved in large homogeneous loads (Stoney and Bourn 1984, p. 46). Semi-bulks differ from the bulks in that they usually need to be handled as individual units. Sometimes these occur as the natural outcome of a production process, as in case of steel coils, and in others they are the result of unitisation (Gilman, 1980).

2.2.4 Break-Bulk General Cargo

The term general cargo has always been applied to the commodities which are handled and transported in a great variety of consignments, and require much more space, more clerical work, and more meticulous care (Nagorski, 1972, p.43). In other words, it has been defined as the commodities which consist of a large number of small and medium sized parcels, covering the whole spectrum of goods from crude materials to sophisticated manufactures together with some substantial residuals from the bulk and semi-bulk cargoes (Gilman, 1980, p.1).

The unit value of general cargo is considerably higher than that of bulk cargoes. This refers to the wide range of goods the general cargo ships have to carry. Some goods are fragile and must be handled carefully, some are noxious or odorous and likely to taint others already on board, some are especially bulky, others must be kept cool. Although it is not possible to indicate the complete list of all the goods appearing under this category, yet the following Table 2.2 shows a selection of their wide variety.

The break-bulk general cargo ships are relatively small compared with the other types of ships in other sectors. Usually the average tonnage is about 15,000 dwt, but as mentioned before, according to the considerable variety of the general cargo commodities, these general cargo ships are capable of receiving a wide range of goods with different properties and destined for different ports. It is also to be mentioned that, since the 1960s general cargo liners have been replaced by unit-load carriers on many routes. A summary of the broad classification of general cargo ships is shown in Table T1.1 in appendix one.

Table 2.2 Typical general cargoes

Goods	*Typical packaging*	*Important carrying considerations*
Plant, machinery, and manufactured goods	Uncased/crates	Heavy, bulky and easily damaged
Chemicals	Bags/drums	Noxious properties, risk of spillage; often carried on deck
Processed foods	Cartons	Easily damaged, must be kept dry; often pilfered
Liquor	Cartons	Often pilfered
Fruit	Cartons	Requires refrigeration; persistent odour
Tea	Chests	Readily absorbs taint
Cotton	Bales	Liable to heat and ignite spontaneously
Hides	Bales	Odorous and vermin infested
Copper	Ingots	High value
Oilseed cake	Bags	Liable to heat up

Source: Buxton, Daggitt and King (1978) p.30

2.3 THE SHIPPING REVOLUTION AND THE NEW TECHNOLOGY

During the period before 1945, substantial changes took place in methods of loading and discharging all seaborne trade in general and the general cargo in particular. The advances in handling goods in that time were all associated with specific trades, where the bulk handling techniques were an essential ingredient of expansion. For example, the coal trade called for larger cranes, hoists and conveyers, the grain trade demanded grabs and elevators, the heavy machinery trade could not have occurred without the largest cranes ever used in commercial docks. Similarly the meat trade relied in best practice on overhead conveyers, and the banana trade as well as other kinds of fruits, made great use of the canvas-sling machine, with its ability and facility to wend its way from the hold of a ship to the quayside.

Jackson pointed out in his review of the history of ports that, "in 1945, most of the goods were transported in man-size boxes or barrels, casks and packages that were stacked loose in sheds, on quays and in holds, and trundled endlessly around. Thirty hundred-weight cranes were all that were generally required because that weight equated roughly to the volume of goods that could be removed by hand or handbarrow if deposited on the quayside at intervals of two or three minutes"(Jackson, 1983,p.152).

Since 1945 and during the post-war period, several major trends have been discernible in the changes in cargo handling processes in the ports. The most fundamental of such changes was the introduction of mechanical equipment in port work. With the introduction of mechanisation, the efficiency of the port began to be measured by the speed with which cargo could be transported during its many stages into and out of ships. Demonstrations of these mechanical changes can be seen in the introduction of many equipments in port operation such as the tractor, trailer, mobile crane and electric truck, and later came the introduction of the forklift truck.

These new machines may be divided into three categories according to the use of each one as follows:

(a) Machines for lifting and lowering cargo, these including,
quay cranes
mobile cranes
forklift trucks
wall and warehouse cranes

(b) Machines for transporting cargo,these including,
trucks powered by electricity, petrol or diesel oil
tractors and trailers
conveyors, either static or mobile
movable belts
straddle carriers
warehouses cargo lifts

(c) Machines suitable for piling and unpiling
cargo, these include,
piling machines, fixed and mobile
forklift trucks
mobile cranes
overhead gantries (Oram, 1965, p.67).

When the idea of unitizing cargo was introduced the main objective was transporting large quantities of heterogeneous commodities from origin to destination without delays in transferring between modes, without inspection or other administrative encumbrances on crossing international boundaries, and without break of bulk until arrival at, or close to the final destination (Couper, 1972, p.147).

Many of the handling problems associated with the carriage of break bulk general cargo disappeared. On the other hand, the assembly of goods was into some form of standard unit to facilitate the process of transportation. In this way the number and variety of items to be handled is reduced and handling rates can be achieved with mechanised equipment. Moreover, by this means international transportation may be regarded as an integrated system, each element of which can be designed to achieve minimum overall transport cost.

The introduction of the unitisation system represented the greatest revolution in the history of ports. This was achieved through four roughly parallel developments: palletisation, containerization, the roll - on / roll - off system, and finally the use of barge-carrying vessels, each of which will now be discussed briefly in turn.

2.3.1 Palletisation

"Palletisation owes its origins to two inventions, the forklift truck and metal banding" (Jackson, 1983, p.152). A pallet, (as defined in James Bird's book, Seaports and Seaport terminals) is "a device on the deck of which a quantity of goods can be assembled to form a unit load for the purpose of transporting it, or of handling and stacking it with assistance of mechanical appliances. This device is made up of two decks separated by bearers, or of a single deck supported by feet ; its overall height is reduced to the minimum compatible with handling by fork lift trucks and pallet trucks; it may or may not have a superstructure" (Bird, 1971, p.98).

Pallets are usually small platforms rectangular in shape with dimensions around 1.2 x 1.00 metres or (48 x 40 inch). They are made from wood and sometimes steel, aluminium, or plastic. After the introduction of forklift trucks from about the 1950s, palletised cargo could be discharged by ship or quayside crane, and moved and stacked by trucks. A later modification increased the operating speeds by allowing trucks to enter through the side of ships and receive goods via internal lifts or ramps.

It should be mentioned that, pallets and containers could be presented as key components of two rival systems. This explains why some operators on a few routes have adopted pallets in preference to containers to provide fully integrated services.

One authority has made the definite statement that 80 per cent of the advantages of shipping cargo in containers could be had if the same goods were palletised, and at a fraction of cost (Oram, 1965, p.87).

The impact of palletisation on the port land use was varied and significant. The quay apron had to be increased in width to become between ten to twenty metres wide, in order to give free movement to the forklift trucks, and, at the same time, to avoid obstacles from other activities such as the quayside cranes, rail tracks, and road vehicles. Port authorities were immediately called upon to provide level concrete roadways on hitherto cluttered irregularly surfaced quays. On the other hand, there were radical changes in the system of sheds and warehouses to accommodate the truck's ability to stack commodities to a greater height than was previously feasible.

Even more important in its widespread consequences was the adoption of metal strapping for sawn timber. As mentioned by Jackson (1983) when he discussed the outcome of the use of the metal straps, he said, "there were two divergent results attributed to this development. Firstly, as the handling operation of timber was now less laborious, there was a tendency for small ships to bring it from sources in Scandinavia to many small ports or even to places that were not properly speaking ports at all. Secondly, the timber commodity now could be stowed easily on board ship, hence the large ships could not be used, especially in the long distance trade, and be dealt with in the giant docks as normal cargo rather than the smaller and shallower "timber" docks. Specialised timber berths soon become a feature of the largest and most modern docks" (Jackson, 1983, p.153).

2.3.2 Containerisation

"The container is the ultimate form that, with the present knowledge of cargo handling methods, the unit load of general cargo can take" (Oram, 1965, p.95). It was the First World War when containerisation was first introduced to transport some food products from Dublin to London. The container system owes its survival and success to the American army, when it was used to transport the personal effects of the army's services officers as they were moved from one station to another during the Second World War.

However, it was not until the 1950s that the full potential of this system was realised, especially with the introduction of the unitisation of cargo as well as the standardisation in size.

It should be mentioned that containerisation was first restricted to the short sea routes, specifically along the east coast of the USA and between the USA and the Gulf of Mexico. However, "in the early 1960s the container system made a breakthrough on deep sea routes between America and its main trading partners" (Gilman, 1977, p.1). The system of cellular ships was introduced and developed in the late 1960s. Since that time, and with the evolution of the port management in dealing with the increasing flow of cargoes (and associated transportation system problems), in the last twenty years containers have become the most reliable and favourable method of transporting, shipping, and handling miscellaneous break bulk general cargo.

Containers are available in a number of complementary sizes according to the standard of ISO (International Standard Organisation), as shown in Table 2.3.

Table 2.3:
The standard dimensions of ISO containers

	Gross Weight ton	Overall Length (mm)	Overall Width (mm)	Overall Height (mm)
20 f Cont.	20 t	6058	2438	2438
30 f Cont.	25 t	9125	2438	2438
40 f Cont.	30 t	12192	2438	2438
35 f Sea-Land Cont.	23.8 t	10668	2438	2438

Source: UNCTAD, 1975

There are many uses for containers in carrying a wide variety of commodities, in addition to their considerable availability to carry the special types of cargoes which have a special nature such as liquids and refrigerated goods. The most common size of container has the nominal dimensions of 6.06 x 2.44 x 2.44 metre (20 x 8 x 8 f). Now, many containers in regular use are 2.59 m high (8.5 f). These are indicated in Table T1.2 in Appendix one (Buxton, Daggitt, King, 1978, p.31).

The container carrying vessels are varied in characteristics and types. The container vessels are generally classified into generations, which refer to certain typical characteristic stages in container development as well as container ship building. Table 2.4 shows the main characteristics of each generation.

Table 2.4: Physical characteristics of container ships

	Container capacity (TEUs)	dwt	Overall length (metr.)	Overall width (metr.)	Draught (metr.)
"First generation" container ships	750	14,000	180	25	9.0
"Second generation" container ships	1,500	30,000	225	29	11.5
"Third generation" container ships	2,500-3,000	40,000	275	32	12.5

Source: UNCTAD,1978, p.127

The term"TEU" is used to define the carrying capacity of a container vessel. One TEU is a twenty-foot equivalent unit and therefore a forty-foot container counts as two TEUs (UNCTAD, 1978). Container ships can be of lift-on lift-off type, where containers can be hoisted from holds by giant shore cranes. Alternatively, they can be of the roll-on, roll-off type, where containers can be hauled on trailers from the ship direct to the shore through a system of ramps. Many ships are adapted for both container and vehicle system or partly, also general cargo in break bulk form.

It has been pointed out by Gilman (1980) that, the world fleet of container carrying ships comprises some fifteen hundred specialised container carriers and flexible ships. Table 2.5 below, summarises the broad breakdown of the type, capacity, and the number of the world container carrier fleet.

Table 2.5: TEU/Capacity of container carrying ships over 250 TEUs ('000 TEUs)
Ships in Service and on-Order, September 1978

	500 TEUs & over	250/500 TEUs	Total	Total %
Fully cellular	625	47	672	59
Container ro-ro	53	6	59	5
RO/RO	88	36	124	11
Semi-container	85	131	216	19
Bulk/container	50	--	50	4
Barge carriers	3	1	4	1
T O T A L	904	221	1,125	100

Source: Gilman, S. 1980, p.9

The impact of the container system on the planning of ports can best be measured by the fact that three main stages have to be considered before the container reaches its destination. The first is the handling of the container from the ship to the quayside.

This process can be achieved by the three most commonly used container handling systems, which are the trailer storage system, the straddle-carrier, and the gantry-crane. This operation requires special consideration in the design of quays to accommodate heavy loads and vast space for transportation movements.

The second stage is container storage. This function usually complements the first one, as the same handling equipment, such as, for example, the gantry crane, can be used for moving containers between dockside and storage yards. It should be noticed that, the size of the storage area depends to a degree on the art of stacking and the type of mobile equipment to be used.

Examples of three different layouts of container terminals can be seen in Figures F1.1, F1.2, and F1.3 in Appendix 1.

The third stage is mainly related to the process of transportation. The adaptation of inland transport to containers is not quite so obvious to the casual glance. Rail networks have provided container terminals with gantry cranes and special rolling stock, while road vehicles are equipped with special trailers.

Finally, planning or organising a container terminal is not an easy job. As mentioned by UNCTAD "there are many factors which have to be taken into consideration in planning a container terminal" (UNCTAD, 1978, p.128). Figure F1.4 (Appendix 1) gives an indication of these factors, and can be used as a checklist in order to ensure that none of the most important issues have been overlooked.

2.3.3 Roll on - Roll off System

The method of roll on-roll off was proposed in the pre-war period as a means of avoiding the difficulty of the smallness of unit. First, it began to be used in the railway, then usage extended to cover road vehicles and trailers in converted tank loading ships, and eventually highly specialised ships with bow or stern loading facilities were used. These vessels adopt a timetable precision which enables them to carry large amounts of trade through limited but selected facilities.

The ro-ro vessels are also employed on certain general cargo services as well as ferry routes. Until the late 1960s these were predominantly short sea routes, often combined passenger/cargo services. However, the ro-ro vessels are now being increasingly used on transoceanic routes including, for example, Europe to North America and Europe to Australia.

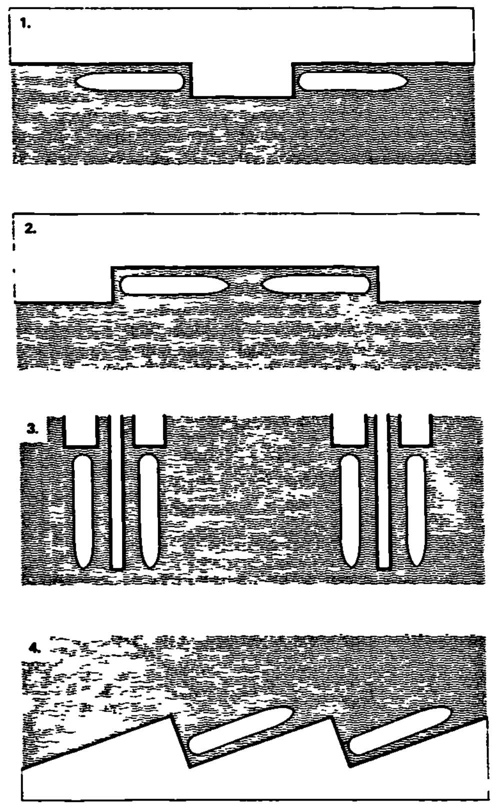
It should be mentioned that the configuration of the ro-ro system has been developed primarily to facilitate rapid loading and discharging and it is not itself a means of unitization. However, it can be adopted to meet the requirements of a variety of standard units, including containers, which may be carried on trailers or by forklift trucks, pallets, vehicles, loading lorries as well as uncrated export cars, and large indivisible loads such as heavy plant (Buxton, Daggitt and King, 1978, p.32). In addition, this system of roll on is universally considered to be the preferred method for tourist accompanied cars.

The impact of the ro-ro system on the design of both the ship and the port is rather a considerable and costly one. It has been estimated that, according to the special design, the ship needs to be more strongly constructed and have spare internal capacity for manoeuvring. The costs of vessel is twice as much as container vessel of the same exterior size, but with only half the payload capacity (Bird, 1971, p.95). On the other hand, terminals for roll on vessels are less costly and easier to arrange. No heavy cranes for lifting container are needed, since the cargo and vehicles enter and leave the ship by their own means or as mentioned before by the help of trailers and tractors.

The basic element of the ro-ro terminal consists of proper berthing facilities, for example, ramps for connecting the vessel's bow or stern to shore, a convenient access road to the ramp for vehicles, storage yard for containers, parking areas for tractors, trailers and cars, as well as a separate access for walking passengers if it is needed (Nagroski, 1972, p.73).

The design of the terminal's quays is such that it allows the ship to berth perpendicular to shore for loading and discharging purposes. Four alternative layouts suggested by UNCTAD are classified and shown in Figure 2.2.

Figure 2.2: Alternative layouts for a ro/ro quay



Alternative 1, offer high degree of flexibility for the future with lost quay portion about 60 metres.

Alternative 2, feasible for small and short length ship.

Alternative 3, restricted only for ro/ro vessels and eliminates large number of ships including Lo/Lo operation.

Alternative 4, can be used by several types of ships with possibility of increasing length.

Source: UNCTAD, 1978, p.147

According to the widespread use of ro -ro services, not only on the short sea routes, but also on the deep sea trade increasing importance has been given to adopting this system in most of the developing countries in view of the great flexibility of operation. The number of ports providing facilities and scheduled services for such a system is 500 ports in forty countries according to the statistics published by UNCTAD in 1978.

2.3.4 Barge-Carrying Vessel

The method of using barges (lighters) of unitized cargo and transporting them between ports is considered to be the most recent and the last in the series of unitization systems of seaborne trade. Simply, it depends on standard oblong barges with several hundred tonnes capacity, each of which is filled with semi or breakbulk cargoes loaded and discharged by conventional methods. Alternatively, they can be filled by containers using special load and discharge facilities. These barges are then loaded aboard a specially constructed barge carrying vessel to be transported from its origin to destination.

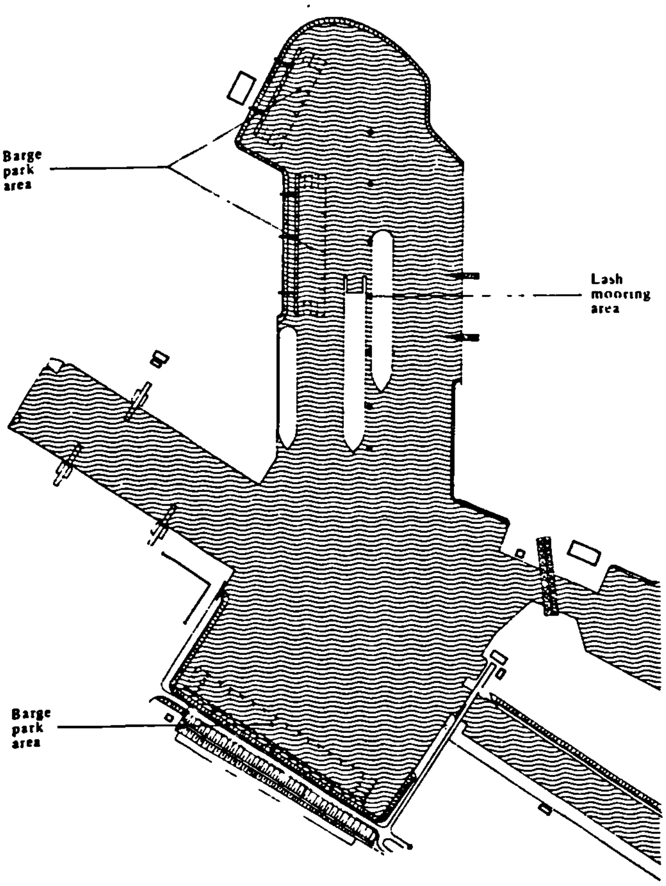
There are two main types of barge-carriers serving this system, LASH and SEABEE. Full information about the capacity, the dimensions, operators, as well as the principal dimensions of barges are indicated in Table T1.3 and T1.4 in Appendix one. It should be mentioned that, according to UNCTAD, the LASH (lighter aboard ship) system has been chosen by all lines except one (UNCTAD, 1978, p.152).

However, recent attention has been given to the development of other types of feeder vessels. Two alternatives are the BACAT (barge aboard catamaran), and FLASH units (feeder LASH).

The role played by the barge system on the ports' planning is rather minor. Because of the flexibility of this system, the special arrangements and facilities for loading and discharging can be kept to a minimum, since the process of loading and discharging the barges from the mother ship has always to be done at anchor outside the port. The barges will then be towed by tugs to any shallow draught berth, except those that carry containers must call at a terminal with facilities for handling containers.

Figure 2.3 gives an impression of the requirements of the barge terminal which can be summarised as areas for barge parking in addition to some traditional facilities for loading and discharging.

Figure 2.3
LASH facilities at Bremerhaven



Source: UNCTAD, 1978, p.154

Now, this unitized method has spread to serve ports throughout the world in general and among the short sea ports specifically, and further development of the actual application of barge carrying vessels concept to international trade can be expected.

2.4 SUMMARY

This chapter has reviewed historically the introduction of new technology in the maritime industry from the Second World War and up to the late 1960s, by which time this technology had became fully established. It began with changes in the world seaborne trade before the 1960s, including the introduction of supertankers. Also, the changing characteristics of the seaborne trade have been outlined through brief reviews and definitions of the deep sea trade as well as short sea trade.

In addition, some other terms have been defined which are commonly used when the characteristics of seaborne trade are mentioned. Such definitions includes the meaning of bulk cargo; how it can be classified into three groups, liquid bulk, dry bulk and semi-bulk cargoes; and how dry bulk can subdivided into major and minor bulk cargoes. This was followed by broad definitions of break-bulk general cargo, and how it can be defined within the context of the international seaborne trade.

The final part of the chapter has been devoted to the technological innovations which have changed the shape of the shipping industry. Such innovations began with the introduction of mechanical equipment in port operation, for example the tractor, trailer, mobile crane, forklift, etc.

This was followed by the presentation of the idea of unitisation of large quantities of heterogeneous cargoes. Four main techniques have contributed to the achievement of this unitisation system First, palletisation which owes its origin to the forklift truck. Second, containerisation, its types and how it operates. Third, the roll-on roll-off system with its flexability of operation. Finally, barge carrying vessels and how they can be useful for the majority of the ports. These four techniques have been presented with a brief explanation of the impact of each of them on the port operation and port's land use.

An empirical assessment of the impact of these technological changes on the port land use functions and activities is presented in chapters five and six. These chapters deals with the two case studies, Alexandria and Liverpool cityports, and which constitute substantial part of the empirical work as well as the findings of this research.

CHAPTER THREE

CHAPTER THREE

TECHNICAL THEORIES OF PORT LAND USE

3.1 INTRODUCTION

The land use planning of the port area is a subject which has had and continues to have the close attention of many planners, beginning from the time the idea of port development arises and does not stop until the port ceases operation. Day by day the maritime industry expects something new. The changes of transport technologies in both sea and land transport systems are placing more demands on port land uses. At the same time, great variations in port activities impose substantial requirements for further land within the port boundaries.

Bearing in mind the significance and importance of port land use, this chapter is to consider and focus on the detailed explanation and description of port land uses. It starts by discussing issues involving the definition of the port's hinterland and foreland. This includes an outline of the different views concerned with the factors affecting hinterlands as well as the aspects of hinterland delineation.

This is followed by a general indication of the different and varied uses of the land inside the port zone. Detailed explanations for each individual use of the land are presented with respect to uses which include the operational area, cargo storage, portside industry, port communication, port service industry, commercial activities, and port related industry.

Finally, it is noted that a sound understanding of land use classification structures related to ports is a prerequisite for undertaking further studies involving patterns of land use in the case studies under investigation.

3.2 THE PORT, ITS HINTERLAND AND FORELAND

The term "hinterland" has been used by different authors in different ways in relating the port to the area it serves and port geography. When the concept of hinterland was first applied to ports, the definitions of this term varied. Morgan suggested that hinterlands could be viewed as "a simple parceling-out of the country behind them, with areas of overlap, where ports compete" (Morgan, 1952, p.111-120). While Morgan's definition was rather general, Weigend was more specific when he pointed out that, "hinterland can be described as organised and developed land space which is connected with a port by means of transport lines, and which receives or ships goods through that port" (Weigend, 1958, p. 192-193). However, hinterland which is literally the region lying inland from a coast or river or, a region remote from towns (Longman English Dictionary), has acquired many definitions. For example Bird (1971) has seven types of hinterland as follows:

A- Immediate hinterland, implying the port area itself and the port-city.

B- Primary hinterland, the area where the port and city assume a commanding role in the life of the area including the immediate hinterland.

C- Secondary hinterland or competitive hinterland. It is difficult to make distinction between this type of hinterland and the preceding two types; however, for working purposes, Bird took it to extend to the point at which less than 70 per cent of an area's traffic is forwarded by or received from the port in question. In other words, it is the area which uses the port for part of its import and export (Takel, 1976, p. 67).

D- Advantage hinterland, an area which may fall within the sphere of traffic influence of one port, due to the non-linearity of inland tariffs from ports in competition.

E- Commodity hinterland, based on the indicated direction of shipments of particular commodities or groups of commodities.

F- Hinterland with functional overlap, the area served by two different ports of two different sizes.

G- Hinterland areal overlap, an area of competition between two ports of comparable size for the same type of commodity (Bird, 1971, 125).

In addition to these seven types of hinterland defined by Bird, Takel has added an eighth definition which is:

H- Split hinterland, according to the numerous characteristics of a manufacturing chain based on raw material imports, the hinterland may consist of two or more separated ports between port and major inland centres (Takel, 1976, p. 68).

It follows that the hinterland can be defined as the organised and developed land area, which is linked with the port by some kind of transportation network in the form of rail, roads, or canals.

The hinterland is not merely an area which a port or ports serve, nor can it be considered the principal factor behind port development.

However, a port does not necessarily have claim to any part of its hinterland, and an inland area could be the hinterland of several ports except where particular arrangements have been made.

On the other hand, the determination and extension of the hinterland are varied with the flow, or volume of the cargo exported or imported through the port. Distinctions between coastwise and overseas trade, and between import and export cargo, must be considered in each case (Elliott, 1969, p. 157).

As the relative competitive position of ports varies, so their respective hinterlands can expand or contract, sometimes very rapidly. It is also to be mentioned that the changes in the hinterland dimensions also occur from natural causes, such as winter icing of ports, or as an outcome of some political events. "Exogenous economic factors are likely to have a direct influence. For example, where centralised governments control ports operations, government policy sometimes favours one port over another and this decision can affect the size of a port hinterland" (Hayuth, 1982 b). Recently, and after the potential of containerisation has been completely explored, the concept of the traditional hinterland has significantly changed. This change not only affected the extent of hinterland, but also the dimensions of its geographical divisions. The introduction of two concepts related to containerisation signifies the concentration of containers through the load centre concept, and the utilisation of land transport through the land bridge concept.

The load centre concept implies a concentration of container traffic at a limited number of large ports. This concept relies upon two principal participants, the port and the carriers, which play the dominant part in this concept. Two fundamental strategies concerned with time-reducing emerged: a) The decrease of turnaround time for ships. b) a reduction in the number of ports of call. At the same time, the nature of containerised operations also encourages traffic concentration on selected overseas trade routes. The carrier which concentrates its traffic in a few ports for economic purposes will require efficient inland movement of this traffic. The cost per unit, volume, and inland transportation network must be considered. Since traffic concentrates on favoured inland routes, hinterland penetration is deeper. The major trade lines as well as the new inland distribution centres which have been created will be complemented by feeder roads and interconnected lines. Simply the traditional concept of hinterland patterns is altered (Hayuth, 1981, p. 164-165).

This idea can be compared with the land bridge concept which has allowed maritime transport carriers to become more involved in inland transportation and, together with railway companies and trucking firms, in the development of new integrated transport systems and itineraries for inland distribution. This type of system has also had a great impact on conventional port hinterland concepts (Hayuth, 1982, p. 15).

3.2.1 The Foreland

The definition of the term "foreland" within the context of port geography was insubstantial, until it has discussed and specified by Weigend in 1958, when he described forelands as "the land areas which lie on the seaward side of a port beyond maritime space, and with which the port is connected by ocean carriers" (Weigend, 1958, p.195). He also pointed out that while hinterland can be represented as an organised and developed land space, the foreland must also be organised with respect to the areas served by maritime carriers.

In this sense, the overseas complement of a port's hinterland is the port's foreland. In other words, a port's hinterland is the foreland for other ports. Therefore, the intrinsic differentiation between the hinterland and foreland lies in the type of carrier in which the commodities arrive or leave on coastwise or seagoing vessels.

Weigend also justified his theoretical definition by practical example when he postulated that any commodities arriving and leaving by ship come from or are sent to forelands. Furthermore, if this cargo is transferred from one ship to another within the port, then it has come from a foreland and leaves again to another foreland for this designated port.

Another attempt was made by Elliott in 1969 to define and identify the proper delineation for the term foreland in respect of maritime geography. He stated that, "the complexity and multiplicity of hinterlands and forelands must be recognised, at least to the extent of an initial division in each case between coastwise and overseas trade and import and export cargo" (Elliott, 1969, p.160-161). He also distinguished broadly between coastwise and overseas forelands, and import and export forelands with the possibility of some further measure of subdivision.

3.2.2 Factors Affecting Hinterlands

Normally the hinterland is linked with the port as mentioned before, by three types of transport modes, railways, roads, and water transport which includes inland waterways and coastwise ship services. Variations in these transport patterns have imposed many diverse factors include those created by economic, geographic, or political situations.

Takel has classified the hinterlands which will be affected by these factors into two main types. These are variable and conditional hinterlands (Takel, 1976, p. 68-69). Variable hinterlands will vary according to the different types of commodities which will move through them. The bulk/value ratio will play an important role in determining the extent of this hinterland. Also perishability plays a part in this determination.

On the other hand, conditional hinterlands depend much upon the standards of communications as well as the efficiency and the standard of equipment of ports. They can also depend upon local labour relations, the standard of skills available, and over criticial factors such as traffics.

3.2.3 Aspects of delineation of Hinterlands

It is difficult to make any delineation of the extent of hinterlands without giving some consideration to the two hypotheses suggested by Bird in 1971, which were as follows:

a) The concept of a cargo generation gradient, which means that cargo destined for a specific port decreases because the distance between the port and the location of generation increases.

b) The larger ports attract a proportionally greater share of cargo generated than smaller ports at any given distance (Bird, 1971, p. 137).

In the light of these hypotheses, one can get an impression that as the trade activities of a port increase the hinterland must become larger, and it is likely to affect other hinterlands. However, as Bird states, this is not necessarily the case as the port's trade can increase under some circumstances even without any increase in hinterland area, if certain social and economical conditions are met. For example, the port's trade could increase with a shift from break-bulk cargo to bulk cargo imports to waterfront industries, leading to the shrinking or disappearance of break-bulk cargo hinterland.

Thus if one has to make a delineation for any hinterland, there are some principal elements which have to be considered and which include the following:

- The location of the port in relation to other competitive ports.
- The cost benefit of the sea journey of the ship.
- The type of transportation mode available between the port and its hinterland or hinterlands.
- The costs of the intermodal transportation system.
- The distance between the port inland depots.

Finally, the symbiotic existence of the hinterland and foreland has been emphasised by Elliott when he stated that "the interactions of hinterlands and forelands involve the consideration of the extent to which the economic activity and especially the development and operation of transport on land is influenced by the nature and organisation of sea transport and vice versa" (Elliott, 1969, p. 167-168). Not all ports have been able to adapt their installations and the transport links into the hinterland to enable them to maintain their status.

3.3 THE DEFINITION OF PORT LAND USE

A seaport or any marine terminal is a point where different transport modes intersect, and transfer from one to another takes place. Such a transformation requires the port to provide facilities for transshipment of ships' cargo and to be transported to and from inland depots by railways, road, inland waterways and a network of pipelines. The port has to provide safe accommodation for ships at quays and berths or at anchor. It has to provide equipment, services and facilities for the turnaround of ships, or in other words, for efficient handling of cargo between ship and shore. Storage facilities also have to be provided as cargo handling between ship and shore normally takes place at a much higher rate than arrival and removal of cargo by inland means.

The port storage facilities vary according to the demands dictated by cargo characteristics. For example, it will differ between bulk cargo represented by ore which will require wide and open storage areas, and general cargo represented principally by a number of small consignments which normally require to be sheltered from bad weather in closed sheds.

Besides the two main functions of the port, which are loading and discharging ships, and the storage of cargo, the port also has to provide accessibility to the inland transportation system. Marshalling areas are required for all kinds of vehicles. Areas of land for commercial activities, supplies, bonds, agencies, insurance,etc. also have to be provided. Land for port related industry such as grain milling, packing loose cement, refining oil, etc. are also required.

In short, the land use planning inside the port zone is not only restricted to the demands of loading, unloading and storage functions, but also, there are a number of activities associated with these two functions which also have substantial requirements for land.

Table 3.1 indicates the varied classification of the land use categories inside the port area, which will be discussed in detail later in this section.

3.3.1 The Operation Area

The operating area of any port is the area where land and sea interface while the process of loading and unloading of ships takes place. This area is subdivided according to use and function, and each individual part has a role in influencing port efficiency. The fundamental planning system of this area should be based on a doctrine of movement, to avoid the occupation of land for a long time. The elements which comprise this operating area could be defined as the quays and jetties and their associated activities.

The Quays and Jetties:

The quay is the most important single construction in the modern port. On its capacity and on the efficiency with which it is operated depends the speed of ship turn round. The throughput of the port can be calibrated according to the throughput of its quays (Oram and Baker, 1971, p. 16).

In this sense, the process of cargo handling between the ship and shore is considered to be the most essential function of the quay. Besides, it is essential for the quay to provide access to

Table 3.1: Land use categories in port zones

1. Operating areas:

   Quays and jetties

2. Cargo storage:

Liquid	-	tanks	Short-term
Dry			
Covered	-	shed	Long-term
Uncovered		hopper	
		open storage	

3. Portside industry:

   Conveyor served
   Pipeline served
   Road or rail served
   Export-oriented (packers and assemblers)

4. Communications:

   Rail/Road/Pipeline/Conveyor

   Marshalling areas
   - road vehicle
   - rail vehicle

5. Port service industry:

To ships	Transport
To port operator	Maintenance
To port users	Services
	Dry docks

6. Commercial:

   Supplies
   Warehousing and long-term storage
   Bond
   Agency
   Insurance
   Offices, for Customs, port health etc., port operators and users

7. Land for port-related industry:

   (a) Primary manufacture, e.g.,
   - Oil and petrochemicals
   - Steel and non-ferrous metals
   - Chemicals
   - Grain
   - Timber engineering or saw milling

   (b) Service industry and selected secondary industry, e.g.,
   - Machinery and plant
   - Transport
   - Car manufacture

Source: Takel, 1983, p. 10, 11

two different transport modes at the same time - ships and inland vehicles. The quay can also be used for temporary storage purposes, for cargoes before their movement to the next stage.

The spatial demand for the quay is always governed by three main factors. As pointed out by Takel, "within the area allocated for quays, spatial demands arise from movement, equipment and cargo. These demands have increased particularly as a result of increased size of equipment, increased speed of operation and the increased rate of movement of cargo" (Takel, 1981, p. 55).

Usually, the conventional quay has to carry two or more railway tracks, one often passing under the cranes, between the crane tracks, which are varying in dimensions, usually between 4 to 5 metres. Here, it should be mentioned that the modern container tracks can measure up to 15 metres in width. The other rail tracks can be located on the quay apron and should be completely flush with the paving so as not to impede the movement of mobile equipment.

The quay apron, or the open strip of land between the edge of the quay and the transit shed, is the first place where cargo is deposited upon discharge from ship. The apron is the area into which the cargo and commodities are hoisted from the holds. Here, they are placed on land trucks, forklifts, or trailers for transport to outside the port or to storage areas. The width of this apron varies according to the type of cargo it receives as well as the type of ship mooring at the quay. Usually the width is not less than 20 metres and not more than 30 metres to allow enough space for the handling operation on one hand, and to be not too far from the transit sheds on the other (Nagorski, 1972, p. 46-48).

However, Takel mentions that "In 1900 a typical berth might have utilised a total depth of land amounting to 40 metres including the quay apron, storage warehouse, and rear access, while in 1979, the quay apron in some terminals reached the depth of 50 to 100 metres" (Takel, 1981, p.55).

The total spatial demands on quays are varied, and depend entirely upon the type of cargo handling and the type of ship using the quay. Thus, the dimensions of the working area of the quay must be calculated for individual berths on the basis of maximum demand likely, and the advantage occurring from greater freedom of movement on quayside must be weighed against the cost involved in a longer movement from the quay to the storage area (Takel, 1974, p. 128). The main problem which may arise and interrupt the efficiency of any berth is the congestion of cargo movement or transport vehicles at the quayside. There are two methods for clearing the quay of cargo, the direct handling route and the indirect handling route. Congestion is more likely in the first method than the other, because in the direct route the inland vehicles have to queue to reach the ship and move away after the loading or unloading process. It happens sometimes that the speed of the ship turnaround is faster than the speed of loading and unloading of the inland vehicles, especially when it is a conventional berth relying mainly on manpower rather than mechanical equipment. In this case, congestion is more likely to occur. In contrast, in the indirect route method, the cargo has to be moved to be stored either in the transit sheds for short term or to a warehouse for long term storage.

3.3.2 Cargo Storage

The basic function of cargo storage in the port is subdivided into two essential forms which are related entirely to the flow of goods through a port. The main tactical aspects of this storage function are:

A. The short and medium term storage. (This is always related to the transit area).

B. The long term storage. (This is always related to the warehousing system).

A. The Transit Area:

The transit areas have been defined as "the areas within the port in which the primary purpose is to provide a buffer zone to harmonise the faster ship-shore flow with the shore-inland movement" (UNCTAD, 1978, p. 118). The transit area is sometimes an open or shed area alongside the operational zone. It is concerned with the storage of cargo which will only spend a short time in the port.

In addition to the most important function of the transit area, which is defined above, there are three other basic functions which can be summarised as:

1- To provide a safe holding area for cargo for the purpose of carrying out checking, manifestation, customs procedure, and port documentations.

2- To provide proper organisation of cargo consolidation and distribution in order to facilitate and smoothing the flow of land transport.

3- To provide proper and adequate space for cargo in order to avoid the overlapping of cargo arrivals which might occur as a consequence of bad weather or any industrial problems.

The size of the transit sheds can be roughly estimated on the basis of experience of existing berths, the actual needs of the terminal or by adopting experience in neighbouring ports. However, the UNCTAD has suggested average dimensions for these transit sheds as follows: "The length of the sheds is usually limited to about 110 to 120 metres by average length of berth (about 160 to 180 metres), with the necessity of leaving wide access space between every two sheds" (UNCTAD, 1978, p. 118).

B. The Warehousing System:

The warehousing system is always adopted when the cargo passing through the port needs long term storage. Takel in 1983 mentions in his definition of long term storage that, there are four fundamental functions for this type of storage;

1- To provide space for cargoes influenced by climate. This can occur when there are certain products which are only available, or can only be shipped over a short period. Similarly, there are some crops which are produced during a small part of the year, while the market demands deliveries over the whole year.

2- To provide space for cargoes or commodities which are speculative purchases to take advantage of low prices or quantity.

3- To provide space for cargoes which are influenced by any political and strategic circumstances and which impose specific demands on ports.

4- The final basic function of the long term storage is related to the nature of the cargo itself. For example, some commodities especially fruits and wine need peculiar precautions for their ripening, maturing, preparation or preservation. Such traffics will take advantage of this type of long term storage system.

An account of the basic functions of both short and long term storage systems of the port would not be complete without reference to the type and the techniques of this storage system.

It should be mentioned that the type and characteristic of cargo is the most essential factor, according to which the most appropriate storage system technique is identified. Thus, it is worth mentioning that, although the amount of cargo to be stored within the port area is varied and diverse, it can be classified under two main types:

- Liquid cargo.
- Dry cargo.

Both of these two kinds has its own special treatment and techniques of storage. Details of the description and requirements of these two types are contained in Appendix Two.

The spatial demand for the storage area usually depends on two fundamental aspects.

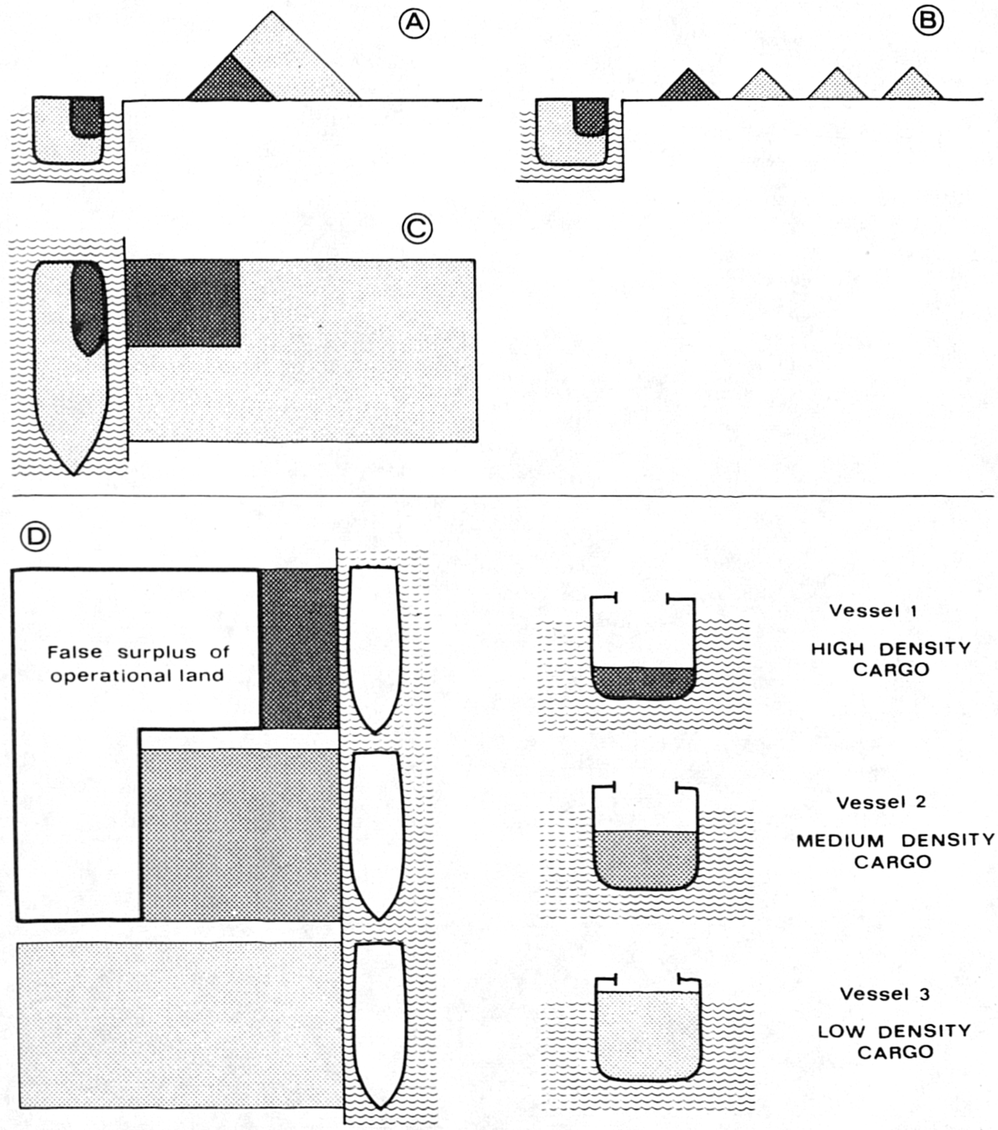
- The size of ship.
- The storage characteristics of cargo.

These two aspects have significant influences not only on the size of storage area, but also on the amount of space required for the entire port operation. Figure 3.1 illustrates the effects of increases in ship size on the storage and transit area of the port.

Bearing in mind the importance of the previous two aspects, Takel has derived a mathematical formula to define the actual dimensions and size for both the operating and storage areas.

Figure 3.1:

Aspects of land requirements for the storage area



A. Increased stacking height and increased ground strength.
B. No increased stacking height and no increased ground strength.
C. Area increases in proportion to volumetric increases in ship size where there are no increases in stacking hieght.
D. A false surplus of land which must be retained by the port in order to give the port flexibility in search for new trade.

Source: Takel, R. 1981, p. 61

Details of the derivation of this formula as well as the aspects and elements which are required to apply such a formula are indicated in (Takel, 1983, p. 6-8).

The dimensions needed for any storage area would not be complete without considering the dynamics of the transport movements of all of the means of transport that work inside the operational and storage areas. Some of these means, such as those involving with palletisation and containerisation, involve the operation of specialised vehicles in the storage areas. Others, such as ro-ro and lo/lo systems, minimise the port cargo time by utilising inland vehicles and barges. These methods of transport always have significant demands for space dedicated to handling vehicle arrivals and departures or barge mooring areas.

Finally, it has to be clear that the land for quays, transit, and warehouses and the land dedicated to the associated transportation modes are considered to be the dynamic part of the port's operational land. However, no matter how important this area might be, the port still requires land for other activities. Some of them are related to the process of cargo handling and all are related to the port's trading activity.

3.3.3 Portside Industry

The portside industry is the type of industry which is mainly dedicated to serving the process of cargo handling. Mostly it is involved with the discharge of bulk cargo. For example, materials such as iron ore, coal, bauxite, alumina, and phosphate rocks are usually unloaded by means of same form of grabbing system. Other bulk tonnage, such as[3] grain, cement, and powder coal, which have a comparatively low specific gravity and viscosity, are unloaded using pneumatic equipment. Other systems of handling, such as vertical conveyers and bucket elevators, are used for discharging dry bulk ships. All the previous systems are located on the quayside and require a relatively small amount of land.

Some other portside industry systems are used for the purpose of transporting dry bulk materials straight from the quayside to the place of storage. Such systems include horizontal conveyers which themselves include belt conveyers, chain conveyers, screw conveyers etc., as well as stackers which are used for stacking up the various kinds of bulk materials in the storage areas. It should be mentioned that, for horizontal transport, unlimited distance can theoretically be covered by a conveyer, although transport economics will usually limit the conveyer systems to a few kilometres before rail or road transport became more economical. Detailed descriptions of all of the systems used for unloading and transporting dry bulk materials is beyond the scope of this section. Further explications are available in the UNCTAD (1978) handbook for port development.

Another type of portside industry is represented by pipeline networks which normally serve liquid bulk cargo terminals, mainly because of the need to segregate the invariably large number of grades of the same liquid commodity. Hence, a complex pipeline network, connected with numbers of storage tanks, is required. Other equipment is needed, but this depends on the number of different grades of the same commodity expected to arrive at the terminal rather than on the total quantity (UNCTAD, 1978, p. 186).

Apart from the mechanisation of discharging and stacking the cargoes and commodities, there are some other activities which can be fitted within the classification of portside industry. Such activities are mostly concerned with the process of transporting cargo to or from the port to the outside depots, using road or rail vehicles. Other activities are related to the process of packing and assembling of goods for the purpose of export. Timber, cement, grain and some general cargoes need to be packed for the sake of stacking and stowing in the vessel. Palletisation is the ideal example of the practice of packing and assembling cargo. Containerisation is perhaps an ultimate example of packing for ease of handling with standardised equipment.

It should be mentioned that the amount of land required for packing and assembling cargo varies according to the type and the flow of this cargo. For example, cargo like loose timber needs less area for packing than the containers which need to be filled in more specialised facilities, such as a container freight station.

3.3.4 Communications

The communications links have a significant impact on the efficiency of any port. Road, rail, pipeline, and conveyer represent this communications network. The amount of space and land needed for these links are considerable, particularly for road and rail vehicles, but pipelines and conveyers can also place severe demands on port land use.

Takel gives some measures to serve as a guideline for the determination of land required for communication links. He mentions that "the minimum width of port roads should be based on a dimension of 3.75 metres per carriageway plus an allowance for emergency of vehicles. Rail tracks require a strip 3.25 metres wide per track, including space between adjacent tracks"(Takel, 1983, p. 12).

On the other hand, the determination of road and rail carrying capacity depends mainly upon the number of carriageways and tracks. This number is limited according to the problems involved with loading and discharging of cargo from the ship. Congestion in the working area is the most common problem which arises when the capacity of road and rail networks do not match the highest rate of ship loading and discharge. As mentioned before, the traditional process of moving the cargo from the berth could be done by a mixture of direct routes (loading and discharging direct from road or rail vehicles at the shipside), and indirect route (via the transit sheds). This process sometimes suffers from certain drawbacks which contribute indirectly to the creation of congestion, there are:

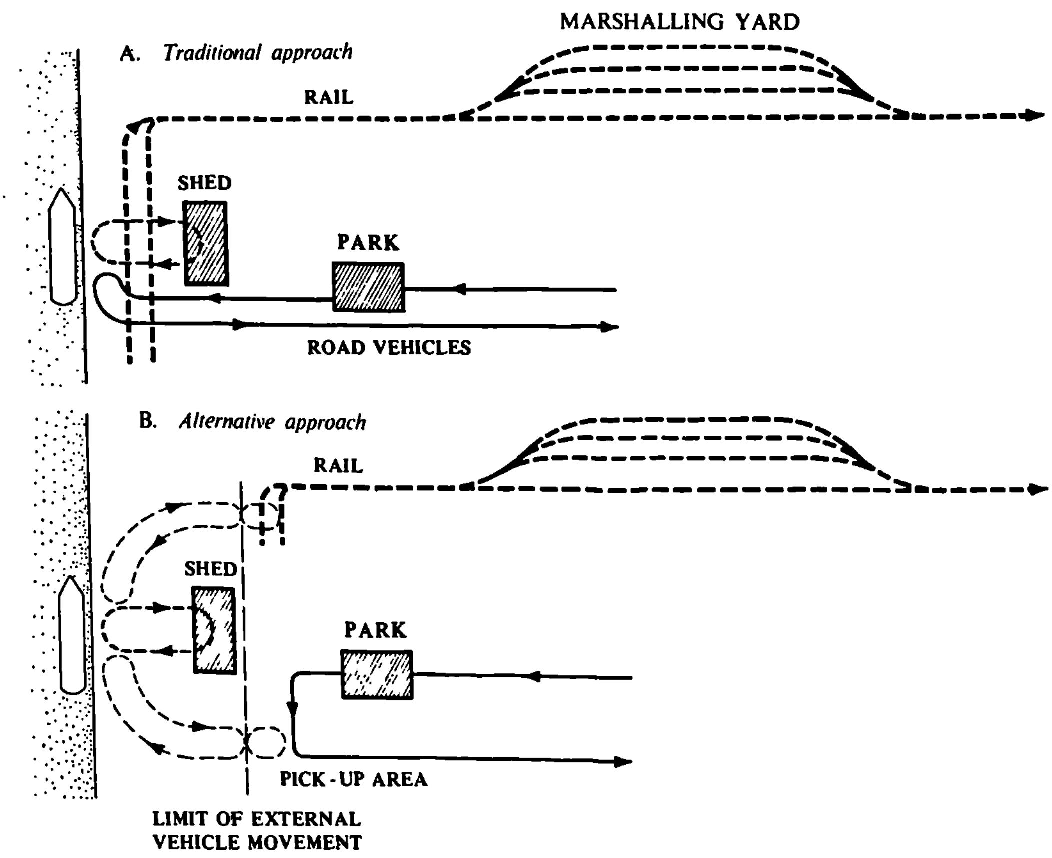
a. The rail and road vehicles movements on the quay interfere with each other and with other operations.

b. The rail track is not recessed and causes apron circulation problems which slow the movement of other vehicles and operating equipment.

c. The rigid planning of vehicle availability at the right time is difficult to maintain so that, direct working generally slows down the ship operation (UNCTAD, 1978, p. 92).

Two approaches have been proposed for solving the problem caused by road and rail vehicles at the quayside. The first is to prevent any external vehicles access to the apron for direct delivery. This is working through the introduction of a transfer system using for example tractors and trailers to deliver the cargo to the rail or road pick up area. In this approach, the direct delivery still exists. The second is to eliminate direct delivery by working all cargo through enlarged transit storage areas. The advantage of this alternative is to reduce the problem caused by delays in the supply of direct delivery vehicles. On the other hand, the demand of land can be significantly increased (UNCTAD, 1978, p. 93). Figure 3.2 illustrates the two approaches in which the alternative approach has a boundary beyond which external vehicles are not allowed to pass.

Figure 3.2
Limitation on vehicle access to quay



Source: UNCTAD, 1978, p. 93

Apart from the areas dedicated to road and rail movements, further spatial demands are placed for marshalling areas for transport vehicles. The principal function of these areas is to provide adequate space for all kinds of vehicles to wait until they are required to reach the shipside for loading or unloading. The shape of these marshalling areas depends on the kind of vehicles either as lorry park or holding sidings. The extent of facilities is determined by the rate of cargo flow as well as the nature of this cargo. Usually the lorry parks require approximately 50 metres sq. per vehicle including space for manoeuvring. Sidings for short-based railway wagons accommodate approximately 380 rail wagons per hectare. Car parks for employees' vehicles require 20 metres sq. per vehicle, including turning space (Takel, 1983, p. 13).

Here, it should be mentioned that the figures provided above are for individual sites of 0.5 hectares or more, and the area per vehicle increases significantly for the small sites because of the amount of space needed for manoeuvring.

Other amounts of land allocated for communication services are related to the pipelines network and conveyers. This land depends upon a number of factors such as:

- The total requirements of the different services and their related facilities (tracks, pipes, cables, etc.).
- The location of these services (above or below the ground).
- The safer working width for services below ground.
- The width for maintenance purposes.
- The total capacity of the supply services.

3.3.5 Port Service Industry

The service industry is the industry which is concerned with the maintenance work of all the equipment used for the different port activities. Good maintenance for port equipment is not an easy task, and there are few ports which have managed to avoid the accumulation of their out of order equipment awaiting repair. Therefore, availability of maintenance facilities for the wide variety of port equipment is needed, and fully equipped central workshops for this purpose must be constructed. A few salient points should be considered. For example, this workshop should include mechanical and electrical sections with the provision for the fabrication of light structural steel work as well as plating (UNCTAD, 1978, p. 98). It is worth mentioning that this workshop is mainly for mobile equipment. Other individual workshops are needed for other purposes such as:

- Civil engineering services (wet repair berth and dry docks).
- Maintenance facilities for water and power supply, refrigeration plant, transport vehicles.
- Cargo services maintenance (repairs for containers, conveyers, etc.)

The spatial requirements for all the types of maintenance activities mentioned above vary from one port to another according to the volume and nature of cargo passing through this port, the port type approach, the types of vessel calling this port, and the custom of shippers and ship owners.

3.3.6 Commercial Activities

The commercial activities inside the port can be considered to include offices for port commercial management, offices for shipping and forwarding agents, shops for commercial retailing, small canteens, and specialised warehouses, such as, cold storage or bonded stores. Normally, the space required for such activities is relatively small compared with other requirements for other activities. However, if the space available is limited, some of these commercial activities, such as most of the offices, can be concentrated in multi-story buildings.

Generally, these activities do not impose much demand on port land use except in some cases. For example, when the distinction between long term storage and specialised warehouses became very fine and the use of them becomes connected with the needs of the hinterland rather than the needs of cargo handling (Takel, 1983, p. 14).

3.3.7 Port Related Industry

The establishment of any industrial zone within the port area can be achieved when the economics of production, the economics of transport, and the availability of markets are considered. The requirements of such industry depend upon the advantage of importing raw materials, skilled labour force, sites and infrastructure provided by the port.

There are number of recognisable characteristics of manufacture which attract certain industrial classes to port areas. These can be summarised, as presented by Takel, as follows:

A- Port industry uses imported raw materials or exports significant quantities of manufactured goods.

B- There is a reduction in bulk or weight (or both) of imported raw materials during manufacture, bringing about significant reductions in the quantities requiring inland transport after manufacture.

C- The imported raw materials constitute an important proportion of the total amount of raw materials used in the process.

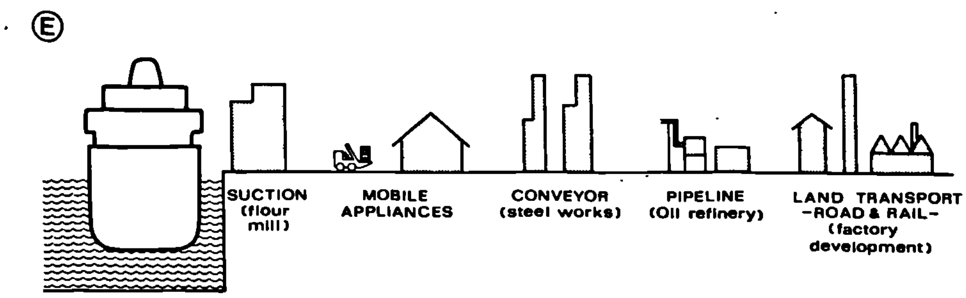
D- The imported raw materials used in the process have low value per unit of bulk or weight in relation to the costs of overland transport.

E- The manufacturing process adds significantly to the value of the product's bulk or weight.

F- The imported raw materials have problems of perishability (e.g. fish) or need immediate special processing (e.g. liquid natural gas) (Takel, 1983, p. 15).

Figure 3.3 illustrates the relationship between the quayside, industrial sites and transfer appliances.

Figure 3.3
Relative location depends on cargo-handling problems



Source: Takel, R. 1981, p. 61

In general, the more difficult and costly the handling problem, the closer to the quayside the industry needs to be (Takel, 1981, p. 64). However, the port related industries should not intrude on the cargo handling process at the quayside. Nevertheless, when locations outside the cargo handling area are to be chosen, some factors must be considered, among them, the accessibility of cargo transfer from berth to industry, the relation between the annual tonnage and the size of site,and the productivity per hectare.

When the type of industry is suitable for the operational zone the throughput in tons per hectare must be consistent with the operational throughput. A good example which supports this theory is what occurs in the grain milling industry, as the port has to receive a huge amount of traffic, amounting to as much as 75,000 tons per annum per hectare of mill site and, because mills and silos are generally laid out for gravity flow in tall blocks, the total areas needed are relatively small (Takel, 1981, p. 64-65). Other industries, such as petroleum, can produce throughput as high as 50,000 tons per hectare of refinery.

The previous two examples of port related industry are part of the type of industry which can be located in the operational area and requiring relatively small sites. Others, such as heavy industry (machinery and plant, transport, and car assembly and manufacture), can be attracted to locations outside the operational area, or at least should lie outside the cargo handling area or more than 700 metres from the quayside.

These industrial zones located in the coastal areas are known as MIDAs (Maritime Industrial Developments Areas). These MIDAs have been widely established in the last two and half decades in western Europe and in Japan. The main aim is to create centres of regional growth and planned development. Vigarie has described four generations representing the evolutionary development of the MIDAs. The first is the Rhine period, characterised by heavy industry; the second is marked by the admixture of varied industries and maritime trade functions; a third is associated with the developing countries; and the fourth group is planned for the 1980s and beyond in both Europe and Japan. for further details see Vigarie, (1981).

Estimation of the total land requirements for industrial areas is considered to be a difficult task. However, it has been recommended that too much space provided for such industry is better than too little. On the other hand, Takel has suggested that, probably the best way of assessing land requirements of these industrial zones is to study the size of existing industrial ports and their hinterland and industrial potential. Furthermore, he pointed out that comparison with other industrial ports must rest on selecting those which resemble in size and prospects, and have similar types of industrial activities to these proposed in the port in question.

3.4 SUMMARY

This chapter has dealt with the broad classification of the port's land uses. It has focused on the different port related activities that contribute to the main elements of port land use planning.

Introducing the chapter with definitions of the terms hinterland and foreland, served as the first theme and provided an initial understanding of the system in which the port as a function place demands for organised and developed land space. This was followed by a discussion of the methods which identify the linkage between the port and its hinterland. A brief review of those articles which determine the dimensions of the hinterland have been considered, as well as the factors that affect variation in hinterland configuration have been examined.

General ideas concerning the definition of port land use, including the stress imposed by shipping activities, the cargo storage, and the other port related activities on port land use have been discussed. A detailed explanation is provided of a classification of land use categories inside the port zone, together with the spatial demands placed by each one. This includes a description of the two main activities placing demands on port land use which are considered to be the operating area and storage area. Other port related activities which place further demands on the land within the port area are considered to be portside industry, port communications, port services industry, the port's commercial activities, and port related industry.

Finally, it should be emphasised that an appreciation of the materials mentioned in this chapter are essential to the carrying out of the empirical work reported later in this thesis.

CHAPTER FOUR

CHAPTER FOUR

CITYPORTS AND LAND USE PLANNING

4.1 INTRODUCTION

The subject of the port-city interface has been a fruitful topic for research purposes very recently. Many authors have discussed this interrelation from different viewpoints but, no-one as far as I am aware, has looked in sufficient depth at land use planning and its changing patterns in connection with the cityport system. Thus, the main purpose of this chapter is to start to make up for this by providing an outline of the port related activities which place demands on city land uses. The changing characteristics of these land use patterns are considered and examined in order to identify the actual interdependent relationships between the port and its city.

Five main port related activities have been identified for this purpose. These are considered to be, port related employment, transportation and its associated activities, commerce, services, and manufacturing industry. Section 4.2 of this chapter provides a brief overview of these different activities with close attention paid to the land use patterns associated with these port activities. Some examples are chosen in order to illustrate the interaction between some of these port activities and their cities or regions.

This analytical review is followed by general consideration of issues involving the cityport as a system in relation to the economic context. Aspects which determine the significance of the role of the port in connection with the national and international economy are identified, with consideration given to the problems which may arise as an outcome of deficiencies in port operation.

Urban environmental problems that may be a result of port proximity, are outlined in section 4.4, together with some possible solutions.

Finally, it is essential to review the different political influences that affect the cityport planning process, and to identify both similarities and differences in decision making between the developed and developing countries. This is necessary in order to understand the nature of planning decisions and procedures adopted in the two case studies under investigation.

4.2 THE CITYPORT LINKAGE AND LAND USE IMPLICATION

A city in which a port is located is here referred to as a city port. This term can be applied to all major ports within an urban setting. The impact of the port's function and activities on the city can be varied and significant. Of major importance from the planning point of view is the relationship which can be observed between the land use patterns of both the port and the city. This relationship reflects clearly the interdependence of the systems represented by the port and its host city.

Throughout history, many ports had the opportunity to be established within or near urban settlements. In turn, many cities were founded at their particular sites because of the strategic location of their ports. Yet history is full of many successful examples of ports and cities which grew and are still growing on the basis of a symbiotic relationship and mutual benefit. "The geographical proximity of cities and ports was a matter of necessity, dictated by conventional shipping technology, the nature of the trade, and the size of the cities" (Hayuth, (1982a), p. 219).

However, it was only quite recently that the subject of interdependence has acquired the attention of geographers as well as planners. They have discussed the enormous changes that have occurred in traditional land use characteristics of urban waterfront and coastal areas. Among those who have devoted their research efforts to contributing to this subject was Bird (1971) when he discussed the problem of the hinterland. He did not mention the important question of the interaction between port development and urban growth. Other authors, like Forward (1969), have been satisfied with making comparisons of different land use characteristics of waterfronts in Canadian port cities. He also neglected the vitally important interface between cities and ports (Hayuth, (1982a), p. 219-220).

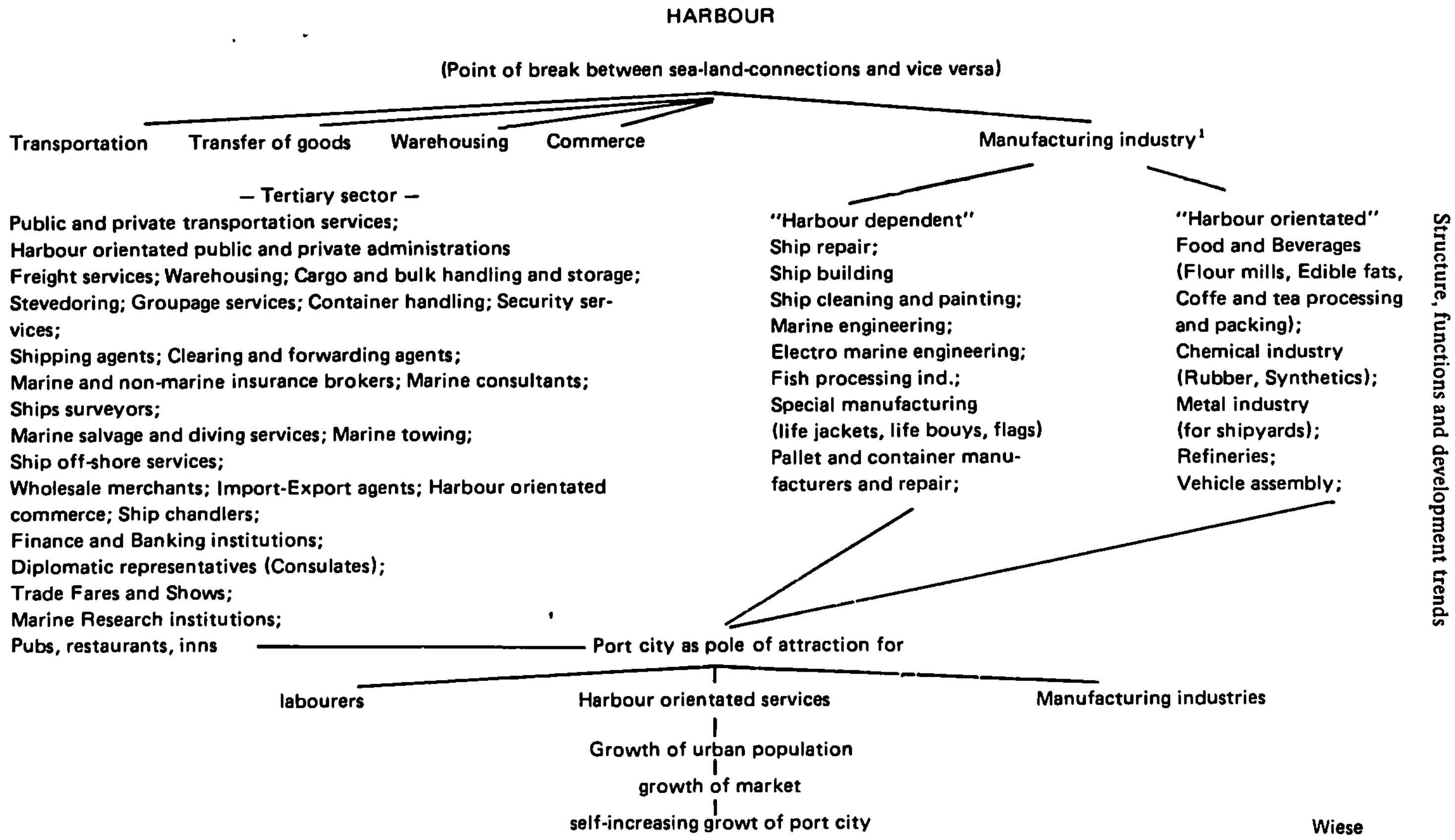
Furthermore, a study concerned with the land use admixture in the waterfront area has been carried out by Kenyon (1968). This was important from the view point of providing specific criteria for the identification of the types and size of port cities, rather than discussing factors which demonstrate the factual relationship between the port and its city. However, recent work by Hoyle and Pinder (1981), has succeeded in bringing together a number of case studies from various ports of the world. These have contributed significantly to a better understanding of port-city inter-relationships, mainly from both the industrialisation and regional development points of view. Hoyle (1983) focused his work on the character of port activity within the context of the transport system and regional economic planning. He mentions the broad concept of the port and its hinterland, but mainly from the transportation perspective.

From what has been written about the port-urban interface and the system in which the equilibrium land use functions between ports and their towns can be identified, one has to say that, so far, little has been done on this particular subject. Up to now, only limited success is evident from efforts to develop or to delineate the interdependent ties of ports and the cities in which they are located. The only credit can be given to Wiese (1981) for his valuable attempt to identify the activities of the port which have an impact on the cityport. He provides a schematic diagram to indicate the types of port activities which have positive impacts on urban growth.

Figure 4.1 illustrates in brief the five principal points of subdivision which represent the co-ordination between the port and city and vice-versa. The author also gives an indication of the activities which the port can stimulate in the city which he summarises as follows:

- harbour orientated commerce and industries;
- the concentration of import and export trade;
- the development of manufacturing industry processing imported raw materials, or semi-finished goods and preparing raw materials before export;
- the creation of a transportation mode and attracts transportation business;
- the growth of financial institutions (Wiese, 1981, p. 82).

Figure 4.1
The impact of harbour activities on the portcity - a schematic diagram



1 Local and non-local market orientated industries on the waterfront, minimizing costs of shipping/transportation;
Large basic processing industries, orientated towards imported raw materials and/or export orientation

Source : Wiese, 1981, p.83

In respect to the previous diagram mentioned above, the author does not give satisfactory answers concerning the question of the spatial demands imposed by the port's function and activities on the land use of the city. He gives detailed descriptions of the secondary sector (manufacturing industry) and the tertiary sector (the services and utilities) of the port which have an affect on the city's land use patterns. But he gives only a marginal description of the impact of the port on the demand for labour and the city's employment structure, and the demand which will be placed by the port oriented services on the urban zones adjacent to the port. Also omitted was any reference to the effects of port developments on the growth of urban population, the growth of markets and subsequently on the entire cityport system, including the negative impact on urban growth.

In this part of the research an attempt is made to understand and to examine the influences and the impact of the physical and the economic developments of the port as a function on the land use patterns of the city. These impacts will be identified by highlighting the principal activities which characterise the linkage between the port and its city.

It is possible to identify five fundamental activities which represent the interdependent relationship between any port and its host city. The first of these activities is the port related employment which has a direct effect on the land use of the city. The other four activities which have either direct or derived effects on the city's land use are:

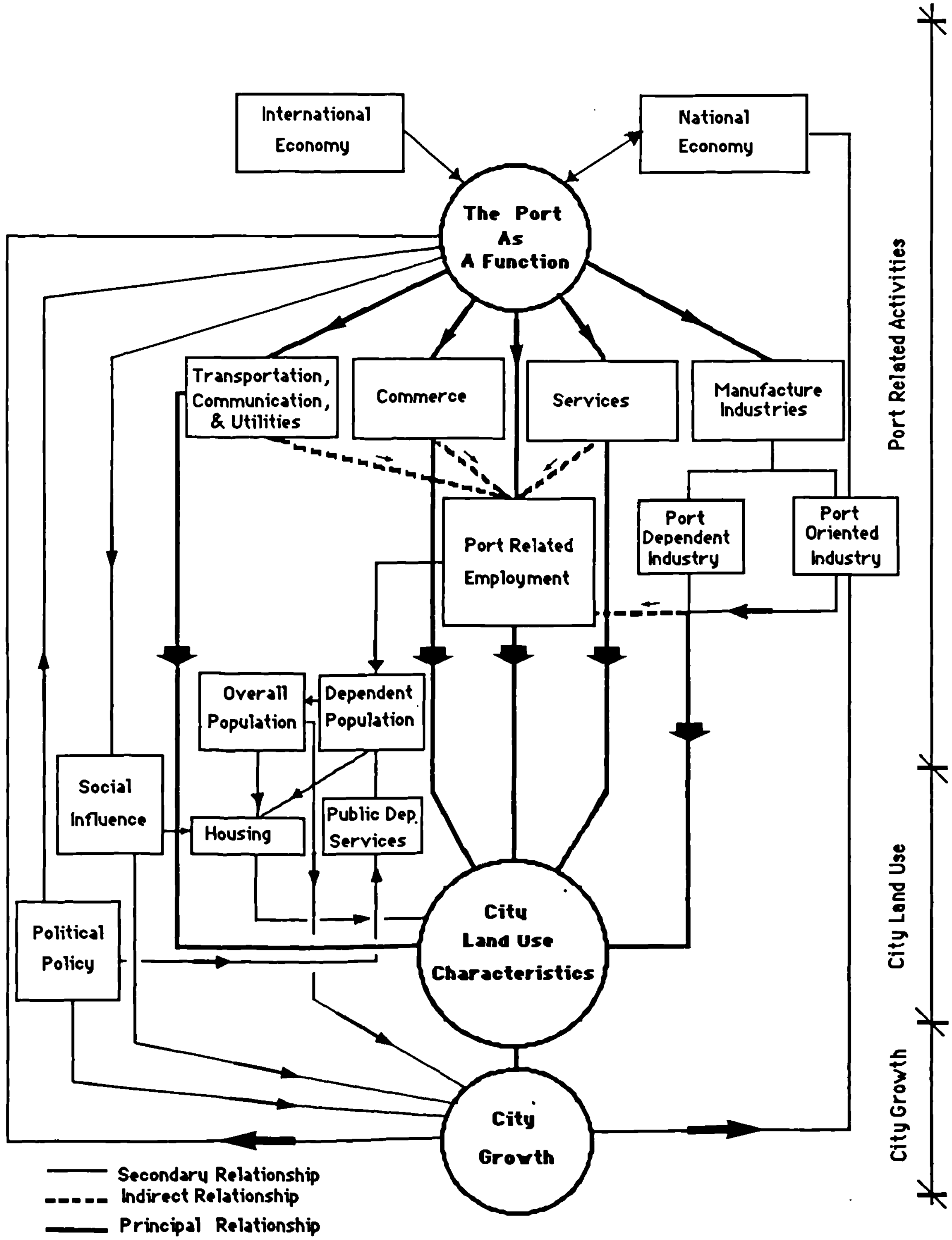
- Transportation, communications,and utilities;
- Commerce;
- Services;
- and manufacturing industries.

The direct effects take place as a result of the spatial demands imposed by each individual activity on the land use of the city. The derived effects, on the other hand, occur as an outcome of the interaction between these activities and the port related employment individually.

The interdependent relationships between the port related activities and the city land use, are represented schematically in Figure 4.2. This diagram indicates the connection between the five main activities identified above, and the city's land use characteristics. Other ancillary aspects affecting cityport land use patterns have been considered. Such aspects could be identified as, housing and public services which serve initially the port related employment. Also attention has been given to the general aspects influencing the system of cityport interrelationships. These aspects are referred to here as social influences and political policies. Some of the main feedback affects of city growth on the port are identified as well.

It should be mentioned that relationships represented in this diagram take several forms. Some may be flows of traffic, people, goods, etc. Others may be money or information. However, the nature of flow influences the type of impact that changes in one linked activity will have on the level of floor space required to accommodate the activity concerned.

Figure 4.2
A schematic diagram of cityport inter-relationships



Detailed descriptions and discussion of the former five activities will reveal the nature of the role played by each of them in relation to the land use patterns on the one hand, and city growth or decline on the other.

4.2.1 Port Related Employment

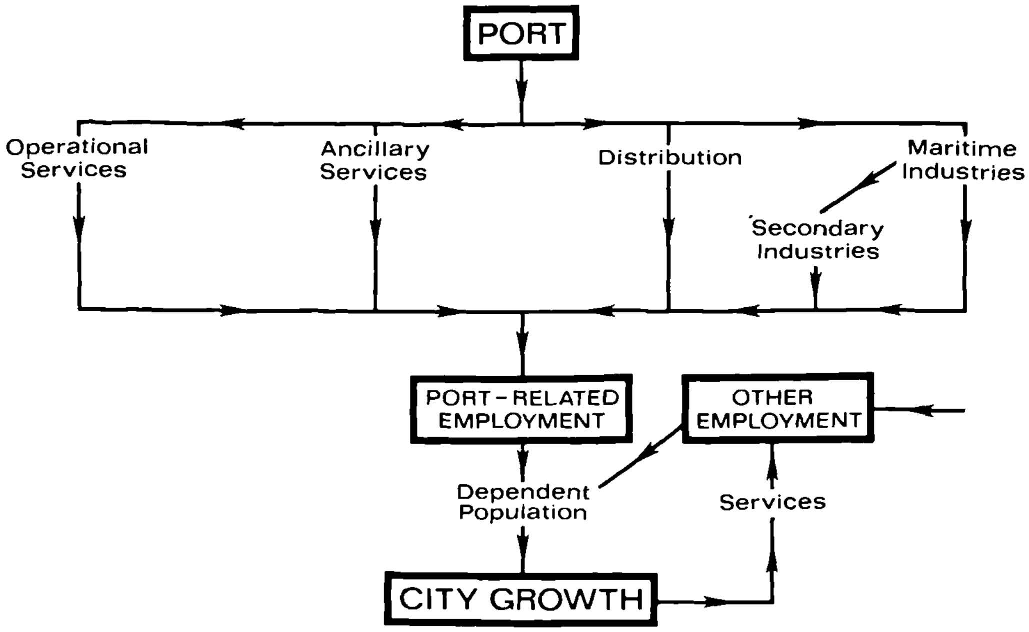
The port labour force and the employment related to its activities have been the theme of many studies concerned with port-city relationships. Among those who have contributed to this subject is Witherick who succeeded in developing a model, in the form of Figure 4.3, which represents schematically the principal ways in which the port might be perceived as contributing to city growth through the medium of employment (Witherick, 1981, p.117).

The model comprises the four fundamental port activities which stimulate the city's employment. These include, the operational services, the ancillary services, distribution, and the maritime industries. This model has been applied to the cityport of Southampton in England. However, for illustrative purposes this model will examine data obtained from other cityports.

I. Operational Services

The most important, sensitive, and critical task in any port is port operation. Many different jobs are integrated together in order to accomplish the eventual work of port operation. These jobs stimulate and generate an enormous amount of employment which involve; pilotage, towing, freight services (including warehousing, cargo and bulk handling and storage), customs and excise, marine salvage and the associated services, maintenance, and other related

Figure 4.3: A model of port city linkages



Source: Witherick, M. 1981, p. 119

activities. The study of Southampton port proved that at least 10,000 people (or 9 percent of the total employment of Southampton) were engaged in port related activities. Among them around 3,300 jobs were related to the port operational services (Witherick, 1981, p. 119). Similarly, in Liverpool port, for example, the work force which totalled about 10,800 persons in 1976, included only 2,840 dockers working in jobs involved with or related to the port's operational activities (Stoney and Bourn, 1984, p. 57-60).

From the previous two examples, one has to recognise the importance of the employment force engaged in the operational services activities in both Southampton and Liverpool ports. The numbers of these workers gave the right indication of the size of each port as well as the volume of traffic passing through each. A similar indication of how much the operational services affect the total port employment can best be seen in the case of East African ports. Table 4.1 presents a statement of the numbers of persons employed in the four major mainland seaports by Kenyan and Tanzanian port authorities and their respective cargo-handling agents, at the end of 1981.

Table 4.1:
Employment in the seaports of East Africa, 1981

	Mombasa	Dar es Salaam	Tanga	Mtwara	Total Tanzania	Total
KPA/THA						
Management	269	242	34	29	305	574
Operations	1,137	6,474	925	233	7,632	8,769
Engineering	1,901	1,256	247	60	1,563	3,464
Finance	335	252	85	24	361	696
Planning	16	17	–	–	17	33
Personnel/misc.	328	725	171	40	936	1,264
	3,986	8,966	1,462	386	10,814	14,800
KCHS/THA (Directorate of Operations)						
Management	173	42	7	1	50	223
Supervisory	524	420	18	5	443	967
Clerical	2,671	621	95	33	749	3,420
Manual	5,391	5,391	805	194	6,390	11,781
	8,759	6,474	925	233	7,632	16,391
Total	12,745	15,440	2,387	619	18,446	31,191

Source: Hoyle, B. 1983, p. 154

In this table it can be seen that, in the largest two ports, Mombasa and Dar es Salaam, the numbers of jobs dedicated to the operational services made up the second largest number in Mombasa and the first in Dar es Salaam. The proportion of employment in this sector in relation to the total of each port is 28 percent in Mombasa and 72 percent in Dar es Salaam. These percentages indicate and reflect the significant impact which the operational services have on the overall employment of the port.

II. Ancillary Services

The ancillary services are the type of port activities which are mainly located outside the port gates, and include a wide range of essentially commercial undertakings which serve the port in diverse ways. The scope of these activities can be extended to cover all the shipping agents (clearing and forwarding agents, commerce ship chandlers etc.) and all the activities which can feed and help the port function, from the nautical and navigational instruments makers to the naval outfitter. Because of the spacious arena of the activities covered by this category, the true contribution of these jobs to the city port's employment situation can be difficult to measure with precision.

However, in many port cities these activities are located together in a district near the port area and create what is sometimes designated as a maritime quarter. A good example of such a quarter is that existing in Southampton. "Many of these ancillary services have over the years became spatially concentrated in a kind of maritime quarter located between the Eastern Docks and the city central business district" (Witherick, 1981, p. 120). A sample survey in that quarter revealed that, these ancillary services employed between 1,500 and 2,000 workers.

III. Distribution

The distributional and wholesaling function relating to both raw materials and manufacturing commodities, is considered to be among the most important activities of any port. Normally, the geographical location of the port is the principal factor determining the growth or decline of this activity. For example, a port like Southampton has taken advantage of its strategic geographical location to become one of the greatest distributional and wholesaling centres in the South of England. Meanwhile, a port like Liverpool in the North West was less fortunate and lost some of its trading areas according to the disadvantage of the geographical location which consequently affects the distributional activities. It is worth mentioning that, in Southampton, some 5,300 persons were employed in wholesale and distribution activities, about 80 percent of these dealing with commodities coming into the city by sea (Withreick, 1981, p. 120). In Liverpool a study concerned with port related employment has revealed that, the estimated number of jobs related to this specific category are quite modest (Stoney, 1984, p. 68, table 3.17). Usually the distribution of goods takes place in those wholesaling centres which are located close to the gates of the port. Nevertheless, in many cases it also takes place directly from the port area and without recourse to the city proper.

IV. Maritime Industry

It has been evident that the prevailing character of many port centres became an attractive location for many industries which can achieve transport economies from the locality of these ports. "The basis of such a locational choice can vary considerably, but is normally connected with the importation of raw materials or export of product" (Takel, 1981, p. 64). On the basis of the previous advantages, Witherick has built his definition of the broad category of port related industries or what we have called here maritime industry. He also makes a distinction between three categories of industry as follows;

a. shipbuilding and other forms of marine engineering which inevitably require a waterfront location;

b. basic industries which process sea-borne imported raw materials;

c. industries producing goods mainly for export (Witherick, 1981, p. 121).

This industrial classification, when applied to some examples of major ports, can provide a clear cut picture of how the labour force and the employment power of these ports responds to such industries. For example, the port of Liverpool employed in 1977 some 1,106 persons in shipbuilding and marine engineering, (according to the Annual Census of Employment). While, it is found that another port like Hamburg has employed at the same time some 4,000 persons in the same sector. This enormous discrepancy between these two examples can be explained by the fact that the volume of traffic handled in Hamburg was three times more than that in Liverpool at that time (Stoney, 1984, p. 75). So, it has to be clear that the size of the port, as well as the volume of traffic have a substantial impact on the port related employment regarding the shipbuilding and the marine engineering sector.

The second type of port related industry relates to the kind of industries which rely upon the imported raw materials. As was mentioned before in chapter three, this type of industry may be located nearby or within the port's boundaries to take advantage of the skilled labour of the port, the site and services, and the availability of markets. Besides that there is the convenience of handling raw materials arriving by sea without transhipment. Such industries include grain milling, food processing, mineral and metal processors, petrol refining, oil related industries etc. The required employment and labour force for each of these types of industry vary from one to another, as well as from one port to another.

For example, the port of Dunkerque, located in the north of France on the north sea, has established an extensive strong industrial complex extending to cover over 8,000 hectares. The rapid changes of the port and the related industrial activities have led to considerable growth of the town as an attractive employment centre. The increase in the employed population has been more than 20,000, with over 50 percent of this total directly accounted for by the expansion of industry which is mainly import orientated (Tuppen, 1981, p. 270-273).

Table 4.2 indicates the male and female structure of the industrial employment of Dunkerque in 1975. It can be noticed from this table that the types of industry depending on imported raw material, such as steel and metallurgy, civil engineering and construction materials, and food and drink, account for the highest figure of employment in comparison with other industries.

This example illustrates that the basic industries which have these import orientations are considered to be among those important industries that depend on the port and which generate a considerable number of port related jobs.

The third type of maritime industry is the kind of industry that depends upon the port to export significant quantities of manufactured products. Industries with this export orientation can be identified as, textiles, packaging products, car and machinery manufacturing, and some food products.

Table 4.2:
Dunkerque's industrial employment structure, 1975

	Employment		
	Male	Female	Total
Food and drink	2520	1065	3585
Energy	1925	155	2080
Steel and basic-metal transformation	16,810	740	17,550
Mechanical engineering and shipbuilding	8670	495	9165
Civil engineering and construction materials	8240	485	8725
Chemicals	365	35	400
Textiles and clothing	735	1015	1750
Others	1580	435	2015
Total	40,845	4425	45,270

Source: Tuppen, 1981, p. 272

Two main factors account for the existence of this type of industry, the availability of markets and adequate employment. Again the example of Southampton illustrates how the advantage of the port's location made it possible to establish good markets, especially in the southern half of England. On the other hand, the opportunities for employment were enormous as illustrated in Table 4.3.

Generally, the manifestation of the inter-relationship between the port and its city can best be perceived through the port related employment. The volume of this employment may be used to indicate how much the port relies on the city in terms of manpower to promote its efficiency. It would reflect how many services the port needs in order to implement its aims and fulfil its role. It expresses also in terms of maritime industries the importance of the port as an indirect generator of employment.

Table 4.3: Estimates of port-related employment at Southampton, 1975

	City of Southampton	Southampton Region*
Operational services	10,000	10,100
Ancillary services	1750	2000
Distribution	4250	6050
Maritime industry		
(a) Shipbuilding and marine engineering	4900	5800
(b) Material-processing	2100	5900
(c) Export-oriented	3600	5800
Total port-related employment (*P*)	26,600	35,650
Total employment (*T*)	113,000	166,400
Port-dependence index (*P/T*)	0.235	0.214

* The Southampton Region is defined as the areas of the Southampton and Woolston, Eastleigh, Hythe and Romsey offices of the Employment Service Agency.

Source: Witherick, 1981, p. 124

However, the contribution of this employment sector to city growth or development can always be seen through the impact of this sector on the dependent population. This subsequently has its own effects on the overall population of the city, and can influence city growth. On the other hand, the city's land use characteristics will be affected as well, as shown before in the schematic diagram in figure 4.2. The housing demands placed by the dependent population will have a substantial impact on the residential zones surrounding the port.

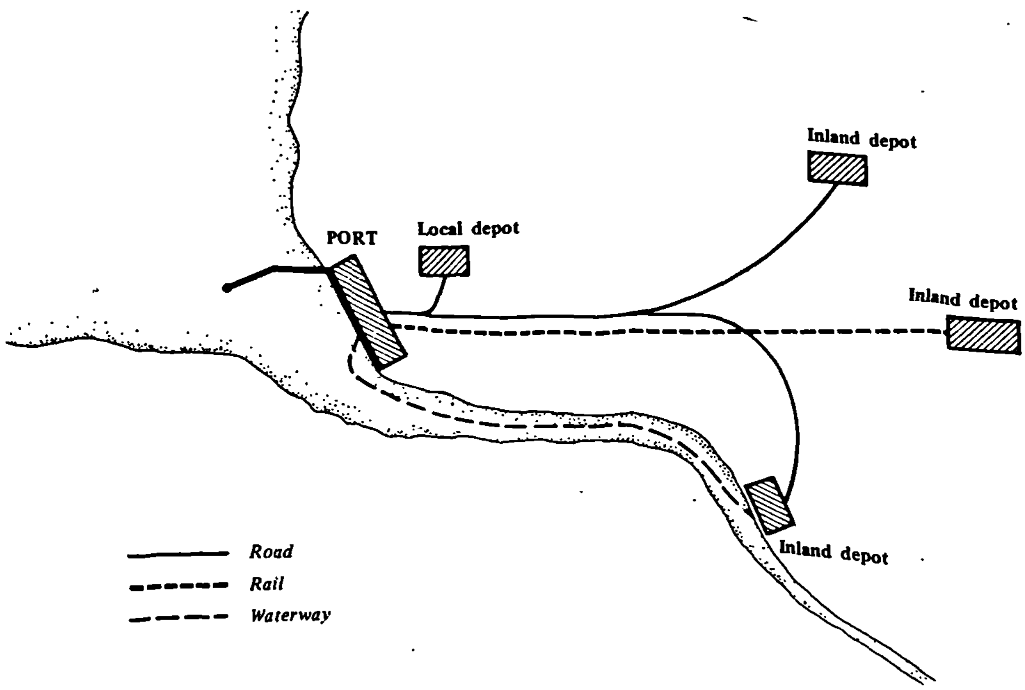
A cursory glance at the land use maps of many port cities reveals that the residential districts located in proximity to the port or close to the CBD of the city are the highest in population density. This highlights how far the port related employment influences and changes the land use characteristics of the city through imposing a demand for housing in the peripheral areas of the port.

4.2.2 Transportation, Communication and Utilities

The importance of the transportation system and its associated services within the framework of port-city linkage is something which can not be neglected. First of all it is essential to define the appropriate means of transportation which will be used to move the goods to or from the port.

Three main modes of transport are able to move the goods from the port to the city and vice-versa. These are, the railway, the road, and the waterway, as indicated in Figure 4.4

Figure 4.4:
Inland transportation network



Source: UNCTAD, 1978, p. 91

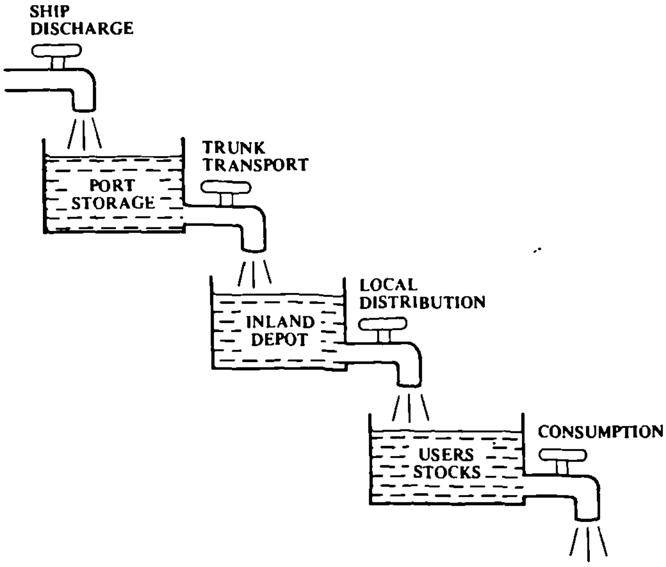
"The process of transporting the goods from the port will often require a sample of existing consignments to be examined. In judging whether the modal split is likely to change, the main factor will be the extent to which waterway frontage, trunk road access and internal rail sidings are available at the shippers' premises (factories, warehouses or mines). These facilities change very slowly in view of the large investment involved" (UNCTAD, 1978, p. 90).

The choice of transport mode depends very much upon the type as well as the class of traffic. It is varied among, for example, break bulk cargo, containers, ro/ro etc., and it has to be related to the distribution system. Figure 4.5 illustrates the traffic movement system (the import flow) from the time it reaches the port up to the time it is delivered to the consumer. This system could be considered as a set of connected tanks with taps which must be shut off when any tank becomes full.

This example can clearly explain the problem which will occur if any of the stores, such as port storage, inland warehouses, or users' stocks becomes full. Then *the logical solution is to stop* the flow into it. This soon causes the preceding store to fill up. In the light of this explanation, similar problems could be raised when the port has to face difficulties resulting from the stores and warehouses of the port becoming full. In this case the longer term solution will be to increase the size of the inland depots.

The second phase of the example illustrates the flow of goods outside the port storage system, in which to some extent the transport process is still under the control of the port management. This means that the port has to make sure that proper provision is

Figure 4.5: The import flow



Source : UNCTAD, 1978, p. 90

being made for the land transport capacity needed to match the forecast of throughput (UNCTAD, 1978, p. 91). The third phase mainly illustrates the distribution process of goods, whether this is on the local or the regional level. Throughout the three phases in this example, the transportation system is fully responsible for the efficiency and the success of the connective relation between the port, the city, and the region beyond.

Another form of transportation that should be considered is the movement of people from the city to the port or vise-versa, involving use of either public or private transport.

There is a strong inter-relationship between the land use activities and the transport system. Together, the land use and transport facilities form a closed-loop system and both are necessary to generate traffic. Justifying this theory, Blunden has pointed out that "many everyday experiences demonstrate that when land use and transport do exist, then the amount of traffic that comes into existence is determined by the level of land activities and the physical characteristics of transport facilities" (Blunden, 1984, p.2).

"The cityport, with its generally good transport systems, stands at the centre of a web of locational inter-relationships, simultaneously reflecting and affecting interactions over a far wider compass than that of transport node and urban settlement which the cityport itself comprises. These inter-relationships generally depend upon the type of economy involved, the level of development at which the transport improvements are introduced and the general and specific objectives of planning intervention" (Hoyle and Pinder, 1981, p. 6).

Through this inter-relationship the influences on city land use vary from one mode of transport to another, as well as from the urban to regional level.

First on the urban level, the impact of the three different transport modes mentioned before on the land use activities of the city take the form of:

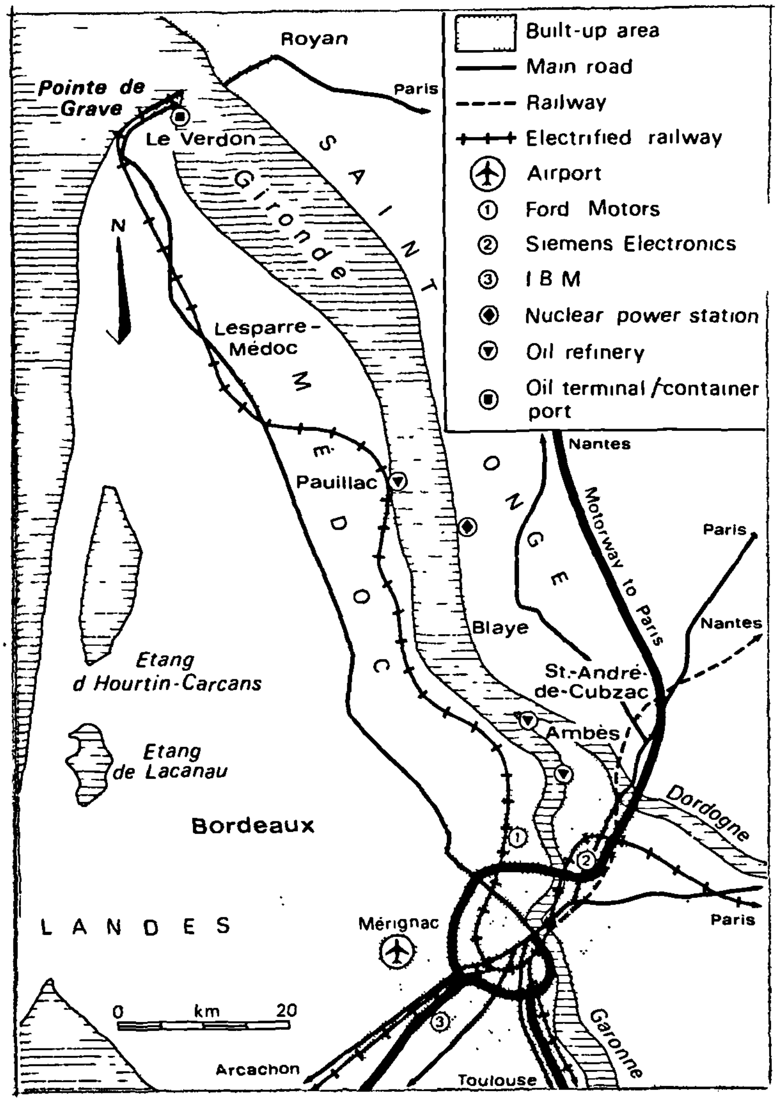
- Sidings, maintenance facilities and the related transfer activities of railway transport (this is for both the urban and regional level).
- Rights-of-way for the road network, storage, services,

parking, and other areas incidental to these activities and which are concerned with road haulage and passenger services.

- The origin and destination terminals and their related transfer and maintenance facilities related to water transport.

Figure 4.6 shows an example of how the transport network links the port with the city's industrial zone in Bordeaux, which is located on the banks of the rivers Garonne and Gironde in south-west France.

Figure 4.6: The cityport of Bordeaux



Source: Lerat, S. 1981, p.105

It appears at first sight that the port activities are well connected with the industrial area close to it. However, the weakness and failure of the policy to create a heavy industrial base that is closely linked to port activity and capable of generating port expansion, shows the limitations of plans which conflict in a basically free economy with the policies of industrial enterprises, especially those of the larger concerns (Lerat, 1981, p.103-111). This example proved that a good transportation network should be supplemented by efficient planning policy so that it can achieve its purpose.

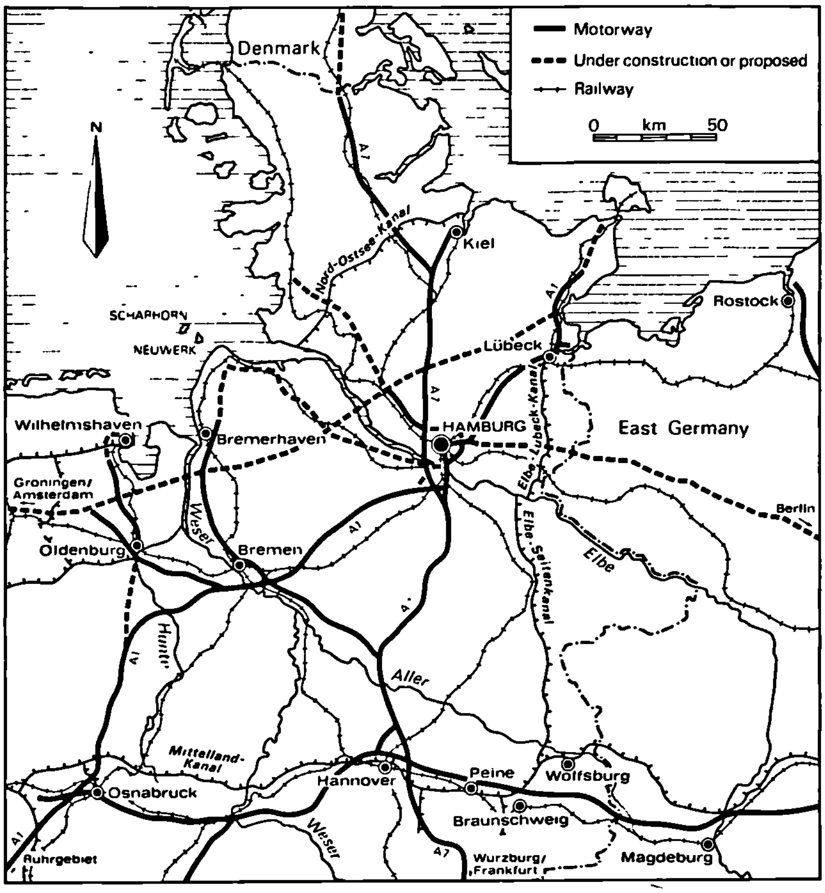
Second, on the regional level, the impact on the land use patterns can be identified as:

- Haulage and its related transfer and maintenance facilities.
- Highway networks and related maintenance facilities.

Here, a unique example is represented by the port of Hamburg. As the port has problems of accessibility and high transport costs, in general it suffers from the effects of locational disadvantage (vide Figure 4.7). The highest priority, however, has been given to developing better inter-regional linkages. This has resulted in massive investments in infrastructure which in turn have radically improved the situation. Access by road has been greatly facilitated by linkage to the main motorway network and the construction of new routes (Husain, 1981, p. 223-241).

Another type of service associated with the transportation system is the communication facilities. Generally the main feature of communication between the port and the city is the telecommunication system. The impact of this system on the land use of the city takes the form of:

Figure 4.7: Hamburg in its regional setting



Source: Husain, M. 1981, p.229

- Telephone and telegraph cables, radio, television and postal facilities and their related transfer and maintenance facilities.

Other utilities involved with port and city linkage that are likely to have an impact on both the port and the city take the following form:

- Pipeline transportation and related transfer, tank farm and maintenance facilities.

- Electricity, gas, water and waste disposal services, including processing and storage, rights of way and related facilities (Chapin and Kaiser, 1979, p. 244-247).

The notable interaction between the transport system related to the port and the city's land use has to be carefully considered because of the problems which may be involved. Such problems can be identified as including road congestion and the possibility of bottlenecks developing in the linkage system. Solutions to these problems may be derived from the accurate forecasting of port throughput with close attention being paid to both the vehicle fleet and route capacity required. Both of these are heavily dependent on the inland distribution patterns that are to be served.

4.2.3 Commerce

The evaluation of the commercial port depends principally on the efficiency of its distributional and wholesaling function. The importance of these two functions was discussed earlier in this chapter (specifically in the port related employment section that deals with distribution activities). However, within the land use context, the impact of the distributional and wholesaling functions on the land use characteristics of the city is quite significant. Chapin has drawn attention to part of this significance when he points out that "The wholesaling and related uses category has involved all the commercial uses of a non-industrial non-retail nature "(Chapin and Kaiser, 1979, p.419).

The impact of the distributional and wholesaling functions on the cityport land use could take the form of:

- Parking areas for customers or employees, loading services and other related areas.

- Wholesale trade, with storage on premises which includes merchant wholesale, wholesale and industrial distributors, manufacturers' sales branches and wholesale assemblers.
- Wholesale trade, without storage on premises which includes wholesale agents and brokers, manufactures' sales offices and representatives, and freight forwarders (Chapin and Kaiser, 1979, p. 244 -247).

From the viewpoint of land use planning, it is important to remember that these commercial activities (specifically wholesaling) and the related use areas require;

1. Reasonably level land, preferably with not more than 5 percent slope, capable of being graded without undue expense, and outside floodplains.
2. Range of choice in close-in and fringe locations, site sizes usually under five acres.
3. Direct access to heavy goods vehicle routes and major street systems for incoming goods and outgoing deliveries, frontage on a commercial street or in well served wholesale centres, rail access for minor proportion of sites or centres.
4. Suitability for development of integrated centres, with consideration for amenity within the development and in adjoining areas (Chapin and Kaiser, 1979, p. 389).

4.2.4 Services

The magnitude of a port as a complete system is often measured by the volume of services operating within this system. Any port, whatever its size, relies upon different type of services to sustain its operational process. Such services could be identified, for example, as shipping agencies, administration of shipping lines, firms of ships' chandlers, financial institutions, etc. Mainly these services are likely to be found in areas either surrounding the port or located within or close to the CBD of the city.

Because of the wide variety of the activities related to these services, their impact on the land use characteristics of the city is very considerable. These take the form of land required for:

- The employee parking, loading services and other related areas.
- Firms headquarters for shipping lines and shipping agents.
- Finance, insurance, and real estate (including marine consultants).
- Special services (including marine salvage and diving and towing services).
- Miscellaneous business services.
- Car repairs and services, metered or parking spaces and garages.
- Miscellaneous repair services.
- Hotels, motels, and recreation and amusement activities.
- Medical and health services except hospitals, sanitariums, convalescent and rest homes.
- Other professional services including professional associations, trades unions, etc.

From the previous classification of the main services related to the port activities, one has to observe that there are mainly three types of services. These can be defined as, first, services which have a port orientation. These can be introduced as, shipping agents, shipping lines, and ships' chandlers, etc. These are also considered to make a direct contribution to the port's operational process. Second, there are those services which have a city orientation, including commercial amusements, hotels/motels and restaurants etc. The third type is those services with a mixed orientation (with the meaning that these services may be related to the port and the city at the same time). This includes the financial and insurance institutions, car services, and various miscellaneous services.

4.2.5 Manufacturing Industry

The role of a port area and its surrounding suburbs as a location for associated industry has long been recognised. The characteristics of these historical examples resemble those of modern times in most respects and the principles which led to their creation also have a continuing relevance. The differences are mainly of intention and scale.

Norcliffe (1981, p. 159) pointed out that "Most new port industries have been located away from the central waterfront, either at suburban waterfront sites or even further away at greenfield sites. Meanwhile, some long established port industries have been experiencing land use competition from non-industrial uses and, lacking space to expand, have also sought new waterfront sites".

Attention has been given in the previous chapter three to the types of industry that are related to the port. Two categories were identified where the combination between manufacturing industry and port land use exists. These were referred to as port service industry and port related industry. They were defined as comprising, respectively, port dependent industry, which includes all the work related to dry docks, maintenance services, special manufacturing, etc. In addition, port oriented industry implies, food and beverages industries, the chemical industry, metal industry, refineries, and vehicle manufacture, etc.

The impacts of these two types of industry on the port land use were identified before. Yet in this section the way in which these industries place demands on the land use patterns of the city may be identified as follows:

- The need of reasonably level land, preferably with not more than 5 percent slope, capable of being graded without undue expense.
- Range of choice in close in, fringe, and dispersed locations: in extensive manufacturing, large open sites for modern one story buildings and accessory storage, loading, and parking areas in fringe and dispersed locations, usually around Five acres as a minimum. However, with some sites it could increase to Ten, Twenty five, Fifty or a Hundred or more acres, this depending on the size of the urban area and the economic outlook for extensive manufacturing.
- The need for direct access to commercial transportation facilities, such as access to railways, major roads, and in some urban areas deep water channels. It is preferable to be located on the same or near the major transportation route that connects the port with the city.
- The residential areas needed for the labour force.
- Good availability of utilities at or near the site.
- Compatibility with surrounding uses, considering prevailing winds, possibilities of protective greenbelts of open space,

development of "industrial parks", and other amenity factors both within the manufacturing area and in relation to adjoining land uses.

- For industrial activities involving water borne wastes, locations where adequate on site pretreatment of wastes is possible (Chapin and Kaiser, 1979, p.388-9).

These are the impacts imposed by the two types of port related industry on the land use characteristics of the urban patterns. On the other hand, there is an efficient and valuable role of port oriented industry, or what are known as *"MIDAs"*, or *Maritime* Industrial Development Areas, in the regional economic context. The dimensions determining this role have been defined by Vigarie in (1981), and can be summarised as follows:

A. Technical induction: which is concerned with the attraction or creation of industries directly related to or dependent upon basic industries, such as a variety of metallurgical plants dependent upon steel, or miscellaneous petrochemical industries derived from oil refining. There is one problem involved with this, which is the determination of the coefficient of direct employment induction. It has been discovered that, for each job in the field of industry there were some related to dependent sectors. In this sense, the establishment of heavy industrial complexes would allow a considerable measure of control of dependent sectors within the context of regional economic development.

B. Synergy within the local environment: the establishment of a polynuclear industrial complex naturally involves supporting maintenance activities, and engenders a favourable climate of economic interaction within the MIDA itself and within surrounding areas.

C. Intergy within the industrial complex: within the context of a developing MIDA, there is an introduction of some activities related to secondary and tertiary industries. Those activities are contrasted in character with those which constitute the basic complex, so that the economic environment and structure becomes self-generating and yields a variety of increasingly diversified industrial activities.

D. Demographic induction: because of the attraction created by these industrial areas of labour and employment, there are some spatial and economic changes involved in order to ensure adequate services and living standards for the migrant industrial employees and their families. A variety of additional employment opportunities must be created, such as for traders, teachers, doctors, etc. In this sense, it is obvious that coastal industrialisation can produce quite significant effects in urban and regional terms.

E. The network effect: any industrial maritime complex acts as a propulsive centre within the urban network. In addition to the demographic movements involved, there is a demand for various transport network links between this complex and the regional areas and all the hinterland. Problems of overall spatial organisation may emerge at this stage. Solutions have been proposed by governments which aim at the utilisation of MIDAs as powerful agents of self-generating change in terms of regional and national development (Vigarie, 1981, p.30-31).

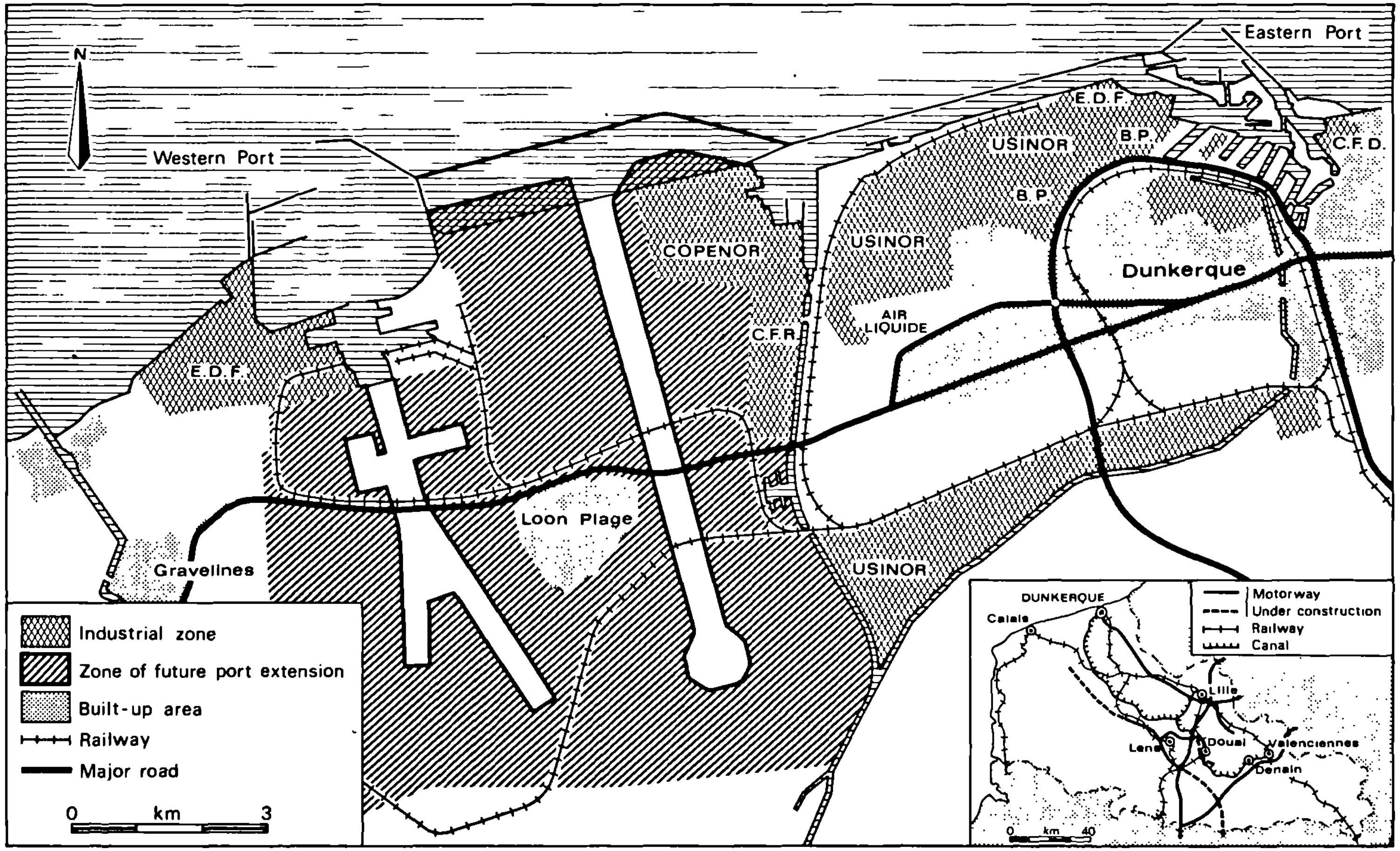
Finally, an example of the penetration of the port related industries within the urban patterns can clearly be noted in the cityport of Dunkerque. As mentioned before in this chapter, there are many extensive industrial activities which have been established in this port. As a result of these and earlier industrial developments, Dunkerque has emerged as a leading centre of heavy industry in Nord-Pas-de-Calais. On the other hand, the port has had to face a substantial increase in area as well as the changes to the new technology in cargo handling techniques. Consequently, parallel with the radical transformation of Dunkerque's industrial structure, the port has been substantially remodelled and extended. These transformations have put Dunkerque to be France's third major deep water seaport on one hand, and an important centre of heavy industrial industry on the other. These have also led to enormous changes in the urban structure of the town. Such changes have considerably enhanced the town's position as a regional industrial centre (Tuppen, 1981). It should be mentioned that, this example has identified the significance of the role played by port related industry in relation to port development on one hand, and the economic growth of the cityport and the entire country on the other.

Figure 4.8 indicates the merging that has occurred between the port expansion, the various industrial zones, and the urban patterns representing the different urban activities serving both the port and its related industries.

4.3 CITYPORTS WITHIN THE ECONOMIC CONTEXT

"The role of cityports within national and international economic systems is especially important for, in addition to the dominant position which they occupy in the transport network and in the provision of standard urban services (including markets and employment), cityports are likely to develop a major industrial sector within the urban economic base" (Hoyle, 1983, p. 21-22).

Figure 4.8 :
Land use patterns in the city port of Dunkerque



Source : Tuppen, 1981, p.269

The significance of this role is usually perceived through the important role played by the port as a function and component of activities in connection to the national and international economy. The port which is considered to be one of the most attractive places for employment opportunities, industrial development, and above all the node of many transport modes, has two major impacts on the national economy of the country.

These two impacts can be defined as direct and indirect impacts. The direct impacts may be identified in terms of expenditures of firms and companies immediately involved in the port's business life. This can be measured by the wage payments and purchases of goods and services that grow out of the firms' direct involvement with the port. The other impacts can be defined as indirect impacts, which comprise the multiplier effects of the money spent by the firms and companies involved in the port (Bailly and Weiss-Altaner, 1981).

It is worth mentioning that the industries dependent on or related to the port also make an important contribution to the national economy of the country. As pointed out by Hoyle (1983), "port industrialisation is not merely a secondary function of port transit trade; port industries are themselves major importers and exporters, creators of employment and users of urban space, and thereby active agents of urbanisation in a physical, economic, and social sense" (Hoyle, 1983, p. 22).

The transportation systems related to the port, on the other hand, also have a significant role to play within the framework of the national economy. Any deficiency in the port operation process will result in delay in handling the cargos and this will eventually cause the problem of congestion. A congested port can be a major drag on the economy of the country. Delay in releasing exports can cost vital foreign exchange. Traders are penalised by the cost of holding stocks and delay charges on railway wagons unable to unload. Importers and distributors are unable to get their hands on essential consumer and investment goods in time. Development projects suffer when capital goods are held up in the docks.

In general, any failure in the transportation chain that links the port with the city specifically, and the hinterland generally might disturb the whole economic system of the country. These points are vividly exemplified by recent events in Alexandria, Port Sudan, and Dar es Salaam, and their effects on the economic life of Egypt and Sudan on the one hand, and on Tanzania, Zambia, Rwanda, Burundi and Eastern Zaire on the other (Bathurst, 1976).

From the viewpoint of the international economy, the impact of the port will best be perceived through the process of exporting and importing of goods. Again a disabled port will not cope with shipping of goods for export, or discharging of goods for import in time. Thus problems of ship delays and accumulation of cargos will exist. Subsequently this will affect the cost per ton of goods, which in turn will considerably influence the international markets.

4.4 CITYPORT PLANNING AND THE URBAN ENVIRONMENT

Cityport development is affected by a number of sets of environmental issues. Among these, there are four separate factors identified by Hoyle (1983): the land situation and the water situation, and the land site and water site. Each of these components will not achieve its potential , unless conditions in the other three are favourable. For example, the land situation influence the level to which port development can take place. The water situation refers to the condition of current and tides. The land site influence the site at which the port is located, and the water site refers to physical conditions of the harbour.

In the cityport planning process, the environmental problems that exist are almost always attributed to the lack of attention paid to the previous four components. Although these problems can take many forms, discussion here will focus upon those which are concerned with water and air pollution, and the need to conserve the coastal landscapes.

4.4.1 Water and Air Pollution

Most of the ports located within the administrative boundaries of their cities cause problems of pollution to the sea coasts as well as the shores of these cities. There are three basic pollution risks endangering the sea coasts, each with its individual character and potential level of consequential damages. These can be summarised as:

A. Chronic Pollution: This normally occurs from oil deposits as well as garbage, plastic deposits, mainly resulting from vessels handling cargo or waiting for mooring.

B. Port Pollution: This mainly results from bilge, ballast, and waste oil discharges from berthing ships. In general terms, the chances of port pollution are proportionate to the level of port usage as it mainly emanates from vessels using the port.

The liquid oil deposits are often found to accumulate in certain port areas and their approaches. The problems associated with this lies mainly in the oiling-up of quays, vessels, boats, and other floating equipment in addition to mooring lines, all of which are subject to a degree of damage from such oil accumulation.

C. Accidental off-Shore Spills: It is very important to associate an accidental off-shore oil spill mainly with the risk of a collision between vessels en route along the coasts of cityports. Such collisions, particularly if tankers were involved, can result in a sizeable spill. Obviously the chances of such a collision are entirely dependent on the density of traffic involved.

It should be mentioned that all of these types of pollution seriously affect the recreation beaches and the tourist resorts alongside the city shores. To some extent, this pollution may be restricted to the sites closer to the port that is associated with an urban agglomeration by strong enforcement of pollution controls. On the other hand, the industrial plants and complexes which rely upon the port, and are thus located near by it, can make an enormous contribution to both water and air pollution.

First, it was mentioned before that most of the port related industries are dependent on petrol products and chemical materials. Some of these maritime industries have attracted so far a great deal of criticism because of the pollution resulting from disposal of their chemical wastes into the sea. Without adequate safeguards, the impact on the coastal shores will be significant, specially from the standpoint of environmental health.

Second, these maritime industries have also an important role in contaminating the atmosphere. For example, at Rotterdam the concentration of oil refining and chemical plants in early post-war developments, as well as the lack of experience of the problems created by such industrial growth, have affected drastically the older residential areas on one hand, and the new housing for labour working in these industries on the other (Takel, 1974, p.20 and Pinder, 1981).

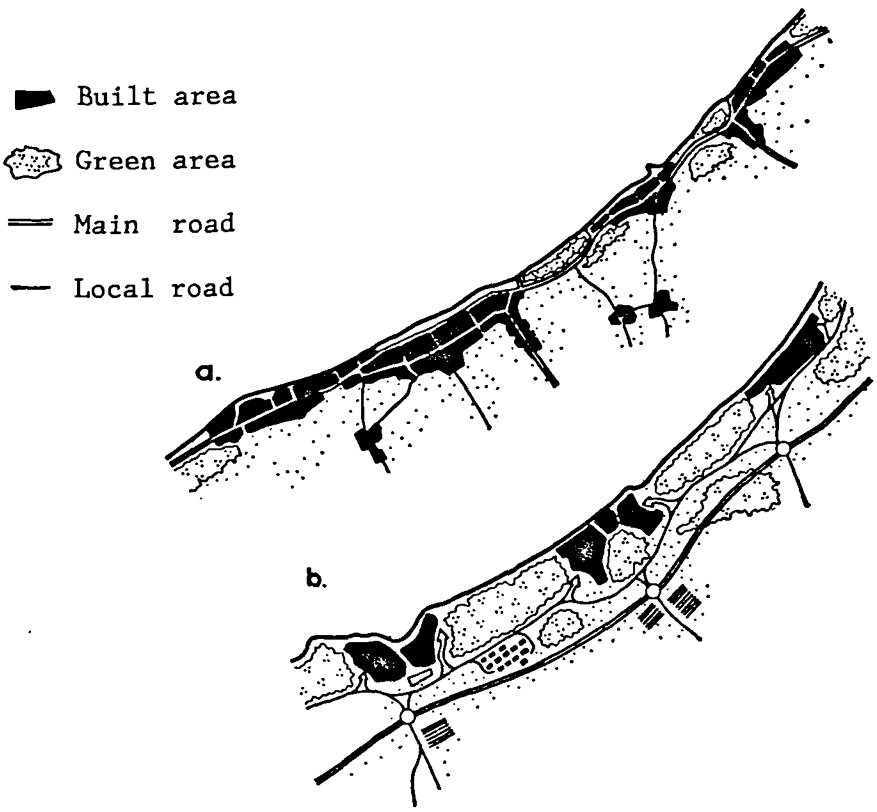
Generally, it should be clear that water and air pollution which is the result of the port and its related activities represent dramatic environmental hazards for the cityport in general and the coastal beaches and the residential areas close to it specifically. Yet, it must be recognised that close attention to this as well as the improving control over pollution will help in solving the problem. Furthermore, the site of the port related industries can be chosen to avoid affecting residential areas or other sensitive features.

4.4.2 The Conservation of Coastal Landscape

The idea of conserving the landscape of shores and coastal areas has been introduced relatively recently, and has attracted the attention of many environmentalists, planners, geographers, and others who are also are interested in studying and solving the problems related to the environment. Among those is Zaremba (1969), who stated that "It must always be kept in mind that the shore belt is of importance to the whole nation, and it would be inadmissible to ruin it by off-land and unpremeditated measures which disregard the natural values of the coastal landscape" (Zaremba, 1967, p.59). This is one of the arguments against any attempt at what is called a ribbon development of the coastal belt.

The concept of ribbon development came into existence as the result of a "fringebelt accretion along communication routes". Where residential areas and transport functions overstep each other, both were bound to suffer, particularly when this harmed the shore line extending parallel with this development of urban patterns. An example which can help in the interpretation of this concept is provided in Figure 4.9.

Figure 4.9:
The coastal line between Copenhagen and Helsingoer



Source: Zaremba, 1969, p. 60. Scale not featured

The portion (a) pictures a ribbon-type pattern of building coverage in a coastal belt (as shown in the area located between Copenhagen and Helsingoer in Denmark). This pattern is unfavourable.

In portion (b) it is suggested that better results were obtained when a new planning scheme was applied. The idea was to separate the urban patterns by using greenlands, absolutely free of any buildings. They are accessible from the route skirting them, and the particular residential sections are interconnected by local roads which avoid running next to the shore line.

It should be mentioned that this sort of functional division of the sea coast also has a marked effect upon the cityport and its urban agglomeration. An expansion of the port's activities and area, either along the coast line or landwards in turn, contributes to the growth of the cityport in a way which changes the ecological balance of the coastal landscape.

4.5 CITYPORT PLANNING AND THE POLITICAL INFLUENCES

In most if not ~~not~~ all of the cityports, the planning process is always affected by a series of influences which determine the direction of policy formulation. These policies are the product of many factors, some of which are internal and restricted to port development, others are external and related to city and regional development. However, the complexity of this process eventually will be directed towards achieving economic and socio-political goals.

The planning of a cityport involves a system of linked decisions. Three main bodies take the responsibility of making these decisions. First, the port authorities or port trusts, which mainly control port administration and management. Second, the local government which can be exemplified by the municipality, political parties, and public participation. Third, central government and politicians.

Here, it worth mentioning that the question of who will be able to make or take the final decision varies from developed to developing countries. This can be explained by the fact that in the developed countries, ports tend to be quite independent of the central government, or in other words, the port is managed by a separate autonomous body (port authority or trust). This will be under quite general overall supervision of the central government, who may impose certain powers and delegations upon the authority. In this case, a *complete decision related to the form of administration* or the development of the port, will then be taken within the framework of the national economic policy. However, when the decision is to deal with the urban planning process for the cityport, arrangements will be made between the local government and the port authority, but mainly the local government will be responsible for the planning decision.

In contrast, in the developing countries the situation is different. The port is considered to be a vital economic tool in the hands of the central government. Central government is able to control and thus govern the overall economy system of the country. So, the port authorities in these countries no longer have the right to establish their own rules and regulations, to select and appoint personnel in accordance with their professional abilities, irrespective of political affiliations. In this sense, the critical decisions must be taken by the central government. Consequently, the influential role of the local government and municipality within the context of the cityport planning process will be diminished. As pointed out by Dix (1984) "The ultimate decision about planning and development rests with politicians, who must obtain and retain the support of the people. But politicians might gain more and continuing support if the programmes they embraced were realistic in terms of their possible accomplishment and in meeting local and national needs" (Dix, 1984, p.223).

Finally, it should be considered that, within this context of developing countries it would be in the interest of both the port and the city planners to liaise in the formulation of strategies and plans. This should lead to the formulation, within expected constraints, of common goals in accordance with national development objectives. Further explanations of these political influences on the planning process of the cityport will be discussed later in the case study of Alexandria cityport.

4.6 SUMMARY AND CONCLUSION

This chapter has been based on a literature review concerned with the theme of cityport interrelationships. Basically, it has focused on the land use implications within the context of cityport linkages. A brief review of what has been written about this subject has been considered, including the negative and positive points of view.

However, it is evident that few authors have discussed the particular theme of cityport land use planning, and even those who did, ignored some essential points such as, for example, the demands that are placed by the port's activities on the city's land use patterns.

In this sense, it was possible to identify five main port related activities in which the direct and indirect impact of the port on the city land use could be examined. These activities include, the port related employment which directly influences the land use of the city. The other four activities have both direct and indirect impacts on the city land use characteristics. These are transportation and its associated activities, commerce, services, and finally the manufacturing industries.

Here, it was necessary to develop a schematic diagram to provide an overview and to indicate the actual relationship between the port as a function and producer of activities and the system of the city as a whole. The marginal influences imposed by sub-activities and other ancillary elements have also been considered.

Detailed explanation of the former five activities revealed that, within the system of cities, the ports' activities have considerable impacts on the land use patterns. These impacts have extended to the degree which the region of cityports also have been affected.

The discussion of cityport land use led to exploration of the significant role played by the cityport as a complete system in relation to the national and international economy. This included two different impacts on the national economy. It also implied the potential problems involved with the port and its transportation system and which can eventually have enormous affects on the economic condition of the country on one hand, and the international markets on the other.

Attention also has been given to some environmental issues which are involved in the planning of cityports. Such issues are mainly concerned with the environmental problems which have arisen in the coastal cities, such as, for example, water and air pollution, as well as the need to conserve the coastal landscape.

Finally, the discussion of cityport planning has been extended to deal with the political influences which affect the planning process and planning system of cityports. This demonstrates how far this system will be affected by the three main decision makers acting in cityports, and which are characterised by the port authority, the local government, and the central government. Also the different impacts of these three political bodies in the context of developed and developing countries have been contrasted.

CHAPTER FIVE

CHAPTER FIVE

A CASE STUDY OF ALEXANDRIA CITYPORT

5.1 FIELD STUDY METHODOLOGY OF THE TWO CASE STUDIES

In the previous theoretical part of the research, attention has been given to two important key issues. There were considered to be, the impact of the technological changes in both sea and land transport as well as the handling techniques on the land use characteristics of the ports, and the impact of the port's function and activities on the land use patterns of the cityport.

In order to examine how these factors have operated in practice, two field studies concerning the cityports of Alexandria and Liverpool have been carried out. The principal aim of these studies was to focus upon the evolutionary changes of the land use patterns inside the port as a response to the new technology on the one hand, and the physical expansion or contraction of the ports and how this influences the land use characteristics of the two cityports on the other.

In these two case studies, attention is drawn to the trends in which the way in which the ports' functions and activities have changed over the last two decades. Emphasis is given to identifying the factors that account for the changing dependency between the port and city with respect to labour, transport systems, commercial activities, services, industry and hinterland requirements.

5.1.1 The Objectives of the Field Study

According to the aim of the study noted above, the following objectives are necessary to achieve this aim. These are:

i. To outline the changes in exports/imports and industries which are dependent on the port, as well as the impact of these changes on the economic growth of the two cityports under investigation.

ii. To investigate the impact of the changing technology of the shipping industry on the land use of the two ports on one hand, and the port throughput over the last twenty years on the other.

iii. To examine the land use patterns inside the two ports according to the activities of each terminal.

iv. To compile information about the evolution of the two ports through an examination of the past and present labour force in order to identify the areas of change with respect to activities, trades, etc. In addition, to examine the changing dependency between the port and city's population and economic structure.

v. To identify the changing conditions of the inland transport systems serving the two ports, and the effects of these changes on the linkage system between the ports and their hinterlands.

vi. To obtain data and information about the public utilities and communication infrastructure of the two ports, and the ones related to the city other than transportation.

5.1.2 Methods of the Field Study

According to the aim and objectives of this field study, two types of field study methodology have been employed. The first is an analytical study of the waterfront of the two ports, with the aim of investigating the impact of the changing technology. The second is the carrying out of two types of survey in the form of a documentary sources survey, and an observation and photographic survey.

5.1.3 The Design of the Analytical Study

The analytical study of Alexandria and Liverpool ports was designed to assess the changes in the land use estates of the two ports over the last twenty years, through an evaluation of the changing functions of the waterfront land uses. In this study the waterfront area in both the two ports was defined as the distance between the foreshore line and the normal boundaries of each port and which is parallel to the normal city block patterns.

The period of the study spans the last twenty years, but the temporal analysis is presented through a series of cross sections, and the specific years of this analysis are 1965, 1970, 1975, 1980 and 1985.

Based on the empirical work carried out by McCalla (1983), it was possible to identify five principal categories of waterfront land use, with direct relevance to the concepts of separation and specialisation of port functions and activities. These are referred to as: cargo handling, urban orientation, mixed orientation, vacant and undeveloped land, and others. Twelve land use categories which account for the range of waterfront functions were chosen as follows:

- Docks and associated warehouses.
- Storage open space.
- Residential.
- Offices and services.
- Commercial (retailing).
- Warehousing (other than shipping).
- Developed open space.
- Public administration and defence.
- Transport (other than shipping).
- Manufacturing and utilities.
- Vacant and undeveloped land.
- Others.

These twelve land uses are grouped within the previous five categories with respect to the function and activity of each of them. These can be described as:

A. Cargo-handling [including docks and associated warehouses, and storage open space].

B. Urban orientation [including residential, offices and services, commercial, warehousing (other than shipping), and developed open space].

C. Mixed orientation "with the meaning that the land uses may be related to either the port or the urban areas", this category including public administration and defence, manufacturing and utilities, and transport (other than shipping).

D. Vacant [including both vacant and undeveloped land].

E. Others, this category covering all the other activities which are not mentioned above and existing in the waterfront area, such as, recreation areas, university projects, etc..

5.1.4 The Complementary Surveys

Two types of survey were carried out in order better to understand the exact impact of the two ports on the inland transport system, as well as the significant influences that contribute to the interdependent relationship between these two ports and their cities. Demonstration of these influences is sometimes difficult but may be traced through the changing dependency of the city on port employment, improvements in inland transportation serving the port, hinterland requirements (which may arise from industrial growth), and changing patterns of market demand for goods (growth of trade) and in general economic circumstances.

With all the above influences in mind, the types of surveys described below were carried out.

i. Survey of Documentary Sources

This survey was based principally upon gathering data and information from documentary materials, published port and government reports, statistical materials, and statements of government polices, which were useful in arriving at an impression of the previous and the current situation of the two ports. Similar material was assembled relating to the two cities and their associated transport networks, traffic flows, etc.. Attention has also been given to the level of port related employment and the changing numbers involved, as well as the public utilities and communication infrastructure of the two ports (other than shipping).

This survey was particularly important as a mean of obtaining data about the rates of exports, imports, and the economic fortunes of both Alexandria and Liverpool on one hand, and an accurate impression of general economic conditions on the other.

ii. Observation and Photographic Survey

This survey was essential in providing supplementary evidence for the field studies. The main purpose were:

- To obtain a clear idea about the uses of the land around the port zones including the sorts of activities related to the port which are concentrated in these areas.

- To give a broad impression, rather than detailed local analysis, of the transport movements generated from the port on the road network around the port zones
- To determine the impact of the environmental effects generated by the port, and effecting the land use of the two cities. Such effects are considered to be the impact of water and air pollution generated by the ports and their related industries, as well as other changes in the ecological environment of the two cities.

The information obtained from the former surveys were utilised to analyse a number of aspects of the mutual relationship between the two ports and their cities. This will be assessed later in the light of the theoretical approach to examining cityport relationships, in order to set out possible land use policies and development strategies for the cityport of Alexandria.

It should be mentioned that, as some of the statistical data sought from the former two surveys were either unavailable or incomplete, it proved necessary to attempt to combine data from different sources. It is important to note that this places some limitations on the interpretation placed on the data that should be borne in mind when looking at information derived from the two surveys.

5.2 INTRODUCTION

This chapter is the first of two chapters tackling the empirical work of the research. It concerns the case study of Alexandria cityport. The first section deals with the methodology adopted in carrying the two case studies under consideration.

Alexandria is the second most important urban centre in Egypt after Cairo. In addition to this, it is by far the most important import and export trading centre in the country. Its port deals with 70 percent of the total of Egypt's seaborne trade. This great role of Alexandria is not a recent phenomenon, as throughout history the city has demonstrated its unique character.

The chapter starts with a concise historical resume of the role of Alexandria and the major events that have contributed to its development. The current role played by the city within the national context is then reviewed. Also, the physical features of the city are briefly represented. The environmental context of Alexandria is specified through four main dimensions, including the policy, socio economic, land use, and transport dimensions. This is followed by a brief description of the port structure and facilities, in which a clear impression is given of the setting of the field work. A detailed land use analysis of the waterfront is carried out with the principal aim of evaluating the changing land use characteristics over the last twenty years as a response to the new technology introduced in maritime industry. An analytical study concerned with the port throughput also has been carried out. The relationship between the increasing rates of land areas and volume of trade has been examined. This matching study reveals some significant findings which tend to support the idea of establishing the new port El Dekheila. The following section is concerned with this proposed new port, its purpose, location aspects, stages of execution, environmental aspects, employment impacts, and traffic forecasts.

Finally, the impact of the two ports on the land use of Alexandria is assessed with regard to the five main port related activities which are associated with the impact of the port as a function of the land use of a cityport.

5.3 HISTORICAL RESUME

Alexandria, Egypt, known throughout history as "a pearl of the Mediterranean", was founded in 332 BC by Alexander the Great. It was built on the site of a small fishing village named "Rakotees" which had the following advantages:

- Its location was ideal for commerce with the ports located on the Mediterranean Sea.
- The island of Pharos which lay opposite the mainland protected its natural harbour.
- The site was fed by numerous canals flowing into the River Nile, which facilitated communication with lower Egypt. Products could be carried by boat to the city and then shipped to other Mediterranean ports.

Dinocrates and Sostratus, Alexander's architects, laid out the city in a gridiron or checker-board pattern. Seven avenues ran parallel to the sea; eleven others ran perpendicular to these. The final form was a city which was divided into five districts numbered by the first five letters of the Greek alphabet. Set out below is a brief description of the various stages of Alexandria's growth (see Appendix 3 for associated maps).

A. Ptolemy the Second, who ruled Alexandria from 285 to 240 BC, decided to connect the city to Pharos Island for expansion. He constructed a huge pier of stone 1,250 metres long and 30 metres wide which divided the harbour in two. Because of sedimentation, the pier became very wide and is now occupied by the district of "Al-Anfoushi" and "Ras El Teen". The two harbours are now the eastern harbour which is used mostly by fishing boats, and the western harbour which is now the main port.

B. Alexandria underwent a second expansion two and half centuries later when Octavius Augustus built dwellings for Roman officials 1.2 km. east of the original city.

C. During the eighteen centuries that followed, Alexandria went through a series of expansions and contractions because of sociological upheavals of various kinds such as wars and revolutions. For example, when the power shifted to the Mamlukes in 1260, they showed interest in Alexandria and its unique harbour to maintain a strong naval presence in the Mediterranean to hold back the crusader incursions. However, it is said that Alexandria shrunk to a third of its original size during the period of the Mamlukes. Finally, the present stage of Alexandria's development was begun in 1805 after the evacuation of the French troops when the family of Mohammed Ali took over the rule of Egypt.

D. From 1805 on, Alexandria began to regain what it had lost in importance and prosperity. The factors which enhanced the fast growth of the city during this period were as follows:

1. El Mahmoudia Canal was dug in 1820. This improvement increased the volume of agricultural output of countryside areas in close proximity to Alexandria, promoted commercial, and initiated migration toward Alexandria from outlying regions.

2. In 1854 a railway line between Alexandria and Cairo was constructed. New settlements immediately sprung up along this

route, causing expansion in three districts, the first was north of El Mahmoudia Canal; the second was south of the eastern harbour; and the third was around El Kabarie railway station.

3. The opening of the Suez Canal in 1869, far from detracting from the importance of Alexandria as a main port, further stimulated its development and attracted a longer foreign commodity engaged mainly in the export of Egyptian cotton in the growing transit trade between Europe and India.

4. In 1876 a new railway station for passengers was built south of the eastern harbour. The old station was served for freight traffic, and warehouses, factories, and timber yard grew up around it. A new image of the city began to take shape when high class families living in the centre moved eastward to El Ramley toward a better environment free from noise and congestion. The construction of new road network which linked the new district with Alexandria caused fast expansion of this prestige suburb.

5. Under the British mandate which began in 1882, Alexandria started another period of foreign domination. The British were interested in the development of the city. As such, they assisted the construction of docks, basins and embankments in and around the harbours. In 1934 they constructed also a 15 mile long promenade along the sea front which was originally known as "El Kornish". Residential buildings subsequently expanded along it, and some of Alexandria's best beaches were developed, thus tourism was fostered. It was only after the 1952 Revolution that the city witnessed the greatest revival in the long history of its port with the development of scores of new buildings and amenities - residential,

tourist, cultural, social, commercial and industrial (Claud, 1984, p. 7-9 and Alexandria Comprehensive Plan, 1984).

5.4 ALEXANDRIA WITHIN THE NATIONAL CONTEXT

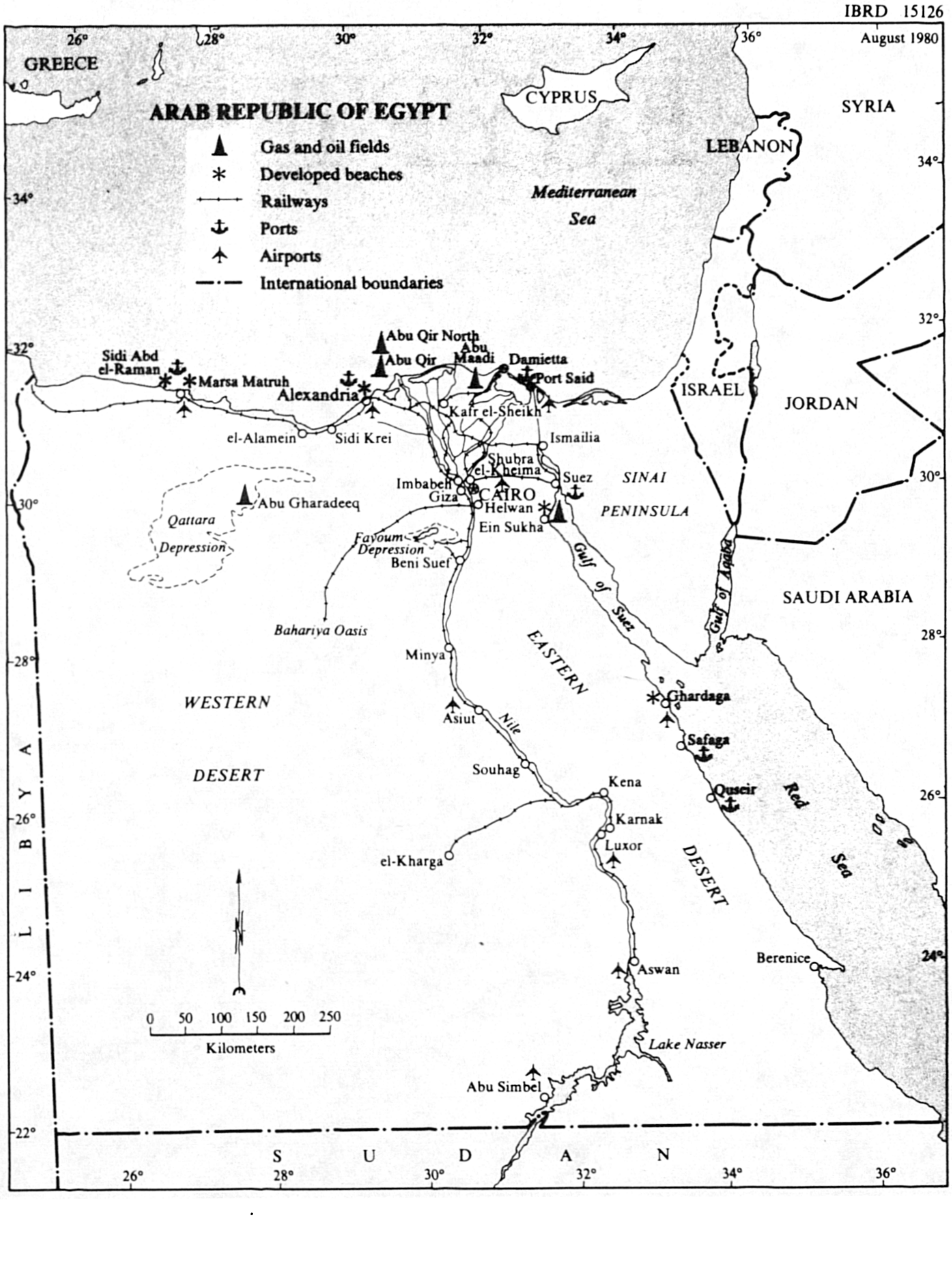
Alexandria city is considered to be the second urban centre after Cairo. It has over 6 percent of the total population of the country. It is also one of the four urban Governorates of Egypt, together with Cairo, Port Said and Suez (Figure 5.1).

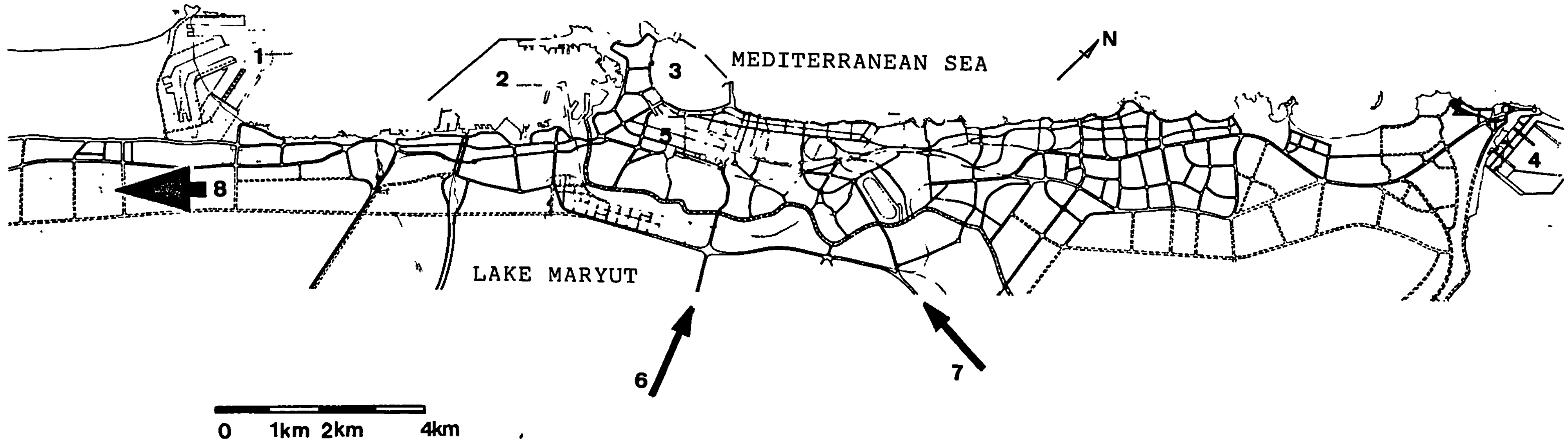
Beside its role as a focus for urban, industrial, and economic activities, Alexandria is the most important importing and exporting trading centre of the country. Its port handles almost 70 percent of the exports by sea (oil exports are excluded), and a little under 75 percent of the imports. As estimated in 1984, the total amount of traffic that passed through the port was 31.7 million tones, representing 68.3 percent of the national trade (Alexandria Port Authority, 1984).

In addition to the huge amount of raw materials, such as cement, flour, fertiliser, coal, and timber, handled by the port, also there are miscellaneous types of commodities such as machinery, equipment and investment goods which rank the port as a one of the busiest general cargo ports in the Middle East area. The study of the master plan (in 1984) revealed that 38 percent of Egypt's manufacturing industries are concentrated in Alexandria.

Alexandria's geographical location is along the coast of the Mediterranean Sea, where the current boundaries are Abu Kir Bay to the east, Matruh Governorate and the desert to the west, the sea to the north, and lake Maryut and agricultural land to the south as indicated in Figure 5.2.

Figure 5.1: Map of Egypt





1, EL DEKHEILA PORT PROJECT
2. WEST PORT
3. EAST PORT
4. ABU QUIER BAY
5. CITY CENTRE
6. DESERT ROAD
7. AGRICULTURE ROAD
8. FUTURE EXPANSION

Figure 5.2 The City of Alexandria

According to the 1976 Census, the population of Alexandria was approximately 2,319,000 of which 61 percent were living in urban areas. By 1980, it was estimated that this number had increased to 2,537,000 which represents an annual increase of 2.27 percent (CAPMAS and Comprehensive Plan 1984).

5.5 THE PHYSICAL FEATURES OF THE CITY

Alexandria may described as a linear city. Ten years ago, it was forming part of a regional context in which the salient characteristic of land use was the lack of urbanised hinterland. This was due to the fact that urban expansion has been limited. This has been mainly attributed to the presence of highly productive agricultural areas bordering on the city, and in addition, to the west there are desert zones with very little infrastructure. In 1976, it encompassed an area of approximately 2711 sq km of which 48 percent was desert, 28 percent arable land, 16 percent urban development and 10 percent water (Padco, Inc. 1981, p.57). However, over time these land use patterns have been the subject of radical changes. Prime agricultural lands are being increasingly urbanised, desert lands are being converted to agricultural uses, also inland water areas are being filled in for either urban or agricultural activities. In the same time the built up environment has seen rapid expansion. In general, the total built up area which forms the city now covers an area about 60 km long and between 2 and 5 km in width (Comprehensive Plan, 1984).

5.6 THE ENVIRONMENTAL CONTEXT

It would be unrealistic to assess any urban system without complete understanding of the dimensions which related to the environmental context of this system. Such dimensions could considerably influence the development of any cityport. In the case of Alexandria four main dimensions are selected in order to characterise the environmental context of the city. These are related to policy, socio-economic, land use and transport dimensions, each of which is now discussed in turn.

5.6.1 The Policy Dimension

As Alexandria is Egypt's main port, the central government has considered it as an effective instrument in the national economy. Therefore, special attention has been given to the development of the port through the Port Development Plan. The number of berths has been increased, a new container terminal has been constructed, and some complementary projects such as new warehouses have been built. On the other hand, a new port has been designed and is still under construction, in order to sustain the main port on one hand, and to serve the huge iron and steel complex at the western suburbs of El Dekheila on the other. A detailed description of the new port and its impact on the cityport of Alexandria will be discussed later in this chapter.

At the same time attention has also been given to the industrial activities located either in close proximity to the port, or far from it. Among these cases are the development of the petrochemical industry, as well as the establishment of the Free Zone at the west region of the city, and which is aimed at attracting foreign and joint venture industrial investment.

Local government has also participated in the decision making process by presenting in 1984 a comprehensive master plan for the city with the collaboration of both Alexandria and Liverpool Universities. The strategy of this project was to draw attention to seventeen major areas in which action and implementation will follow in due course. These include not only such obviously pressing matters as housing provisions and new communities, growing population, commercial and industrial activities, etc. but also attention is drawn to some urgently needed protective measures, raising important issues of priority which are particularly difficult to decide where resources are limited (Dix. 1984, p.120).

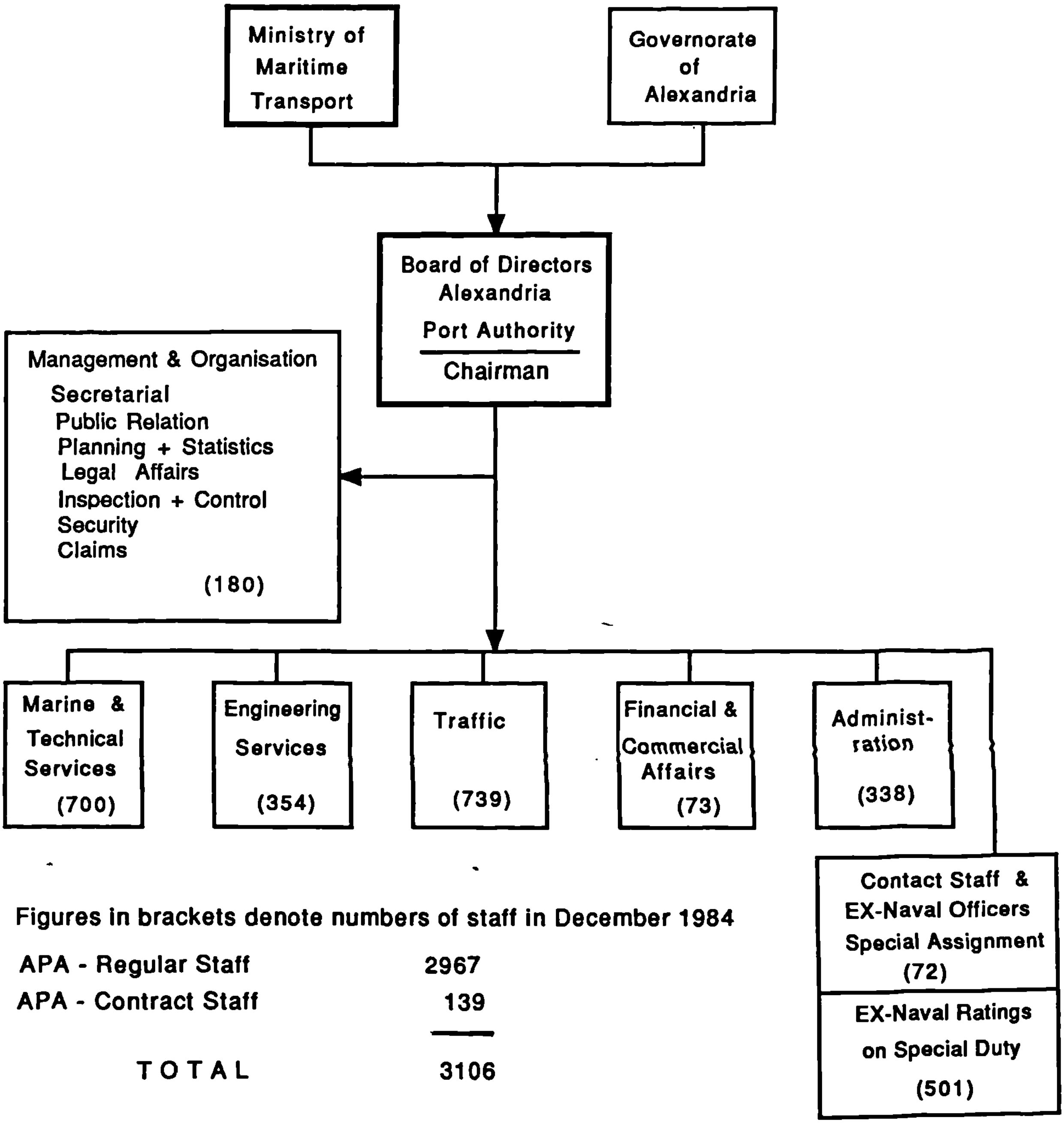
Regarding the port, the local government is participating theoretically rather than practically. Figure (5.3), indicates the organisation chart of the port. It can be recognised that the local government is acting at the same level as the central government. However, in practice the total and entire decisions related to the port are always taken by central officials.

5.6.2 Socio-Economic Dimension

Alexandria's economic base relies upon miscellaneous activities which contribute to absorbing 27 percent of the total employed population of the city (according to the 1976 Population Census). Among these activities is manufacturing industry which accounts for more than one-third of the national industrial stock (Padco, Inc. 1981).

A more accurate measure of the city's industrial employment is derived from the 1976 Population Census. The census reveals that 203,500 or 33 percent of Alexandria's total active population

Figure 5.3: Alexandria Port Authority (APA)
Organisation Chart



Figures in brackets denote numbers of staff in December 1984

APA - Regular Staff	2967
APA - Contract Staff	139
TOTAL	3106

Source: Alexandria Port Authority, 1984

(15 years or older) is engaged in manufacturing activities. Table 5.1 indicates the distribution of this active population by the economic sectors. The industrial employment is followed by services and trade, with shares of 25.7 percent and 14.2 percent respectively.

Table 5.1:
Distribution of Alexandria active population by economic sectors, 1976

Sectors		Active Population In (ooo)	%
Agriculture		30.6	4.9
Mining		2.6	0.4
Industry:		203.5	32.9
Textile	96.2		
Food Processing	25.5		
Engineering Machinery	24.3		
Chemicals & Petroleum	21.2		
Wood & Furniture	11.0		
Paper & Printing	10.3		
Basic Metals	8.8		
Non Metallics	5.2		
Other Industries	1.0		
Electricity & Water		8.0	1.3
Building & Construction		40.0	6.5
Trade		87.4	14.2
Finance		8.9	1.4
Transportation & Storage		59.5	9.6
Services		158.6	25.7
Not Stated		17.9	2.9
TOTAL		617.0	100.0

Source: Padco, Inc. 1981, p. 76

The public sector dominates industrial establishments employing 25 or more workers, and represents 53.2 percent of the employed population.

Employment in the private sector is mostly in small scale (less than 25 workers) and informal activities. According to the census the private sector represents 44 percent of Alexandria's total industrial employment.

The port has contributed significantly not only on the local level (through the related economic activities of Alexandria), but also on the national level. The considerable amount of trade handled in the port has placed it in the first rank among the other Egyptian ports (as will be discussed later). However, within the economic context of the city itself, the significance of the port and its associated industries are not sufficiently considered. This can be explained by the fact that Alexandria governorate has no part in the revenue achieved by the port, which is entirely directed to the central government.

5.6.3 The Land Use Dimensions

The land use dimension in Alexandria can be divided into two main contexts, the regional context and the urban context.

A. The Regional Context

As mentioned before, the land use of the Alexandria region has been exposed to significant changes in the last decade. According to the NUPS Landsat Data (Padco, Inc. 1981, p.57), the period 1972-1978 saw the urbanised area in the governorate increase by 30 percent through both desert and arable land. Agricultural land uses also increased by seven percent, despite urban encroachment, through efforts in land reclamation. Desert areas and the inland water basins (Lake Maryut), on the other hand, showed net losses in areas, as indicate in Table 5.2 below.

Table 5.2:
Alexandria Landsat Derived Land Use Statistics in Hectares*

Class	1972	1978	Change
Urban	6,375	8,273	+ 1,898
Water ***	21,186	18,954	- 2,232
Agriculture ****	13,043	14,083	+ 1,040
Bare	4,999	4,294	- 705
Total **	45,603	45,604	

* Data does not cover entire area within governorate.

** Total number of hectares will vary between 1972 and 1978 due to rounding of class statistics.

*** Water class contains part of adjacent sea as well as several inland water bodies which have altered in size during the six year period.

**** Agricultural class has grown in size at the expense of inland lakes and wetlands.

Source: Padco, Inc. 1981, p. 58

Other major losses of arable land have occurred along the Cairo/Alexandria agricultural road. Several warehouses and factories have been developed, and there have been signs of considerable industrial and urban polarisation in Kafr El Dawar (south east Alexandria), and Idku (eastward).

The main inland water basin, Lake Maryut, due to its proximity to the port and open areas to the west, is an attractive location for water linked industries both as a source of water and depository of waste.

Inland waterways in the Alexandria region have played an important role in the current patterns of land use. They provide the urbanised areas with a source of potable water, bulk water for industrial and agricultural purposes and as a means of transport.

B. The Urban Context

The Governorate of Alexandria is divided into five administrative districts, (El Montazah, Eastern, Central, Western, and Ameriyah) with a total area of around 314,360 sq km excluding Ameriyah district. The latter has an area of about 2,365 sq km, and most of the district is desert and uninhabited. The five districts are further sud-divided into subdistricts (or Kisms) as indicated in Figure 5.4. Four of these subdistricts (El Gomrok, El Manshia, El Laban, and Mina El Basal), are distinguished by certain natural boundaries within the port (El Mina) and are directly affected by port related activities.

Because Alexandria is a linear city, the main pattern of urban development has a decidedly linear orientation, running parallel to the coast for approximately 35 km, from Agamy in the west to Abu Kir in the east. Three main factors have contributed to this development model. These are:

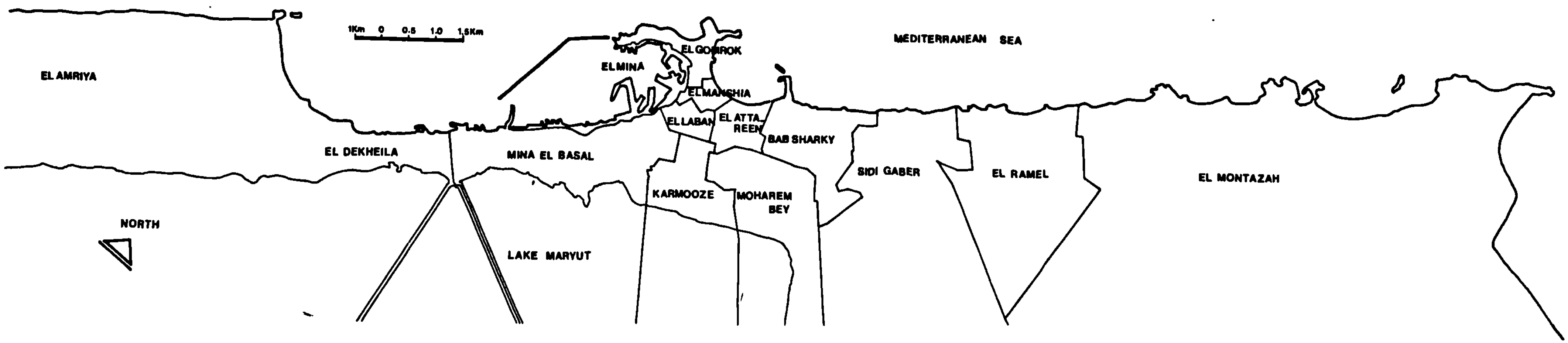


Figure 5.4 The Administrative Districts of Alexandria Governorate

- The protection of the eastern agricultural land;
- The major transportation corridors (roads and railways) run in an East-West direction;
- The presence of geographical obstacles running parallel to the coast (in particular, Lake Maryut).

The residential land use is the most dominant in Alexandria, especially in the older and central parts of the city, along transportation routes, and in the areas surrounding the port. Generally, it is difficult to segregate residential land uses from other functions. However, residential land uses are less mixed east of the city centre and south of the coastal district (excluding the principal transportation corridors).

Land uses associated with the industrial sector are mainly concentrated outside these residential areas, (south of the railway), along El Mahmoudia canal, and around the eastern part of the city which is adjacent to the port. However, small industrial sites are dispersed and are often found merged within the residential areas.

5.6.4 Transport Dimensions

The three main transportation modes which operate in Alexandria and its region, are roads, railways and waterways. The city is well connected with its neighbours and the hinterland beyond. The desert motorway connects Alexandria with Cairo, and has had a significant impact upon the development and urbanisation of Ameriyah district south west of Alexandria. The Cairo/Alexandria agricultural road links the city with the Delta region, and has had an enormous role in stimulating development between Alexandria and

Kafr El Dawar, the centre of large industrial textile factories. The Alexandria/Matruh road has permitted substantial development to the west, as well as the SOMID Petroleum Transfer Station located in the north west coast. The internal road networks, on the other hand, connects the port with these two main transport corridors but with the tremendous increases in traffic flows these local networks have became inadequate.

The railway network links Alexandria with the majority of the other Egyptian cities and in particular with the Delta region and Cairo. The local railway connects Abu Kir suburb with the city centre of Alexandria. Here it should be mentioned that this local line has already reached a high degree of saturation.

The waterways represented by El Mahmoudia Canal (which in little use today) and the new Canal (El Nubariya) recently constructed, connect Alexandria with the Nile. They play a significant role in transporting commodities from the port to its hinterland.

5.7 THE PORT STRUCTURE AND FACILITIES

The port is partly sheltered by an offshore reef running roughly parallel to the shoreline, and in the absence of any significant tide or littoral drift, generally the port is favourably situated for navigation. The port has an elliptical shape with a length of about 4.8 km and the greatest width of about 2 km. The shore area available to the port is, however, severely restricted by the encroaching city of Alexandria and Lake Maryut. This shore area accounts for 900,000 sqm, excluding the container terminal which is about 163,000 sqm. The water area is about 7.5 sq km. This represents a ratio between land and water of 1:8.

There is a custom wall surrounding the port with a length of approximately 9 km. The port also has 84 berths with a variety of depths and lengths. Some of them are used by the ship building yard, others are not suitable for use and need radical maintenance. The number in active use is about 50 deep water berths of up to 12 metres in depth with a total quay length of about 7000 metres. However, these statistics provide a misleading picture of port capacity when judged against the present day criteria of the appropriate berth length and depth for ocean going vessels. For general cargo traffic, for example, there are no more than the equivalent of about 22 berths suitable for present day vessel sizes. The storage sheds, on the other hand, account for an area about 140,000 sqm (excluding the open storage area).

Vessels enter the deep water of the port to reach the quays through one of two access channels dredged through the offshore reef. The main channel, known as the Great Pass, running roughly WNW provides a channel about 2 km in length and 183 metres wide with a dredged depth of 12 metres below sea level. The Boghaz Pass 1,600 metres in length and 100 metres wide lies NW of the port and is dredged to 8 metres, as indicated in Figure 5.5.

The commercial port has facilities for receiving ships from 10,000 tons up to 50,000 tons according to the type of ship and the kind of cargo carried on it. In addition to this facility, which is concerned with the commercial berths, the port accommodates a naval basin, a basin for petroleum traffic and other specialised facilities, such as three floating silos for cement with a capacity

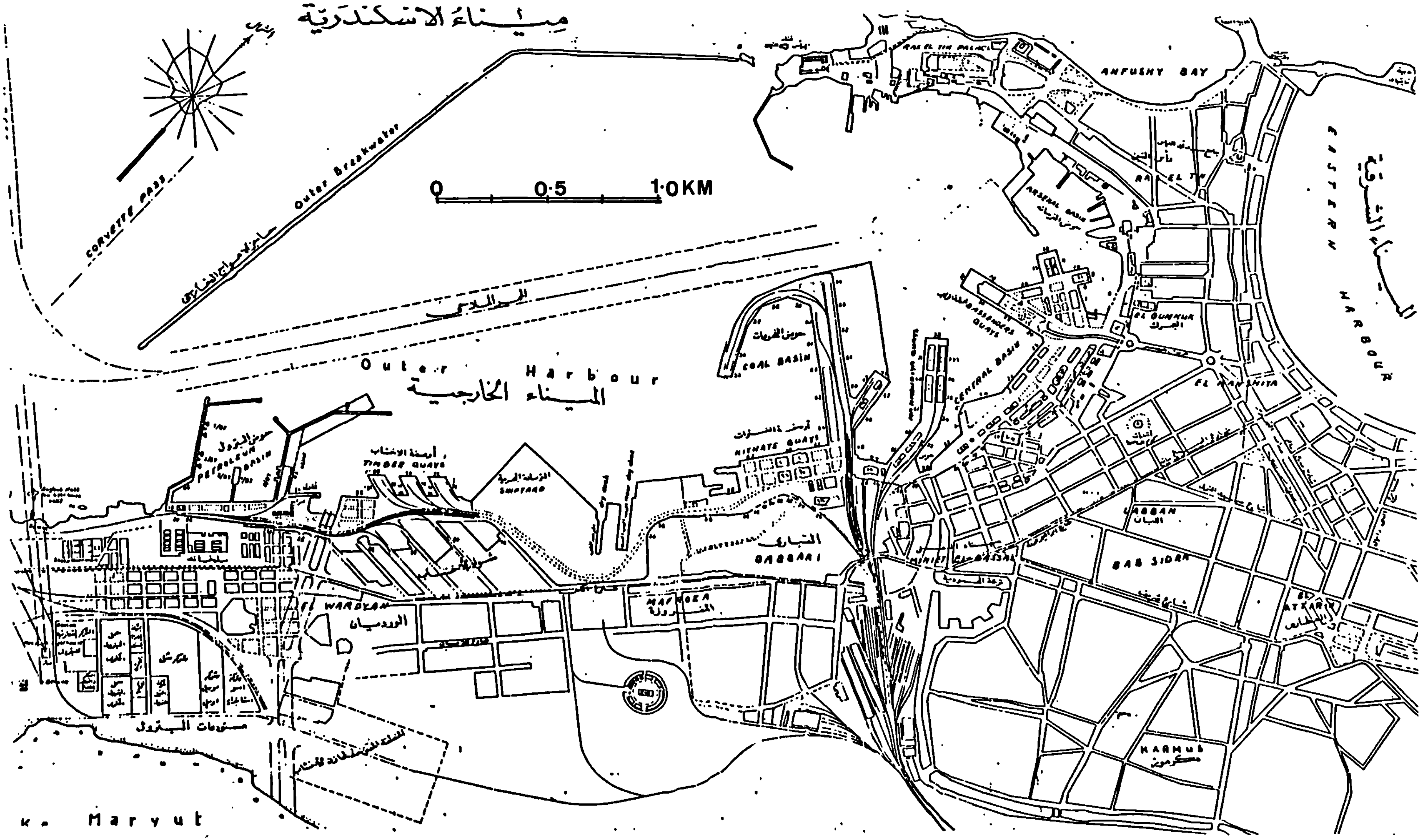


Figure 5.5: Alexandria Port Layout

of between 17,000 and 40,000 tons and productive capacity between 3-5 tons per day. There are also eight silos for grain and seed storage. In the centre of the port area there is a large naval dockyard which is a considerable obstruction to internal port traffic. This is attached to a dry dock for ship repairs (with the dimensions of 168 x 14 x 7 metres for length, width and depth, respectively).

It should be mentioned that the commercial port lies westward from the lighthouse promontory. To the eastward lies the smaller, shallower port with breakwater protection, used almost exclusively by fishing and pleasure boats.

5.8 THE EVOLUTION OF WATERFRONT LAND USE

According to the design of the analytical study mentioned earlier in this chapter, the waterfront of Alexandria port has been divided into eight sections, which are defined by the limits of active commercial port activities at the most recent of the study dates. These sections have various sizes based in part on land marks located at or near street intersections that did not change during the period of the study (Figure 5.6). "It is necessary to divide the waterfront into sections if the extent of the functional separation of port and urban areas were to determined"(McCalla, 1983, p.54).

In the waterfront study, the area located to the north of the east side should have been included. However, because this site is occupied by the Egyptian Navigation Force, it is a restricted military area for which too little accurate data and information concerning land use is available.

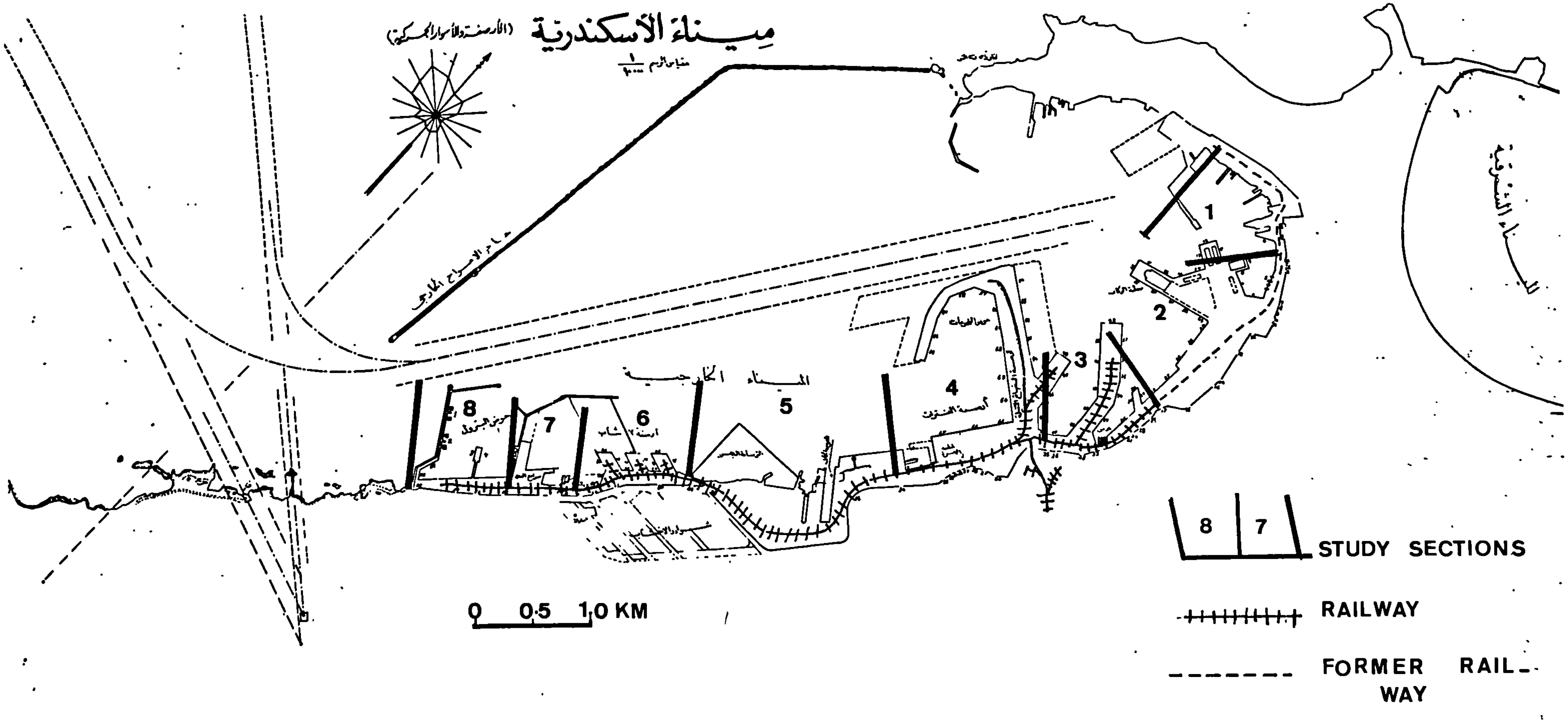


Figure 5.6: Study Sections in Alexandria Port

The twelve land use activities identified before have been examined and assessed in order to establish the extent of changes in functions in the waterfront. The base information upon which the analysis of changing waterfront functions was carried out included maps, documentary sources and photographs, together with detailed land use maps for the existing waterfront (see Appendix 3).

5.8.1 Analysis and Interpretation of Waterfront Functions

All the information about the changing functions of the waterfront of Alexandria port, as measured by the amount of land in various uses, is illustrated in Table 5.3. The evolution of the port land use as well as the similarities and differences between the different types of land use can be observed. The similarities take the following forms:

A. In the last twenty years the waterfront has grown substantially in area by a factor of 1,45 (from approximately 733,000 sqm in 1965 to 1,063,000 sqm in 1985). This growth can be seen to have taken place mainly because of the growth in demand for areas of land for the function of cargo-handling, such as, for example in the container terminal which is located between sections (3) and (4), as well as the fertiliser quay and the new dry dock located at section (4) and (5).

B. The docks and associated warehouses are the predominant land use in the waterfront area in the period from 1970 to 1985, which is consistent with the importance of Alexandria as the first and major seaport in Egypt. It should be noted that the amount of land related to the cargo handling function has grown by a factor of 2.4 (from 147,000 to 352,400 sqm) during the study period.

Table 5.3 :
WATERFRONT LAND USE (in thousand of square metres) OF ALEXANDRIA PORT

Land Use of Alexandria Port	1965		1970		1975		1980		1985	
	Area	%	Area	%	Area	%	Area	%	Area	%
Cargo-handling										
- Docks and associated warehouses	147.20	20.10	299.07	34.30	305.20	34.90	326.80	36.40	352.40	33.20
- storage open spaces	58.15	7.90	96.68	11.00	101.70	11.40	109.70	12.20	248.60	23.40
Total	205.35	28.00	395.75	45.30	406.90	46.30	436.50	48.60	601.00	56.60
Urban orientation										
- Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Offices and services	3.37	0.46	4.37	0.50	4.67	0.58	6.50	0.72	6.91	0.65
- Commercial (retailing)	1.00	0.13	1.20	0.13	2.30	0.29	2.95	0.32	3.65	0.34
- Warehousing (other than shipping)	1.47	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Developed open space	20.00	2.70	20.00	2.30	20.00	2.30	20.00	2.20	20.00	1.80
Total	25.84	3.49	25.57	2.93	26.97	3.17	29.45	3.24	30.56	2.79
Mixed orientation										
- Public admin & defence	4.77	0.65	8.07	0.92	8.57	0.97	9.93	1.10	12.67	1.19
- Transport (other than shipping)	272.53	37.18	163.01	18.71	157.13	17.87	141.82	15.78	254.37	23.96
- Manufacturing and utilities	33.00	4.50	126.40	14.50	130.40	14.80	141.90	15.70	159.90	15.00
Total	310.30	42.33	297.48	34.13	296.10	33.64	293.65	32.58	426.94	40.15
Vacant										
- Vacant and undeveloped land	191.90	26.18	153.40	17.64	148.40	16.39	140.40	15.58	4.50	0.46
- Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	733.39	100.00	872.20	100.00	878.37	100.00	900.00	100.00	106.30	100.00

C. There has been a considerable change in the amount of land dedicated to storage open space, as the proportion of this function has increased by a factor of 4.2 over the study period (from only 58,150 to almost 248,600 sqm). This can be explained by fact that there has been essential need for more storage space because of the dramatic increases in the traffic coming to the port over this period, as indicated in Figure 5.7

D. As expected, the amount of land devoted to urban activities has faced a very minor increase. This can be attributed to the absence of residential areas and warehousing (other than shipping). On the other hand, the slight increase has taken place because of the increased proportion of offices and services activities which have increased by a factor of 2.00 (from 3,370 to 6,910 sqm). In addition, commercial activities increased from 1,000 to 3,650 sqm, when the Port Authority established some small sheds and kiosks for selling antiques to the tourists (see Figure 5.8).

The differences in the land use functions of the waterfront are largely observed in the land uses of mixed orientation and in vacant land.

A. The mixed orientation:

The proportion of land devoted to this category has increased by a factor 1.3 over the study period (from 310,300 in 1965 to 426,940 sqm in 1985). The changes can be attributed to two categories of land use, public administration and defence which increased from 4,770 in 1965 to almost 12,670 sqm in 1985, and manufacturing and utilities which increased from only 3,300 in 1965 to 159,900 sqm in 1985. Meanwhile, the transport (other than shipping) area decreased over the study period due to the closure of

Figure 5.7: Part of the vacant lands which have been converted to storage open space. Here it can be noticed that these open storage spaces are not the subject of any planning regulation.

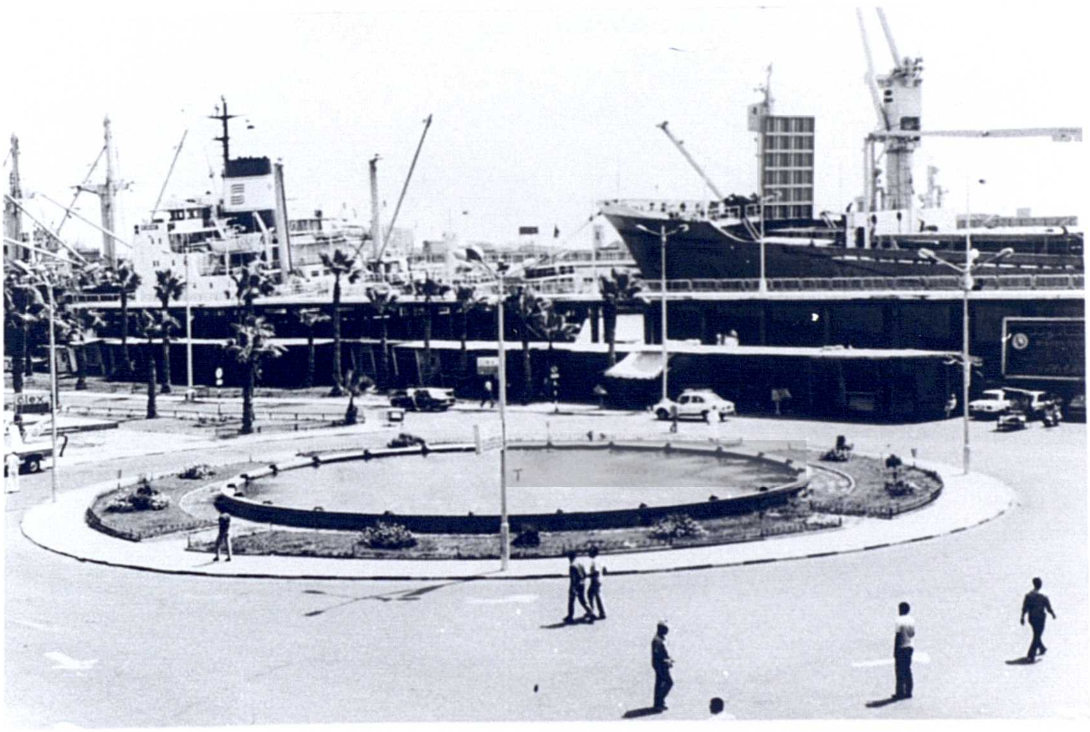


Figure 5.8: The new kiosks established by the port authority to serve tourists.

most of the railway lines serving the port area. The area accommodating manufacturing and utilities increased suddenly between 1965 and 1970 due to the establishment of a ship building yard (section 5) in 1965-1966 with an area of about 105,693 sqm.

B. The changes in the vacant and undeveloped land uses are accounted for by different factors. In 1965, vacant land made up the second most extensive land use, with 26.18 percent of the total land use compared with the much lower proportion of 0.46 percent in 1985. This dramatic change testifies to the success of the port authority's policy of encouraging the bringing of vacant land into active use as open storage areas. This policy is intended to be consistent with the Open Door Policy* which was established by the government after the 1973 war. On the other hand, it represents a contribution to attempts to solve the problems of accumulation and congestion of cargo in quayside areas.

C. The category of "others" did no appear at all significant in the study of waterfront land use in Alexandria. During the period of study, the types and patterns of land use did not contain any kind of activities, such as recreation areas or university projects, which can be covered by this category.

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* "In 1974, Egypt adopted a new strategy in the pursuit of its objectives to accelerate the pace of economic development. This strategy, as expressed in October Working Paper, has since become known as (the opening up) or the open door policy. Essentially, it connotes the movement towards a less regimented economy in which both the private sector and foreign investment are called upon to play a greater role along with the existing public sector in Egypt's economic development" (Driscoll et. al.,1978).

The similarities and differences in the waterfront functions in the last twenty years that emerge from this analysis are consistent with expectations. The port has expanded inside its boundaries, and the cargo handling land use has grown at the expense of other land uses, or through the creation of new land areas reclaimed from the sea to cope with the changing technology of shipping industry.

It is also to be expected that some other land uses would show different patterns of change not only because of technological changes that have taken place in both sea and land transport, but also because of various decisions which have been taken by the government to promote the economy of Alexandria on one hand and the economy of the entire country on the other.

5.8.2 Land Use Specialisation in the Waterfront

There has been no previous attempt to analyse systematically the land use of Alexandria port waterfront, in order to reveal changing patterns of specialisation with respect to different types of land use. The approach adopted in carrying out a study of these patterns was based on a method employed by McCalla (1983). "To show that specialisation of land use has existed in the waterfront sections, location quotients were calculated from the standard formula", which is of the following form:

$$qi = \frac{Si/S}{Wi/W}$$

where qi = location quotient for land use i

Si = area of land use i in a waterfront section

S = area of all land uses in the same waterfront section

Wi = area of land use i in the entire waterfront

W = area of all land uses in the entire waterfront

The usual practice when applying this method is to identify those areas (or, in this case, the waterfront sections) in which the location quotient is greater than 1.00. This indicates that in such areas the land use under consideration is more strongly represented and dominant than in all areas i.e. the proportion found in all area is greater than that found in all areas together - in this case, the entire waterfront.

Using the factor 1.00 as the critical value of the location quotient enables areas of specialisation to be identified. However, in some cases it may be found that the location quotient only exceeds the critical value by a very small amount, such as 0.02 or 2 percent which indicates only a very marginal degree of specialisation in comparison with the overall pattern of land use.

In order to identify the areas in which a more distinct pattern of specialisation is found, it is appropriate to adopt a more restrictive criterion. In this way those areas with only a marginal degree of specialisation are not given the same weight or not treated in the same way as those areas in which a much higher level of specialisation is recorded. For illustrative purposes a critical value of 1.10 has been adopted in the tables presented below. This enables the identification of those areas in which the proportion of a land found in a particular area exceeds the overall average share by 10 percent. This is considered to be a much more robust indicator of the degree of specialisation.

The patterns to emerge when these alternative critical values are adopted are presented below. This is intended to demonstrate the extent to which the impression conveyed by the use of the conventional critical value of 1.00 tends to cloud the pattern of specialisation due to the presence of many location quotient values only fractionally greater than 1.00.

In tables 5.4 and 5.5, the land use quotients greater than 1.00 and 1.10 are displayed by waterfront sections and the study years. The discrimination between the cargo handling activities and the urban activities is the main concern of this study of sectional specialisation. If a section has a location quotient greater than 1.00 in any of the urban activity land uses, it is said to be urban oriented. The cargo handling specialisation is shown by location quotients > 1.00 in docks and associated warehouses land use.

The urban oriented activities have been concentrated in the east as well as central portions of the waterfront, more specifically in section (2) over all the periods of study, and in section (3) only in the first five years.

This is explained by the fact that these areas of the waterfront are those nearest to the central business district of Alexandria. It is also to be considered that these areas contain the site of the original port which was established by the Alexander the Great in 332 BC. This means that the old port still exists in the same location, even if there has been a westward shift as the port has expanded, but not away from the city centre.

The legend of Figures : 5.4 and 5.5

- Docks and associated warehouses
- Storage open space
- Residential
- Offices and services
- Commercial (retailing)
- Warehousing (other than shipping)
- Development open space
- Public administration
- Transport (other than shipping)
- Manufacturing and utilities
- Vacant and undeveloped land
- Others

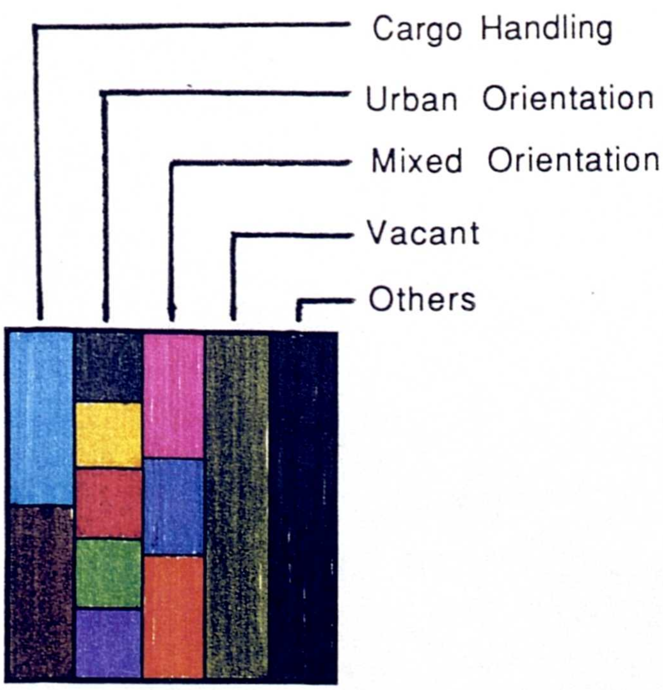


Table 5.4 :

Land use with location quotient > 1.0 for Alexandria Port

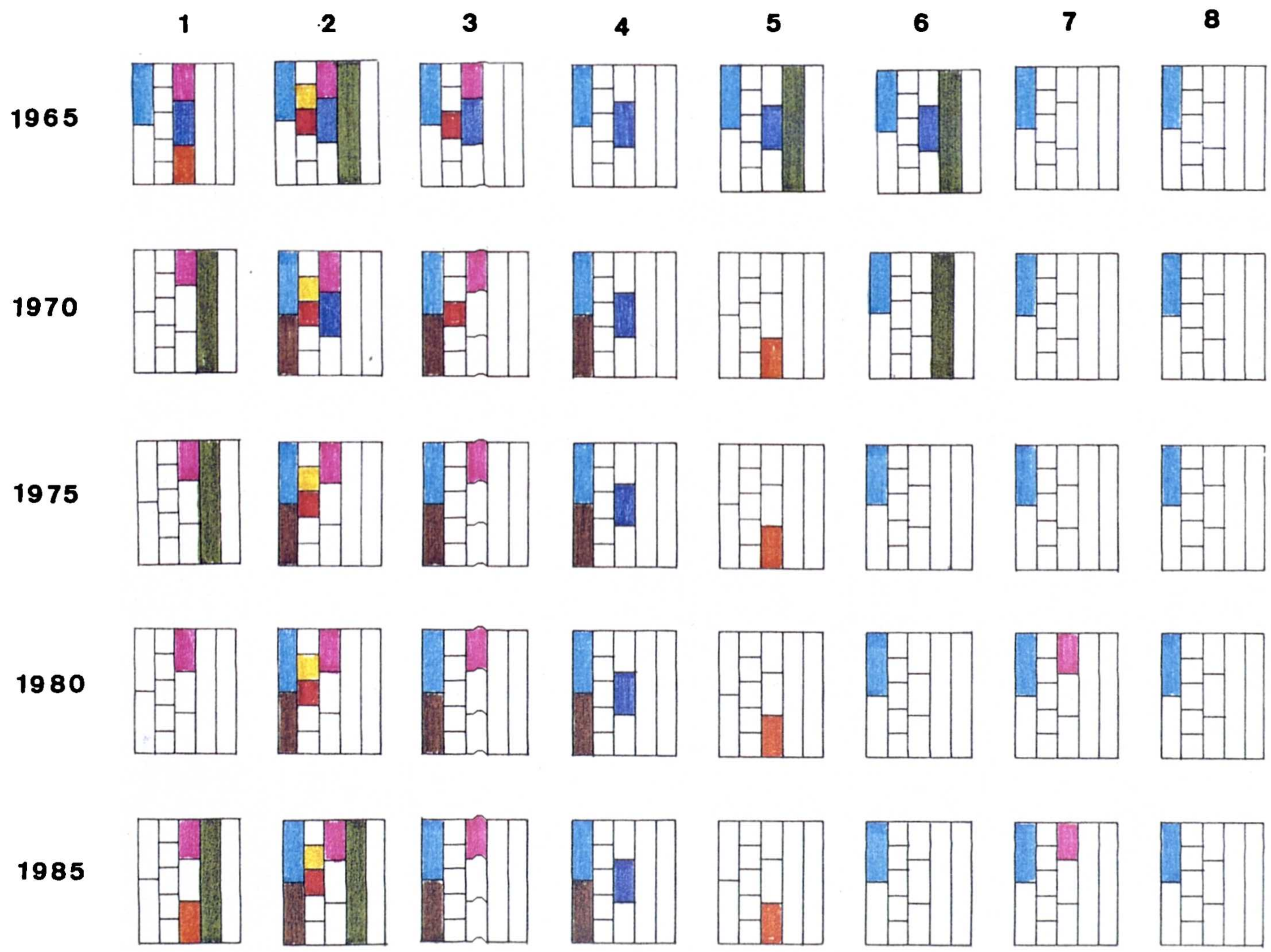
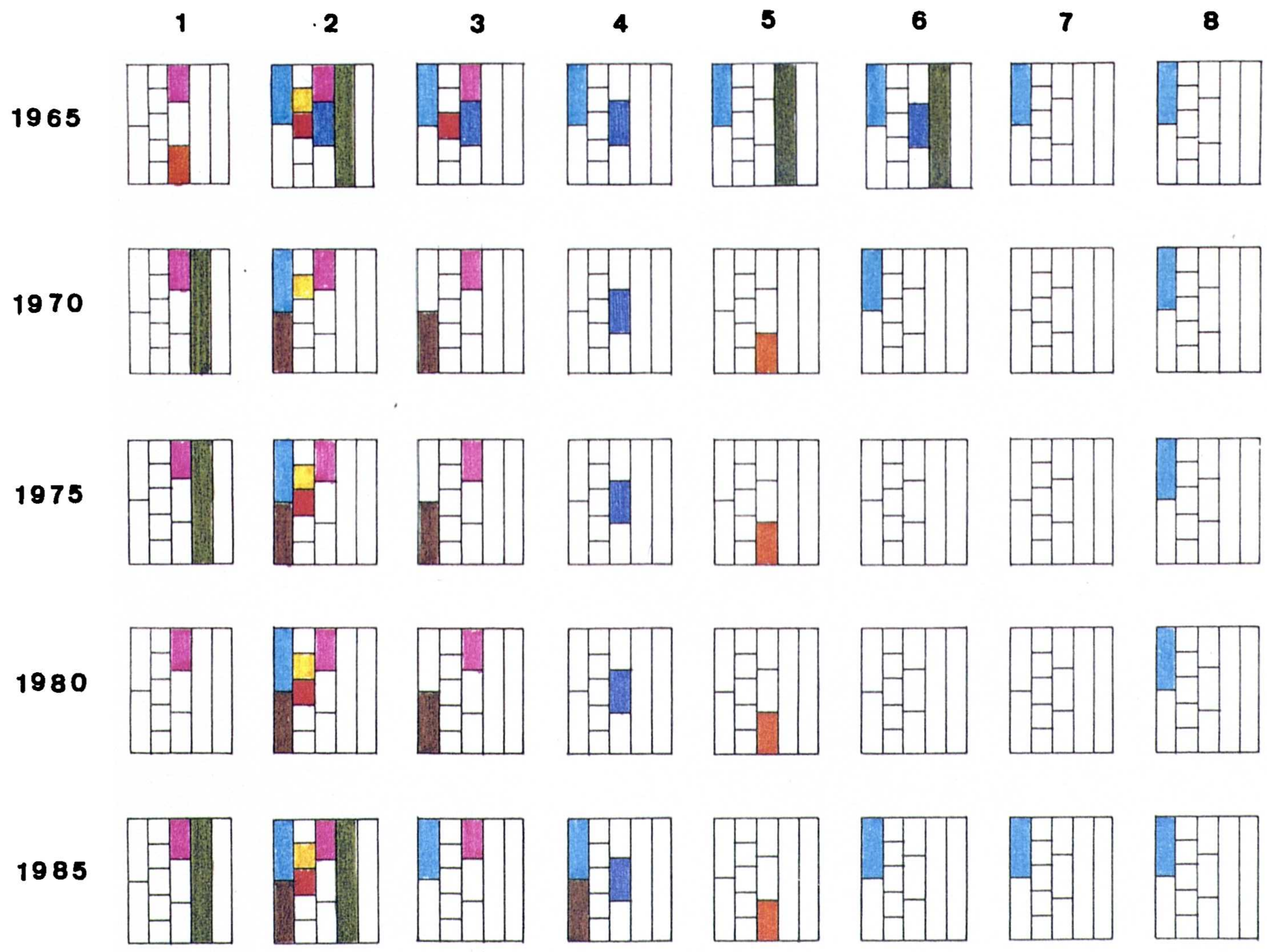


Table 5.5 :
Land use with location quotient > 1.10 for Alexandria Port



In the early stages of the study period the cargo handling activities, represented by docks and associated warehouses, were predominant in all sections, but in section (1) the location quotient only exceeds the critical value 1.00 by a very small percentage, only 1 percent. Then when the critical value 1.10 was applied the dominant activities in section (1) became the public administration and manufacturing, which are considered to be mixed orientation activities.

At the same time some urban activities, such as offices and services and commercial (retailing), were concentrated only in sections (2) and (3).

It should be mentioned that, in the last twenty years which are the total period of this study, the specialisation of the urban activities was represented and continued to be represented by only the offices and services, and commercial (retailing) activities. It is also to be noted that those two activities are concentrated only in section (2) from the beginning of the 1970s up to 1985. This can be attributed to two main reasons. Firstly, this section is considered to be one of the largest areas of the waterfront with an area of about 139,210 sqm. Secondly, it includes several types of urban activities because it is considered to be the section that is nearest to the main CBD of Alexandria. Figure 5.9 shows part of the urban and mixed activities existing in this section.

Other urban activities, such as residential, warehousing (other than shipping), and the developed open space, did not affect the land use patterns of the waterfront because of the small proportion which they represented of the total waterfront area.

Figure 5.9: The building of maritime passenger station. It is considered to be the main complex of offices and services activities which is urban activity, as well as some commercial activities (antiques shops). It has also some administrative offices for port management and shipping lines which are public administration.

Figure 5.10: The new container terminal opened in 1984 with high technology equipment.

It is also notable that some sections devoted to cargo handling activity, for example, sections (4), (6) and (7), did not change over the study period, but during the specific duration 1970-1980 the degree of specialisation in these sections was very small. This is demonstrated when the critical value 1.10 is applied to those sections and indicates no significant activities in these areas, as illustrated in table 5.5. These sections that display cargo handling specialisation were originally found in the central and western portions of the waterfront and later expanded on new land reclaimed from the sea, such as section 4, and the creation of the container terminal in 1984 (see Figure 5.10 above), and section 8 and the creation of new petrol berth No.86 in 1981.

It should also be mentioned that, although the docks and associated warehouse function was dominant in all sections in 1965, it began to contract in the beginning of 1967 from some sections and gave way to other activities, such as the development of manufacturing and utilities represented by the shipbuilding yard, in section 5. It is also notable that, although there is now one section with an urban orientation specialisation on the waterfront area, the amount of land devoted to this function has decreased by only about 0.7 percent during the study period.

One section only, (section 8), did not show any change over the period of study. This section is devoted to specific cargo handling function and continues to serve as a petrol and oil terminal.

The separation and specialisation of port functions from urban functions can be seen in Tables 5.4 and 5.5, but it is better illustrated in Tables 5.6 and 5.7, which reveal great overlaps in

Table 5.6:

Separation of the port function from other land uses as shown by number of times docks and associated warehouses and storage open space and other land uses have location quotient more than 1.00 in the same waterfront sections.

	R	O	C	W	DS	PA	T	M	V	H	Total
1965	0	1	2	0	0	3	6	1	3	0	16
1970	0	1	2	0	0	2	3	0	2	0	10
1975	0	1	1	0	0	2	1	0	0	0	5
1980	0	1	1	0	0	3	1	0	0	0	6
1985	0	1	1	0	0	3	1	0	1	0	7

Table 5.7:

Separation of the port function from other land uses as shown by the number of times docks and associated warehouses and storage open space and other land uses have location quotient more than 1.10 in the same waterfront sections.

	R	O	C	W	DS	PA	T	M	V	H	Total
1965	0	1	2	0	0	2	4	0	3	0	12
1970	0	1	0	0	0	1	0	0	0	0	2
1975	0	1	1	0	0	1	0	0	0	0	3
1980	0	1	1	0	0	1	0	0	0	0	3
1985	0	1	1	0	0	2	1	1	1	0	7

Abbreviations

R = Residential.
O = Offices and services.
C = Commercial.
W = Warehouses (other than shipping).
DS = Developed open space.
PA = Public administration.
T = Transport (other than shipping).
M = Manufacturing and utilities.
V = Vacant and undeveloped land.
H = Others.

land use specialisation between docks and associated warehouses and other land uses in the waterfront. In 1965 there were sixteen overlaps, three of them with urban oriented land uses, but when the critical value of 1.10 is applied the overlaps reduced to twelve and the proportion of the urban oriented uses remains the same.

In 1985 there were seven overlaps and the proportion of urban oriented land use overlapped with the cargo handling remained the same. This can be explained by the fact that the urban oriented activities were restricted to two sections only.

4.9 PORT THROUGHPUT

Egypt's seaborne trade has increased dramatically in the last ten years, as is evident from the statistical information of the APA (Alexandria Port Authority). According to these figures in 1977 the total seaborne trade was 22.93 million tons. This figure had drastically increased to 46.4 million tons by 1984. Alexandria's share has continued to be the greatest among the three main ports of Egypt, Port Said, Suez and Safaga. From Table 5.8, it has been estimated that Alexandria accounted for 60-70 percent of the total seaborne trade of Egypt during the 1980 to 1984 period.

However, according to the previous analysis of Alexandria port land use evolution, it has been found that the amount of land devoted to the cargo handling function was substantially increased, because of the increases in the port throughput. So, a brief consideration of port productivity will aid understanding and estimation of the actual needs of land, or at least will give a clearer picture of the future needs of land dedicated to such activity.

Table 5.8: Foreign Seaborne trade of Egypt from the period 1980 - 1984 in (000) Tons

Major Egyptian Ports	1980	1981	1982	1983	1984
Safaga	1746.10	1623.00	1668.00	1689.00	1999.00
Port Said	3765.00	4682.00	5562.00	6050.00	6314.00
Suez	4640.00	6688.00	7858.00	5238.00	6344.00
Alexandria	23210.80	27639.70	27268.50	30759.70	31720.40
Total	33361.90	40632.70	42355.70	43736.70	46377.40
Alexandria as a % of Egypt	69.6	68.00	64.4	70.3	68.3

Source: Alexandria Port Authority, 1984 p.10

The volume of the Egyptian foreign trade has increased by 39% in 1984, relative to the base year 1980. The proportions of annual totals attributable to Alexandria are indicated above.

It was possible to obtain information about Egypt's seaborne trade in terms of exports/imports for the two years 1975 and 1983. These data were gathered by the United Nations and the Norwegian School of Economics. The original form of the data was one hundred and twenty eight types of commodities. However, with the great assistance provided by Dr Sidney Gilman, it was possible to aggregate and classify these data into groups of commodities. With the aid of a micro computer, and specially the the Symphony programme, it was possible to manipulate and present the data under eight main headings covering all the main characteristics of seaborne trade. Also, the percentage share of Alexandria was specified according to the information of the APA. The manipulation of the data made it possible to estimate the changes in Alexandria port throughput per year, in addition to a projection of growth over a five year period, as illustrated in Table 5.9. The projection is based on a crude extrapolation of the 1975-1983 rates of change.

It should be mentioned that, in order to obtain reasonable results from this data, crude oil has been excluded from the calculations, for two principal reasons. First, the figures of crude oil account for the greatest proportions in exports and imports of Egypt. These proportions always give a misleading impression about the volume of traffic. Second, Alexandria is not the first or main port for exporting or importing oil, thus it is better to evaluate the port's productivity without considering this type of traffic.

The analysis reveals that, in 1975, Alexandria's share accounted for 74 percent of the total seaborne trade of Egypt. This enormous percentage was due to the increases of three groups of commodities, the semi-bulk, cars and trucks, and general cargo. The reason for such increases is likely to be that, at that time the two ports Port Said and Suez, at the northern and southern ends of the Suez Canal, were not completely recovered from the consequences of 1973 Egyptian-Israeli War. Thus, Alexandria had to deal with most of the seaborne traffic. On the other hand, the third port of "Safaga" located on the Red Sea was and still continues to serve mainly as a major and minor bulk port with little general cargo.

Table 5.9 : Alexandria Maritime Trade 1975, 1983 (000) Metric Tons (Excluding crude Oil)

	Alexandria % Share75	Total Egypt75	Total Alex.75	Alexandria % Share83	Total Egypt83	Total Alex.83	Average % Change P/Y	Estimated Change P/Y	Estimated Growth 5 years
Major Bulk	68.2	5253.94	3583.2	74	7067.78	5230.2	4.8	253.2	1265.9
Minor Bulk	66.3	1417.97	940.1	67	8530.53	5715.5	25.3	1446.6	7232.8
Semi Bulk	84.5	2297.24	1941.2	60.3	4589.44	2762.0	4.5	124.5	622.4
Liquid Bulk	72.3	589.22	426.0	78.6	1923.81	1512.1	17.2	259.4	1297.2
Oil & Fats	78.9	359.23	276.3	75	536.98	402.7	4.8	19.4	97.1
Refrigerates	68.4	444.58	304.1	78.7	834.85	657.0	10.1	66.4	332.1
Cars & Trucks	82	113	92.7	79.4	188.98	150.1	6.2	9.3	46.6
General Cargo	81	2657.74	2152.8	74.1	3422.43	2536.0	2.1	52.3	262.4
Total	74.0	13123.92	9716.3	70.0	27085.82	18965.6	8.7	1653.7	8268.6

Source : Based on analysis of data from the United Nations/Norwegian School of Economics

In 1983, Alexandria accounted for 70 percent of the country's total seaborne trade. The highest percentage related to the groups of commodities represented by refrigerates, cars and trucks, liquid bulk (excluding oil), and general cargo respectively. It is worth mentioning that the increases in the percentage of refrigerated commodities is attributable to the great demand for importing meat, fish, and poultry. The decreases in the percentages of cars and trucks, and general cargo is probably due to the improvement of port activities in the other Egyptian ports.

Furthermore, the minor bulk commodities accounted for the highest percentage of change per year which is 25.3 percent. This can be explained by the fact that, during the period from 1975-83, there was a great demand for cement for construction purposes. Therefore, huge amounts of this commodity had arrived from Europe and especially Romania, to be handled in Alexandria.

In terms of general cargo, it was surprising to find that, although Alexandria is considered to be a general cargo port, the average change per annum of this specific type was just 2.1 percent.

The discrepancy between the totals of 1983 in the previous two Tables 5.8 and 5.9 presented above is normal and is due to the fact that, in the first table the total of Egypt generally and Alexandria specifically included crude oil traffic. On the other hand the differences between the figures obtained from the United Nations statistics and the figures provided by the APA are mainly due to the adoption of different classifications of cargo in the two sources of information.

It is possible to combine the data obtained from the preceding Table 5.9, (concerned with the throughput of Alexandria in 1975 and

1983) with the data obtained from the former Table 5.3, (related to the evolution of waterfront land use) to produce an estimate of port throughput in relation to the area of the port, as presented in Table 5.10.

Table 5.10 illustrates the relationship between net area and annual trade, based on 1975 and 1983 figures. The Table reveals a broad discrepancy between the percentage change in land area compared with the percentage change of throughput. In 1975, the total area of Alexandria port was 219.5 acre (approximately 878,000 sqm). In 1983, the area had increased to about 225 acre (900,000 sqm approximately). The annual percentage increase in area was only 0.3 percent which contrasts with the enormous increase in annual cargo throughput. These figures can be used to demonstrate the huge increase in efficiency with which the land was used - rising from 44,265.6 tone per acre in 1975 to a figure of 84,291.6 tone per acre in 1983 - almost doubling, reflecting an annual percentage increase of 8.4 percent.

Table 5.10: Volume of trade and area/tonnage analysis 1975-1983 for Alexandria port

Area in Acres		Average % Change Land P/Y	Estimated Change P/Y Acre	Volume of trade (000) Tons		Throughout Tons/Acre		Average % Change P/Y	Estimated Change P/Y Tons/Acre	Estimated Growth 5 years Tons/Acre
1975	1983			1975	1983	1975	1983			
219.5	225	0.3	0.7	9716.3	18965.6	44265.6	84291.6	8.4	7066.9	35331.5

The value of figures of land and trade shows that, the estimated rate of increase for land was 0.7 acre per annum. In contrast, the estimated rate of increase for trade was 7,066.9 tons per acre per annum. This contrast in rates of increase between the land and trade can be attributed to the following reasons:

A. The area of Alexandria port is very restricted in terms of expansion. As mentioned earlier in this chapter, the port is surrounded from the east as well as the south by residential areas. Westward there is very shallow water which is not suitable for navigation. Hence the only way for expansion is to in fill the water to create new land. Bearing in mind the cost of berth construction, which is very expensive, it is a difficult task to rely upon construction of new berths to cope with the increases in trade rates.

B. Again as indicated before, the port has 84 berths, some of which are used as shipbuilding yards, and only 50 berths are in a good condition and have sufficient equipment for cargo handling purposes. This means that the port is operating with just 65-70 percent of its potential efficiency. In the absence of good management, the expectation is for delays, congestion and accumulation are this effects the process of development.

C. The dramatic increase in the rates of imports has imposed further reliance on the port to deal with such an increase. According to an APA statement, the port has had to deal with approximately 25-40 percent more handlings of cargo than the actual capacity in the last five years (1980-1984), which is reflected in the extent to which the increase in port throughput has not matched the rate of growth in the availability of land.

5.10 SUMMARY OF FINDINGS

The analyses of both the evolution of Alexandria port waterfront land use, as well as the port throughput have revealed some significant findings which are likely to affect the future of port development on the one hand, and the land use policies of the cityport of Alexandria on the other. These findings can be summarised as follows:

1. In the last twenty years the port of Alexandria has had to evolve to cope with up to date technology in performing its port functions, but the expansion accompanying this evolution did not affect the location of the port itself. This means that the port function did not move away from the original site which is very close to the city centre.

2. Although the land use devoted to the cargo handling function has increased and expanded, it has not done so into peripheral areas. This pattern can be seen in all of the study sections which include cargo handling activities as well as urban activities. This position is probably best explained as locational inertia, since the land was owned by APA from 1967 and so is not subject to the forces of land use competition.

3. In spite of the short duration of the study of waterfront land use, the analysis presented point to a great contrast between what happened on the evolution of Alexandria port waterfront land use, and what has been postulated by James Bird in his two books in 1963 and 1971, and Robert McCalla in his paper in 1983 about the movement of port function away from the city centre.

4. There has been separation of the cargo handling function from other waterfront activities in Alexandria, as well as the speciali-

sation of land use activities. Certainly, there are areas of urban orientation now existing in the waterfront, but there is not any significant movement of cargo handling function from its original location. This means that it is unnecessary for the port function to take up new locations within the traditional port area to cope with the changing technology in transport as well as the changing dependency between port and city.

5. In the last ten years the port has had to meet substantial growth in the volume of trade passing through it. This growth is contrasted with a very slight and marginal increase in the area of land. This imbalance between land and trade has resulted in chronic problems which have affected the port's efficiency, and continues to affect the role played by Alexandria port as the first and major port in Egypt.

From the above findings it seems that the creation of the new port of El Dekheila, to the west of Alexandria city, is the ideal solution for all the problems that have befallen the old port. This new port can be considered to be an example of a type of locational shift in response to changing technology, but one that is occurring because the old port has reached the limit of its capacity to achieve marginal adjustments or changes in adapting to meet the needs of shipping companies.

It would appear that a critical point has been reached in the history of the development of Alexandria port. A threshold has been passed which has resulted in the necessity to develop an entirely new type and scale of port facility in order to meet these future needs. Nevertheless, it can be expected that the old port, the subject of this study, will continue to play a vital role complementary to that of the new port long into the future.

5.11 THE NEW PORT EL DEKHEILA

Within the context of the development of Alexandria port, the Egyptian Government instructed IMC (Industrial and Mining Complexes), an agency of the Ministry of Industry, to arrange for the development of port facilities at the suburb of El Dekheila to accommodate forecast levels of commercial and industrial traffic. The port will in particular provide facilities for the importation of iron ore and pellets to be used in the Dekheila integrated steel mill project. In addition to these industrial facilities, other commercial facilities will be provided, which will include provision for containers, general cargo and timber traffic. The APA has considered the new port as the natural extension of Alexandria port. So the APA's own modernisation and development plans have been updated in the light of the combined facilities at Alexandria and Dekheila. The objectives of this redevelopment plan include:

1. The improvement of main transport arteries to the port of Alexandria/Dekheila.

2. The integration of port services offered by Alexandria and Dekheila and cargo allocations within both ports of the enlarged port.

3. The future development of both ports to 1990, with particular reference to the designation of land for port related use.

4. Recommendations for the entrance channel to Alexandria, in the light of the new channel being dredged for Dekheila (details of these objectives are provided in appendix 3).

After the completion of construction, the port facilities at Dekheila will be handed over to APA and became an integral part of an enlarged Alexandria Port under APA ownership and under APA control.

5.11.1 Location Aspects

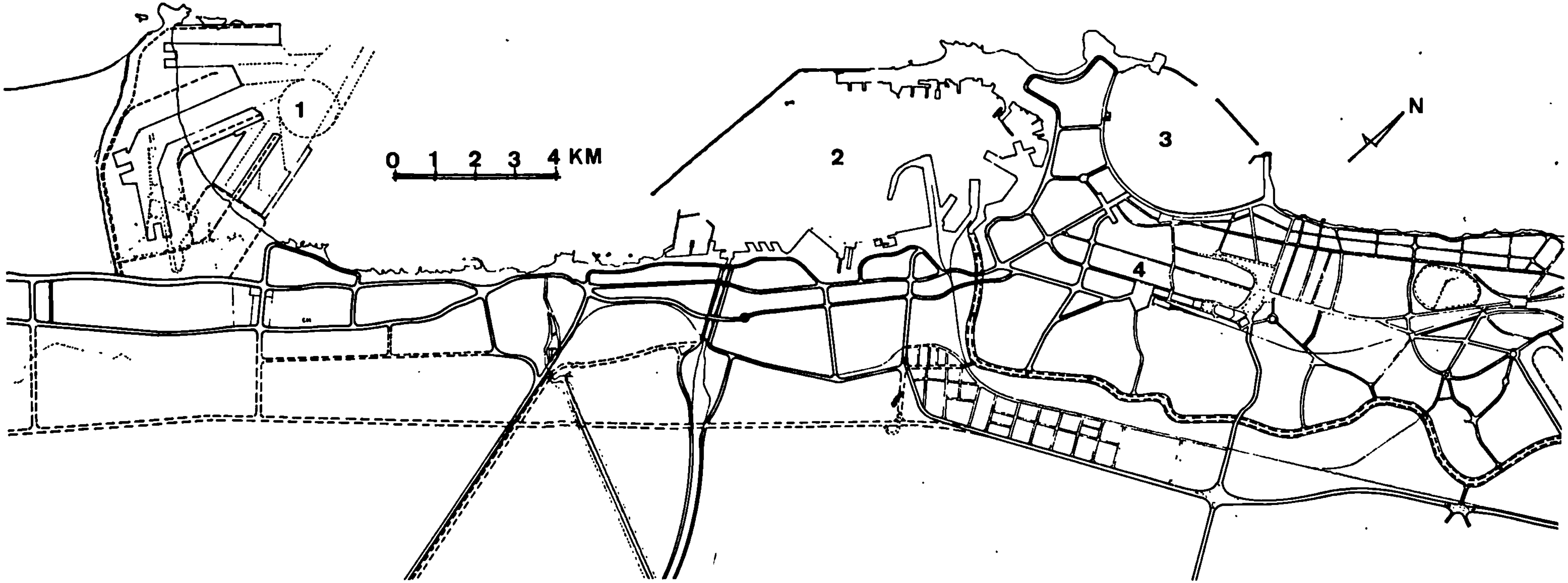
The waterfront of El Dekheila possesses some natural advantages as a port site from the navigational viewpoint. It lies about 10 km west of the port Alexandria and is partly protected by a reef of rock outcrops which form the core of a main breakwater affording shelter from the predominant westerly and north westerly prevailing wind. There is also a natural bar lying offshore running parallel to the coast and existing port of Alexandria lies within this reef (see Figure 5.11).

It should be mentioned that, the shore area of the new port is very narrow, and is limited by the steel mill complex. The commercial berths have been located in such a way as to minimise the excavation of hard material. The entrance channel has been dictated to afford easy access by large ore carriers to the mineral berth.

5.11.2 Stages of Execution

Project execution commenced in November 1980, with the construction of the main breakwater which is 2.25 km in length and 10 metres deep. The second stage of execution began in 1982 with the main target to fulfils the following:

- The construction of the mineral jetty which is 660 metres in length and of a depth of between 14 and 20 metres, to accommodate carriers up to 160,000 dwt.
- The dredging of the access channel and manoeuvring area. The channel's width is 250 metres, with a depth of about 20 metres.



1. The New Port El Dekheila
2. Alexandria Port (the Western Port)
3. Eastern Port
4. City Centre

Figure 5.11 The location of El Dekheila Port Project

It should be mentioned that the implementation of this stage is linked with the scheduled timetable for the execution of Dekheila steel project and which was supposed to be completed by the target year 1986.

The third stage deals with the construction of container, general cargo and timber berths with a total length of 1550 metres and depth of 12 metres. It has been planned that this stage will be completed by 1987-1988, as well as the rest of technical work.

5.11.3 Operational Targets

Targets for productivity in port operations at the new port have been arranged according to APA's main modernisation plan, so that after a reasonable period of time the new facilities will function satisfactorily. These targets, based on those achieved at Alexandria and assuming full port completion in 1987-1988, are as follows:

		1987	1988	1989
(a)	Availability of container quay cranes, are unloader & rail-mounted quay cranes.	85%	90%	95%
(b)	Availability of mobile cargo-handling equipment (excluding staddle carriers, side loaders).	75%	80%	95%
(c)	Availability of straddle carriers, side loaders.	65%	70%	75%
(d)	Gang shift productivity in tons per gang hour for general cargo (average of imports and exports).	10	12	12

Source: The Comprehensive Plan, 1984

5.11.4 Environmental Aspects

The impact of the new port on the environment many be considered from two viewpoints: (a) the effect of marine works on the present coastal region and, (b) the effect of development of shore works on the adjoining resort town El Agami.

It has been proposed that, any pollution which might occur from vessels using the new port will be effectively controlled by APA, under regulations for imposing penalties on offending vessels. On the other hand, a shelter of trees will screen the port area from the town of Agami. Road traffic from the port destined for Cairo will be able to reach the desert road by a proposed new road link without any effects for either Alexandria city or El Agami town. However, because of the traffic handled at the mineral jetty, which will include iron ore, pellets, scrap steel and possibly small volumes of minerals such as fluorspar, there will be a minor effect on air quality.

5.11.5 Employment Impact

The new port will create local employment opportunities during the construction stages which presumably will extend to 6 years. On completion of the project a wide range of jobs will be created totalling about 1000 workers (Comprehensive Plan, 1984). This number will range from port dockers to skilled and semiskilled workers in the operation and maintenance of equipment, to the management of port facilities. All of these jobs will be filled by staff already within APA and its agencies and by local recruitment.

5.11.6 Traffic Projection

The rapid growth in the economy and the resulting quantum increase in Egypt's seaborne trade which has taken place during the the recent years are expected to continue in the future. Imports will account for about 75 percent of the projected port traffic. Traditional exports will remain relatively stable because of the increasing domestic demand pressures resulting from growths in population and increase in per capita income (Ikram, 1980). According to the statements of APA as well as the report of the Comprehensive Master Plan, it is expected that the rate of general cargo traffic will grow by about 5.5 percent by 1995. Growth in grain imports will continue, and should reach about 95 million tons by 1995. For cement, it is estimated that the demand for imports will decline and the economy will become self-sufficient in this type of trade by 1992, because of ongoing and planned investment. Adequate supplies of fertiliser should be similarly be available from domestic sources by about 1987. The Dekheila Steel Complex, on the other hand, will generate demand for imports of iron ore and pellets of about 1.3 million ton initially, increasing to 3 million ton after 1990 and for scrap steel, 200,000 tons until 1991. Traffic projections for all ports of Egypt by major commodity and commodity groups are summarised in Table 5.11 below.

The Alexandria/Dekheila Port Complex will continue to handle a substantial portion of the total seaborne trade of Egypt. However, it is expected that its share will decrease because of availability of additional new port facilities. The share of the national total will be about 65 percent in 1987 and 60 percent in 1995 compared to 70 percent in 1983-1984. Table 5.12 summarises traffic projections

Table 5.11: Traffic Projection for Selected Years /1
in (000) tons

	1982 /2	1986	1995
General Cargo	8,100	10,800	17,700
Cement	5,200	3,000	1,000
Grains	6,300	7,300	9,600
Timber	1,100	1,600	2,500
Coal	2,600	2,900	3,500
Pellets	---	1,300	3,000
Phosphate	130	340	300
Salt	50	160	160
Fertiliser	900	500	100
Scrap	---	200	---
Other	400	900	1,350
T O T A L	25,030	29,300	39,610

/1 Excludes petroleum products.
/2 Estimates based on actual figures for first 9 months of 1981.

Table 5.12: Allocation of Forecast Traffic between
Alexandria and Dehkeila in million tons

	1986			1995		
	Alex.	Dekh.	Total	Alex.	Dekh.	Total
General Cargo	5.0	1.7	6.7	6.5	2.7	9.2
Cement	2.0	0.0	2.0	0.5	0.0	0.5
Grain	3.0	0.0	3.0	3.8	0.0	3.8
Timber	0.9	0.4	1.3	1.2	0.8	2.0
Coal	2.9	0.0	2.9	3.5	0.0	3.5
Pellets	0.0	1.3	1.3	0.0	3.0	3.0
Other	0.8	0.2	1.0	0.8	0.3	1.1
T O T A L	14.6	3.0	18.2	16.3	6.8	23.1

Source: Comprehensive Plan, 1984

for Alexandria/Dekheila port for selected years and major commodities.

Finally, it has to be mentioned that container movements have increased rapidly in the last eight years. The number of container carriers has increased from 176 in 1978 to 670 (including both ro/ro and lo/lo) in 1980. During the first nine months of 1981, the number of containers handled reached about 50,000; 39,000 for imports and 11,000 for exports. In 1984, this number had increased substantially to reach 139,747; 73,676 for imports and 66,071 for exports. According to the provision of suitable terminal facilities at Alexandria/Dekheila Port Complex, the containerised traffic will be increased to a level currently observed in other ports in the region with container facilities.

In the pervious sections an attempt has been made to overview the case study of Alexandria port in terms of land use evolution and evaluation of port throughput This is followed by a brief description of the new port El Dekheila. In the next section another attempt will be made to examine the impact of these two ports on the land use patterns of Alexandria city.

5.12 THE CITY LAND USE AND THE TWO PORTS

In the previous chapter Four, the direct and indirect impact of the port as a function and its related activities on city land uses was identified through five main port related activities. These activities included, port related employment, transportation and its associated activities, commerce, services, and manufacturing industry. In this section an overview of these five activities will be examined in order to identify the impact of Alexandria port as well as the new port El Dekheila on the land use patterns of Alexandria city. The impact of the ports on the city's urban environment will also be considered.

5.12.1 Port Related Employment

Alexandria Port Authority has the main responsibility for management, control, expansion, and modernisation of the port. Operational responsibility for various activities, however, is shared by APA and eight other companies assembled together under the name of PSOMT "The Public Sector Organisation for Maritime Transport". This agency was established in 1983 and is directly related to the Ministry of Maritime Transport. The activities of these eight companies are mostly considered to be operational work (shipping agencies, loading/unloading, storage warehousing, etc.). This distribution of authority has made port employment more fragmentary. Table 5.13 indicates the total registered workers of Alexandria port. However, it should be mentioned that the figures representing the numbers of casual workers are not 100 percent reliable because of variation in sources and the lack of accurate data.

The impact of the port related employment on the land use of Alexandria city can best be perceived through the housing demands placed by those who are working in the port or who have a relationship with any port activity. It is difficult to find any study or official document dealing with such a point. However, according to the observation survey and with some help from the master plan report, one can estimate that more than 65 percent of the blue collar workers of the port live in the residential areas adjacent to the port. These areas correspond to the four districts El Gomrok, El Manshia, El laban, and Mina El Basal. It is worth mentioning that these four districts are considered to be among the highest density districts in Alexandria, with medium and low standard of living (Comprehensive Plan, 1984). Meanwhile it is not possible to identify the places where the white collar workers are living, because of the variation in the standard of living.

Table 5.13: The employment of Alexandria Port in the last ten years 1974 - 1984

Year	Registered	Others*	Total
1974	10,100	1,200	11,300
1975	12,400	2,500	14,900
1978	12,200	3,000	15,200
1980	13,100	2,900	16,000
1981	12,900	2,600	15,500
1982	13,550	2,350	15,900
1983	13,200	3,000	16,200
1984	13,000	2,700	15,700

* Estimated Figures, rely upon "gates" calculations and numbers of permissions given to those workers.

Source: Department of Workers Affairs of each individual company and authority operate inside the port.

It has been mentioned earlier that the new port will create two types of employment opportunities. The local employment for construction purpose will be supplied from El Dekheila district which is the highest in density (158,000 person/sq km). The operational employment will be supplied by the APA. This includes those who have been working in Alexandria port and have enough skills to deal with the new and up to date technology.

It seems from the analysis that the interdependence relationship between the port and its city in terms of employment supplied by the city is rather steady. The impact on land uses is more accentuated in all the residential areas surrounding the port. This is can be considered to be a classic example of the typical traditional cityport.

5.12.2 Transportation and Associated Activities

The impact of port related transportation and its associated activities on the city land uses is best assessed through the condition of roads, railways, and waterways as well as the state of communications and pipeline networks.

In Alexandria, the modal distribution of cargos reaching the port is highly oriented to the road transport because of its relative speed and flexibility, in comparison with the other two modes. In 1984, approximately 90 percent of the total throughput was transported via the road system, while the railway transport system accounted for only 7 percent, and the inland waterways made a rather minor contribution (the remaining 3 percent of the total), as indicated in Table 5.14.

Table 5.14: Modal subdivision of traffic generated by Alexandria Port 1984, in (000) tons

	Truck	Railway	Waterway	Total
General cargo	6,378	0.00	0.00	6,378
Cement	5,957	0.00	0.00	5,957
Dust	395	0.00	0.00	395
Coal	89	467	634	1,190
Fertiliser	300	0.00	0.00	300
Timber	1,201	0.00	0.00	1,201
Supply	3,081	872	10	3,963
Total	17,401	1,339	644	19,384
Average	90%	7%	3%	100%

Source: Alexandria Port Authority, 1984

The Table shows that road transport handles the overwhelming proportion of the cargo passing through the port. Most of the heavy traffic generated by the port has destinations in other governorates. A small proportion has destinations in non-urbanised zones of the city which are easily reached by the existing southern tangential expressway, as well as the extraurban roads, such as, for example the industrial zone of "Ameriyah". Only a negligible proportion of traffic has its destination inside the urbanised area of Alexandria city. Thus, the heavy truck and lorry traffic which can be seen in urban Alexandria is mainly due to the inadequate provision and availability of general or specialised roads to carry this traffic through the urbanised area.

One further factor which contributes to the occurrence of congestion outside the port area, is the traffic organisation inside the port. This is based on the principle that vehicles can gain entry to or leave the port via a large number of gates, many of which are connected almost directly to specialised berths. Although this system has enabled earlier traffic problems inside the port to be solved, it has had the effect of transferring or exporting traffic problems into the urban road system outside the port. This external system is inadequate to serve the large number of gates and to provide a means of separating port generated traffic from that generated by the city's central area.

Thus, the impact of port related transport on Alexandria city land use, can clearly be seen in the problems attributable to the traffic generated by the port. These problems can be summarised under two main points:

a- The large number of port gates which are considered to an advantage for traffic organisation inside the port. However, on the other hand, it is a disadvantage for the road conditions outside the port which are congested all the time, especially in front of certain gates, such as gates 14 and 27 Figure 5.12.

B. The lorries and trucks waiting to enter the port, or waiting to load or unload at the warehouses outside the port, clog up the traffic in the urban roads, especially in the areas of Kabbary and Karmouz as indicated in Figure 5.13.

In contrast to road traffic, other transportation activities, such as communication and pipelines do not have much impact on the city land use.

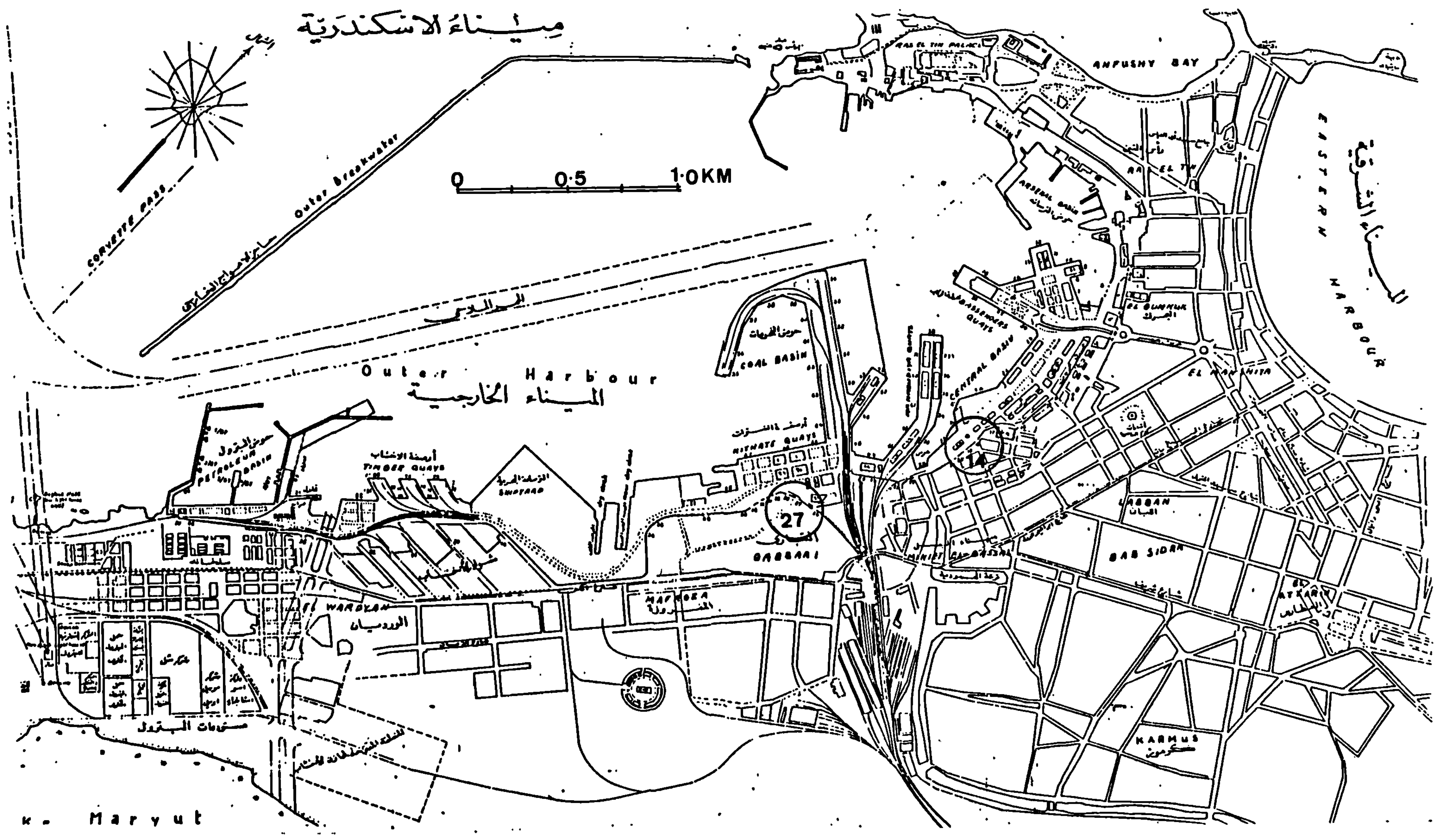


Figure 5.12 Gates 14 and 27

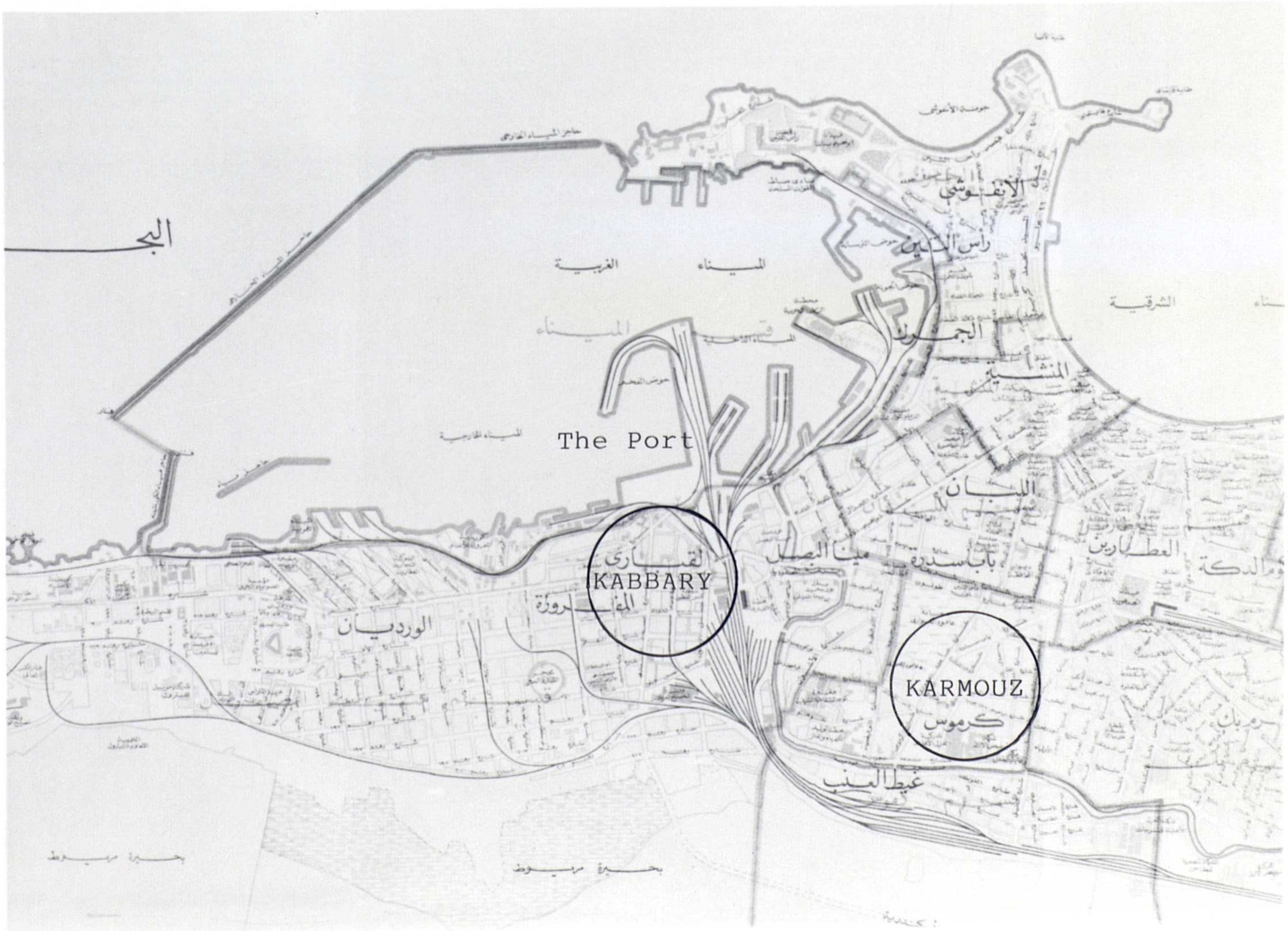


Figure 5.13 : The areas of Kabbary and Karmouz in relation to the Port

5.12.3 Commerce

Alexandria's share within the context of Egyptian seaborne trade is quite considerable as illustrated earlier in Table 5.8. The port has to serve a wide hinterland through a well organised distributional and wholesaling system. However, partly as a result of continuing to use a less advanced technology, and partly as a result of mismanagement, Alexandria has not fulfilled its potential role. The wholesaling activities with their wide meaning are not well organised. These activities consist essentially of a very large number of small one-man businesses, with little attempt made to take advantage of economics of scale. In addition, no designated area is dedicated to such activities related to the port. However, the marginal impact of these wholesaling activities on the city land use can always be seen in the extent to which warehouses and storage areas are dispersed outside the port gates and in some areas along the ring road connecting the port with the eastern part of the city.

5.12.4 Services

Alexandria is the second administrative city after Cairo. Thus, most of the services are serving the city and its suburbs. However, there are some indicators which reflect the impact of port related services on the city land use which can be seen in the form of firms of headquarters for shipping lines and shipping agents which are located mostly near the port in El Manshia district. Some of them are found in the central business district. Certain types of firms relating to, for example, maritime insurance and special services (marine salvage, diving and towing etc.) tend to be located outside the port gates. Miscellaneous repair services, on the other hand, are found at various locations around the port. Finally, three and four star hotels are located in El Manshia district in addition to other amusement services mainly located in the city centre.

5.12.5 Manufacturing industry

As mentioned earlier in this chapter, the manufacturing industries in Alexandria account for more than one-third of the national industrial stock. Among these industries there are only two which are considered to be port related. These are, the petrol industry and its associated industries, and the pressed cotton industry. Both industries are located near the port and have a considerable impact on the city land use. The petrol refineries and petrochemical industries are located in El Max area near to the petrol terminal. The pressed cotton industry is located in El Kabbary area. The impact of these two industries on the city land use can be contrasted. The petrol industry occupies large open sites in the outskirts of the city, with direct access to the desert highway and connected with the port by underground or suspended pipeline networks. On the other hand, the pressed cotton industry occupies very restricted three storey plant adjacent to the port in a very high density district with lack of adequate storage facilities.

Here, it should be mentioned that the new iron and steel complex which has been constructed in El Dekheila will be added to these manufacturing industries related to the port since it will rely upon the new port in handling the iron ore. Other small industries depending on the port such as rope manufacturing, metal manufacturing, and some small food processing industries have a very marginal impact on the land use, and are mainly concentrated around the port.

5.12.6 The Impact of the Port On the Urban Environment

As a major industrial city, Alexandria's main urban environmental problems are attributed to the pollution generated by these industries. The contribution of the port to these problems is rather modest. However, because of the proximity of the port to the urban agglomeration and the pleasure beaches, these latter areas are suffering significantly from different types of pollution related to the port. These can be summarised as;

1. Chronic water pollution (garbage, plastic deposits, etc.) which results from the passing ships or those queuing to enter the port;
2. Air pollution generated from the port related industries located in El Max area.

Also it should be mentioned that although the impact of the new port on the environment in terms of water pollution has been considered in the outline of the project, the new steel mill project will impose the hazard of air pollution on the city because of its disadvantageous location in relation to the prevailing wind.

5.13 SUMMARY AND CONCLUSION

This chapter has been focused on the cityport of Alexandria, which is the first of two case studies that comprise the empirical work of the research. The chapter began with an outline of the field study methodology adopted to carry out the two case studies in question. This was followed by the historical background of Alexandria. The aspects which surrounded its foundation, the stages of development as well as the advantage of its strategic location have been reviewed. This historical resume indicates the significant role played by Alexandria in the past and the present regarding the national and international levels.

The overview of Alexandria's rank within the current national context of Egypt has revealed that the city is acting as the focus for the urban, industrial, and economical activities. Being located on the Mediterranean and bordered by agricultural land from the east and the lakes from the south, Alexandria take the form of the linear city. This location has imposed constraints on its expansion trend.

On the other hand, the city's environmental context has been outlined through four main dimensions. The examination of the policy dimension shows that the city has acquired the attention of both the central government as well as the local authority because of its effective role as a port in relation to the national and local economy. The socio-economic dimension revealed that the city is experiencing a rapid growth of population, with about 27 percent of the population being economically active. The outline of the land use dimension shows that, within the regional context, the city has expanded almost 30 percent by urbanising areas from both desert and arable land, since 1977-1978.

At the urban level, the governorate of Alexandria is divided into five administrative districts, which are further subdivided into fourteen subdistricts the port which is the main element of this study is surrounded by four of the highest density subdistrict. The transport dimension indicates, on the other hand, that the city is well connected with its neighbours and hinterland by three modes of transportation. These are roads, railways, and waterways.

The analysis of the case study in question began with a brief description of port and its facilities. This was followed by detailed land use analysis which examined, over the last twenty years, the changes that have occurred in land use patterns of the waterfront, in response to the new technology. Analysis of the port throughput has made it possible, together with the study of land use, to identify some important findings which give a clear picture concerning the relationship between the land and traffic that it generates. It has been found that the port has reached the point at which the need for new port facilities is essential to solve the land use problems that exist in the old port. The proposed new port has been reviewed, and aspects which relate to the purpose, location, environmental condition and some other points, such as, operational target, employment generates, and the traffic projections have been indicated. Finally, the impact of the two ports on the land use of Alexandria has been discussed. This discussion was extended through the examination of the five principal port related activities, and the outlining of the impact of the port as a function on the land use of the cityport, as well as the urban environment.

CHAPTER SIX

CHAPTER SIX

A CASE STUDY OF LIVERPOOL CITYPORT

6.1 INTRODUCTION

This chapter is the second that relates to the empirical aspects of the research. It is concerned mainly with the case study of Liverpool cityport. In the first section, the historical evolution of the port is outlined. A number of substantial issues are identified which reflect the crucial role played by the port in relation to the development process of Liverpool city on one hand, and the county of Merseyside on the other. This historical background is followed by a general description which provides the basis for identifying the main type of activity inside the port, as well as the currently active areas.

Liverpool, as a major port in the north west of England, has faced radical changes in terms of land use characteristics as a response to the introduction of new technology in maritime industry. These changes are assessed through a detailed analysis of the pattern of port waterfront land use over the last twenty years. In this analytical assessment the factors which contribute to such changes are examined.

Finally, the impact of the Liverpool port as a function on the land use patterns of the city is reviewed with respect to the five principal port related activities identified before in the theoretical study.

6.2 HISTORICAL BACKGROUND

The history of the city and the port of Liverpool extends from more than six hundred years ago, when King John's charter in 1207, gave an invitation to settle in and around Liverpool with all the feudal rights including all the liberties as well as free customs. "Liverpool was formerly a small Fishing Town; but many people coming from London in time of the sickness, and after the fire, several ingenious men settled in Liverpool; which encouraged them to trade to the plantations and other places; which occasioned sundry other Tradesmen to come and settle there.." (Bird, 1963, p. 227).

Liverpool as a port took advantage of the major events that affected other cityports in England. In the seventeenth century, Liverpool gained from the trade recession that befell London, especially when the transatlantic trade began to revive. Several other causes have contributed to the prosperity of Liverpool at that time. These include the increase in the extent of the hinterland for some products, such as the Lancashire coal exports from 1611, and the discovery of rock salt in Cheshire in 1670. These products represented readily saleable back-cargo for vessels making longer voyages to Liverpool from other parts of the world.

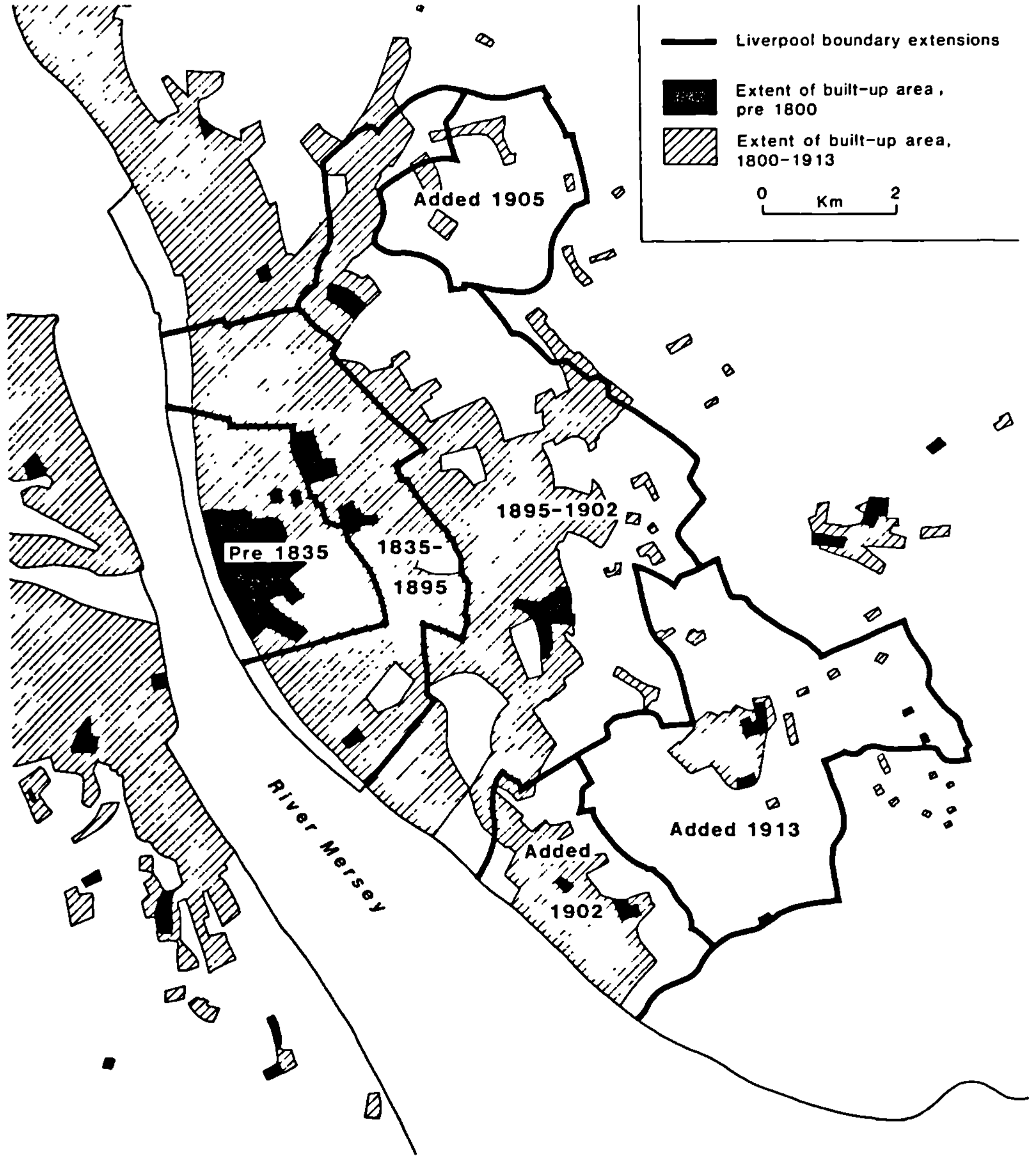
It should be mentioned that after 1670, significant new trades were opened up with the Caribbean and North America for sugar, tobacco, indigo and later, cotton (Lawton, (1982a), p.1). Between that time and up to 1800, Liverpool had established good trade with West Africa, especially in slave trade. Liverpool provided 74 percent of slaving vessels by the turn of the century. In 1715 the first dock system was founded to accommodate the rapid expansion of trade. The widening hinterland of the port in the industrial North and Midlands and the extension of its trading foreland throughout the Atlantic and much of Southern and Northern Europe, were responsible for its rapidly growing and increasingly cosmopolitan population (Hyde, 1971).

By the beginning of the nineteenth century the boundaries of Liverpool could no longer contain the rapidly expanding built up areas, as indicated in Figure 6.1. As residential areas expanded, parts of the town centre were increasingly given over to commerce and industry. This expansion in commercial activities was manifestated by the increasing range and quality of the shapes which pointed to the emergence of Liverpool as a higher-order regional centre. On the other hand, the older industries, notably shipbuilding, pottery and chemicals, were progressively displaced from the waterfront and inner areas. In their place a wider range of processing industries, comprising oil-seed, grain milling and soap-boiling was added to sugar, tobacco and brewing (Lawton, (1982a), p. 3). These industries flanked the docks and the Leeds-Liverpool Canal, with extensive warehousing, storage and associated activities, such as transport and handling facilities for timber and coal as well as a wide range of imports.

It is important to recognise that in the period between 1830 and 1860, the traffic of the port trebled, and it had trebled again by 1913 (Hyde, 1971). In 1860, twenty one docks and some 10 miles (16 km) of new quayage had been constructed. These included, for example, the Albert Dock complex. This was followed by seven new docks, culminating in the massive Gladstone Dock system (1913-27).

During the inter-war years, Liverpool faced great difficulties, and subsequently these affected the port. From 1915 to 1920 volume of imports increased to one-third of the UK total

Figure 6.1: Growth of Liverpool, 1835-1913.
The dates of boundary extensions to the Borough and the extent of the built-up area in 1800 and 1913 are shown



Source: Lawton, R. (1982)a, p.5

compared with one-quarter pre-war. However, during the period extending from 1919 to 1939 the changes in the national and international economy associated with severe depression brought a substantial fall in the volume of Liverpool's trade (Lawton, (1982a), p.9).

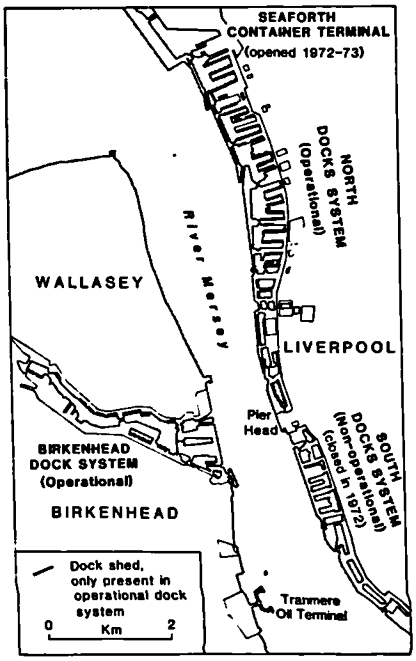
During the Second World War, the port played a most vital role in the war effort, leaving 35 percent of Merseyside's population in shipping, services, transport and distribution in 1947, when, apart from the post-war boom in shipbuilding, the rapid run-down of activity brought a sharp increase in unemployment to 6.5 percent, two and a half times the national average. Nevertheless, in 1953 the port of Liverpool still contributed much toward the employment opportunities in Merseyside. At that time one-tenth of the labour force was directly employed by the port and one-sixth in port industries and commerce.

With the introduction of new technology in maritime transport and the improvement handling techniques at the beginning of 1960s, the use of the port and its labour force again suffered from decline. The total traffic fell dramatically in the 1970s, from 28 million tons in 1967 to 15.8 million in 1979, and the registered labour force fell sharply from 23,000 in 1963 to 9,451 by 1972 (Gilman, 1982). These radical changes imposed a new image on the Merseyside area generally and on Liverpool specifically. Now even after respectable stages of development, Liverpool and the county of Merseyside still face massive economic, social and political problems, which seem far beyond the power of local and regional governments to resolve.

6.3 THE PORT STRUCTURE AND FACILITIES

Before 1972 the port of Liverpool extended four miles north of Pier Head, and more than two miles south, and included almost three miles of dock frontage on the Birkenhead side of the River Mersey. Primarily as a consequence of the technological changes affecting the shipping industry in the early 1960s, the port of Liverpool lost the entire two miles of dock frontage in the south, by the closing down of the south docks in 1972. The port has gained, on the other hand, from the opening up of the Royal Seaforth container, timber and grain complex, which began operation in 1973, as indicated in Figure 6.2.

Figure 6.2: Docks owned by the Mersey Docks and Harbour Company



Source: Gilman, 1982, p. 31

The current facilities and patterns of activities of the port are illustrated in Figures 6.3 and 6.4. These patterns include 50 berths for conventional cargo ships, in addition to the 200 hectares of dock complex at Seaforth. The total facilities that are available to accommodate the principal types of traffic are indicated by Stoney (1984). These consist of the following:

Figure 6.3: Facilities of the North Docks System

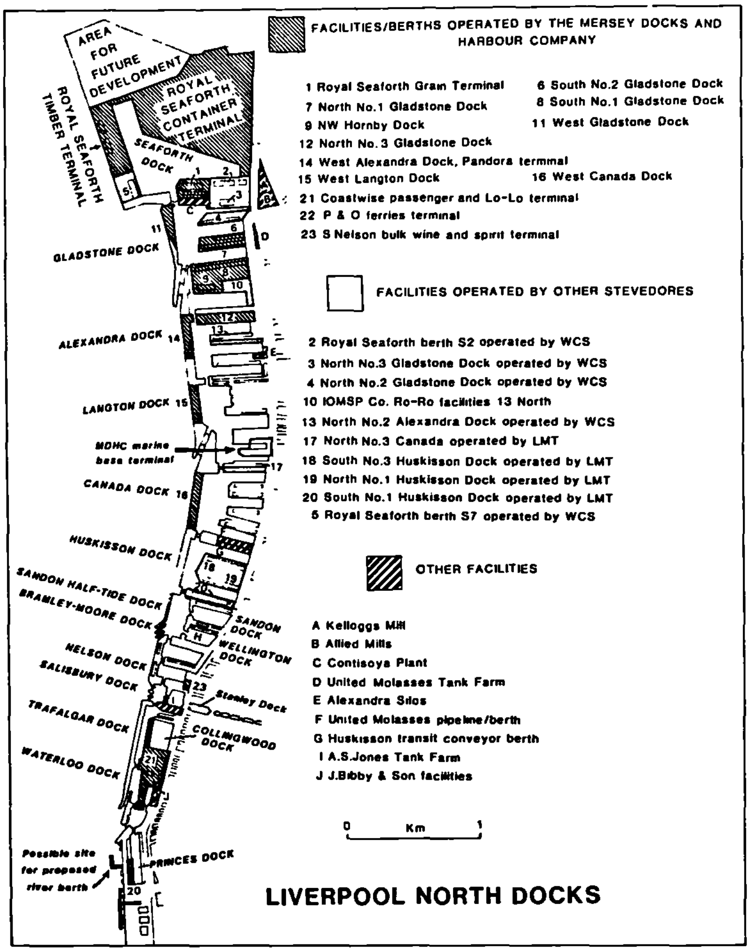
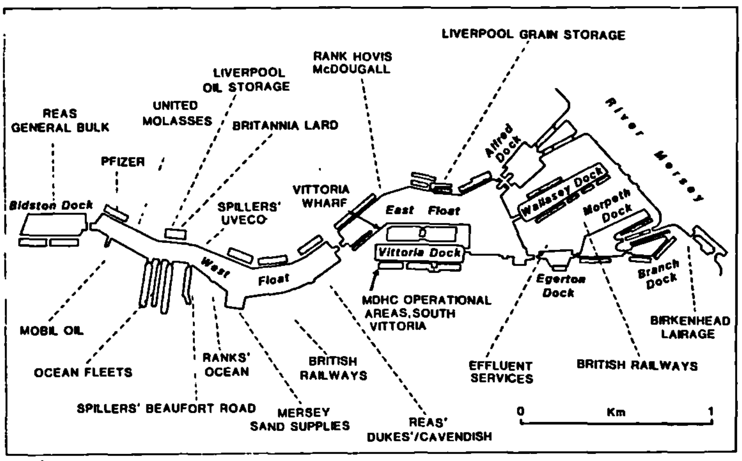


Figure 6.4: Facilities of Birkenhead Dock System



Source: Gilman, 1982, p. 32 and 34 respectively

- Conventional Traffic:
  50 berths (30 of which were operated by Mersey Docks Harbour Company, and 20 by shipping lines).

- Containerised Traffic:
  A quay of 1,100 metre and a staking area to accommodate a variety of box sizes.

- Ro-Ro Traffic:
  Berths for ships up to 35,000 Dwt.

- Specialised Facilities:
  1. The Seaforth grain terminal with a total capacity of 133,000 tons and linked directly to three mills.
  2. The three mineral and ore berths on the Birkenhead side.
  3. Two specialised grab berths for sugar at Huskisson Dock in the North Docks.

- Bulk Liquids:
  A terminal for edible oil, bulk lubricating oils and liquid chemicals.

- Packaged Timber:
  Over 600 metres of quay frontage at Seaforth terminal for berthing vessels carrying timber.

It should be mentioned that there have been no major changes in the facilities since 1975, except for the transfer of the Belfast car-ferry terminal to Langton Dock from Princes Dock.

6.4 DESCRIPTION OF PORT ACTIVITIES

Gilman has stated that "In the present time all the activities of Liverpool port are concentrated on five main areas of the northern part of the Liverpool system and Birkenhead" (Gilman, 1982, p. 30). The short and near sea lines principally use the Pier Head complex. However, after the shifting of the Belfast car-ferry as mentioned before, this part of the port is now dedicated to the accommodation of the cross river services. The container services, on the other hand, used to be divided according to the origin and destination. For example, the Waterloo container terminal used to deal with container services to Portugal, Morocco and Spain. Other terminals provided facilities for semi- container services to West Africa as well as the West Indies. However, after the official opening of the Royal Seaforth Terminal, most of the container movements are diverted to the modern equipped terminal, with its 1,100 metre quay, five Panamax gaintries, and 48 hectares of land (Gilman, 1982).

The general cargo activities have been concentrated in two locations. The first, to the north of Pier Head on Liverpool side where there is an area dedicated to general cargo and small bulk terminals. Among these are found the operations of the independent stevedores and other shipping lines. The alcoholic beverages and spirits terminal is located at the Nelson Dock, where bulk spirits are piped directly into Stanley warehouse. It is worth mentioning that the area located at Huskisson Dock, between the private stevedores zone and the Gladstone end, is considered to be an area of low intensity use. However, partial attempts of redevelopment have taken place in this area, such as the Langton Graving Dock and Branch 1 of the Alexandra Dock. These two projects were part of significant redevelopment plans for the whole Northern Docks, which were directed towards the development of an efficient new combination of terminals for mixed container break-bulk services. "However, traffic is not buoyant, finance is short and progress has been fairly slow. The Northern end of the dock system, Hornby Dock, Gladstone Dock and Seaforth Complex, is the busiest part of the port" (Gilman, 1982).

The Royal Seaforth Complex is located at the far north of the Dock system. Beside its reputation as a container terminal, it has good facilities for general cargo activities represented by the most efficient grain terminal, with its extensive storage facilities. The timber terminal, is located also a well equipped modern berth, capable of dealing with enormous amounts of cargo efficiently.

The second location for the general cargo activities is situated on the opposite bank of the River Mersey, on the Birkenhead side, as indicated before in Figure 6.4. At the present time, nearly all of the activities in Birkenhead are concerned with grain transhipped from the Seaforth terminal, and coal, bauxite and oil at Tranmere terminal for coastal imports.

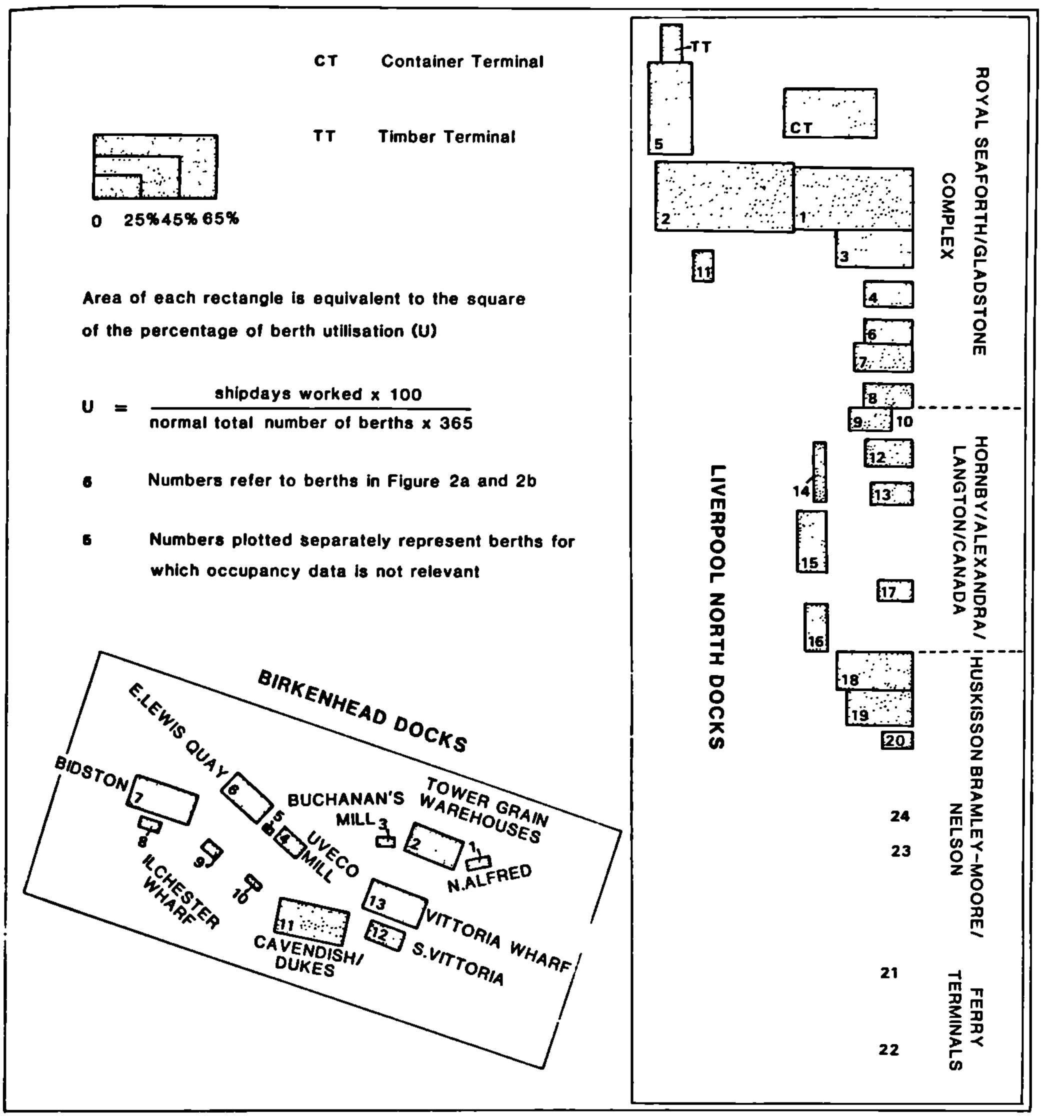
The MDHC (Mersey Docks and Harbour Company), owns all of the land, but the terminals are mainly operated by companies leasing land from MDHC. For example, the Vittoria Dock is used by Harrison Line to East Africa ports and by the Pacific Steam Navigation Company to serve the west coast of South America. Bidston Dock has ceased operation at the present time and Egerton Dock and Morpeth Dock (which are considered to be the older part of Birkenhead Docks) are now closed.

A summary of the various active areas in the port of Liverpool estate is presented by Gilman (1982). This includes the pockets of activity that remained in closed docks. Figure 6.5 illustrates the extent of cargo handling operations in the port by measuring the intensity of usage of different berths.

6.5 DESIGN OF THE CASE STUDY

According to the aims and objectives of the field study mentioned in the previous chapter, the case study of Liverpool port has been carried out with the main aim of assessing the changes that

Figure 6.5: Berth utilisation within operational docks



Source: Gilman, 1982, p. 35

have occurred in the waterfront land use patterns in the last twenty years, i.e. from 1965 to 1985. This involved an evaluation of the changing functions of the port with special attention to the separation and specialisation of the waterfront land uses.

As indicated before in the previous chapter, the waterfront area is defined as the distance between the foreshore line and the normal boundaries of the port which are parallel to the normal city block patterns.

It should be mentioned that, although the port of Liverpool is split into two parts (the Liverpool side and the Birkenhead side), the main concern of this case study focused upon the Liverpool side. A justification for this choice is appropriate. The Liverpool side is considered to be the largest part of the port adjacent to the city of Liverpool. Therefore, it was decided that, by concentrating on the Liverpool side in the examination of the changing land use patterns inside and outside the port area, a sound demonstration of these changes could be reasonably attained.

The waterfront has been divided into nineteen sections, eleven of them covering the northern part of the port, the other eight sections covering the southern part. In Figure 6.6 the sectorial divisions are of various sizes and are based primarily upon the designated terminals of the port. As will become clear, it was necessary to divide the waterfront according to the individual terminals if the changing land use patterns over the last twenty years were to be evaluated.

In this study, the area in the vicinity of Pier Head (between sections N1 and S1) should be included, since it contains the largest administrative area of the port which is the Port of Liverpool Building, as well as part of the local ferry terminal. However, at the same time, it contains some other activities which are considered to be non-port related activities, such as the main bus terminal of the city, and two other administrative buildings not related to the port.

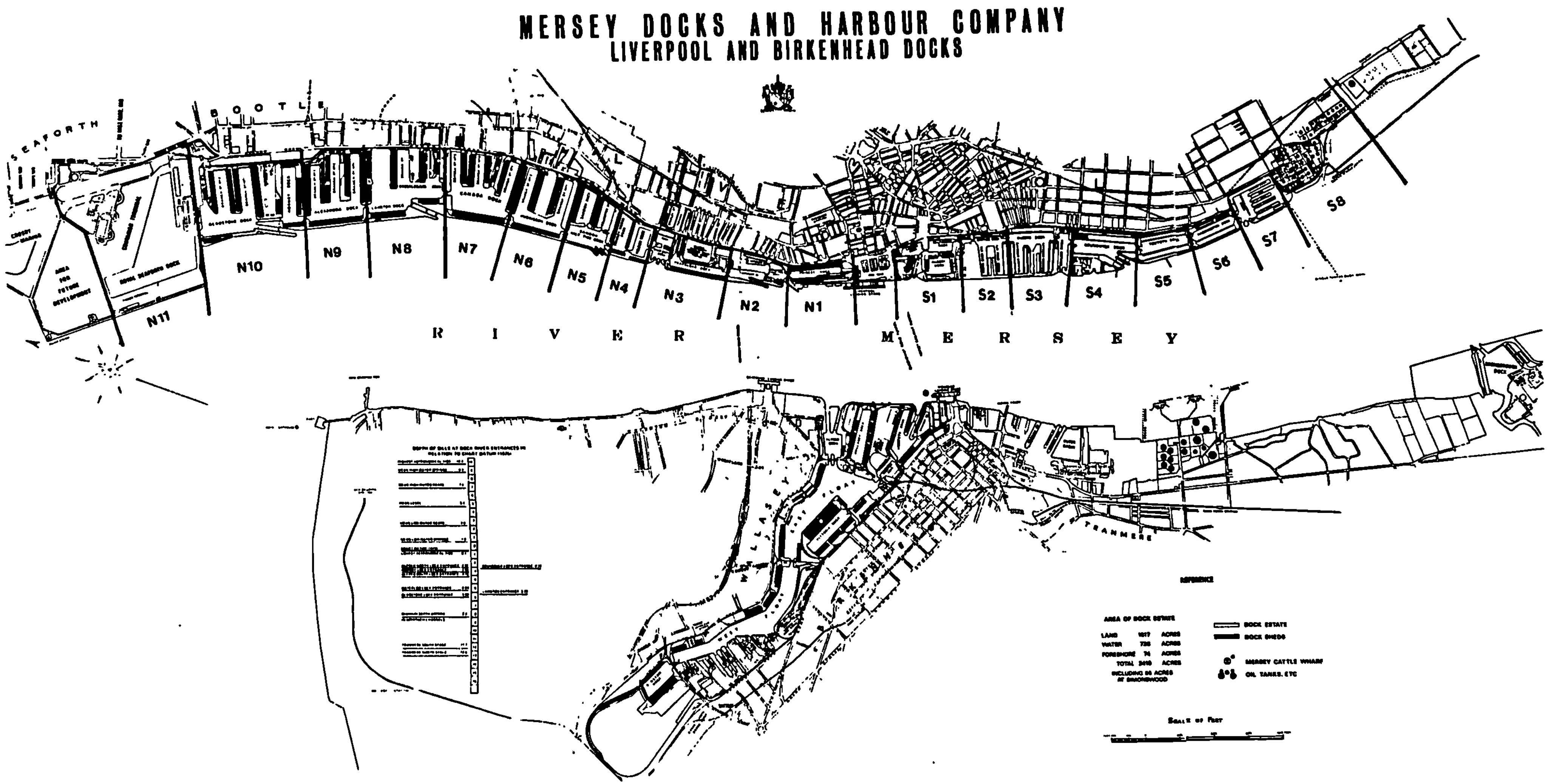


Figure 6.6 Study sections in Liverpool Port

For the purpose of this study, five principal categories of land use were adopted (see Section 5.1) which are more relevant to the concept of separation and specialisation of the port function and activities. In addition, twelve land use categories were employed which account for the range of waterfront functions.

The principal source of all of the data and information analysed below includes the detailed land use maps relating to the port which were assembled with the help of the Estates Department of MDHC, as well as a documentary survey. The process of map assembly and compilation was extremely time consuming.

6.5.1 Analysis and Interpretation of the Waterfront Function

The information about the changing functions of Liverpool waterfront, as measured by the amount of land in various uses, is illustrated in Table 6.1. This provides a visual impression of the nature and extent of the changes in land use patterns over the twenty years period. Similarities and differences between the various types of land uses can be identified as reflecting the following observation:

"The port of Liverpool responded to changes in transport technology and trading patterns with a combination of policies of investment and rationalisation" (Gilman, 1982, p. 28).

The waterfront has increased in area by a factor 1.53 over the period of this study, increasing from approximately 2,706,320 sqm in 1965 to 4,141,600 sqm in 1985. This growth can be directly attributed to the establishment of the Royal Seaforth Complex which occupies an area of about 1,647,500 sqm in the northern part of the port (section N11). This project was begun in the middle of the

TABLE (6.1) : THE WATERFRONT LAND USE (in thousand of square metres) OF LIVERPOOL PORT OVER THE LAST TWENTY YEARS

Land Use of Liverpool Port	1965		1970		1975		1980		1985	
	Area	%	Area	%	Area	%	Area	%	Area	%
1) Cargo-handling										
- Docks and associated warehouses	1071.30	39.58	1035.90	38.28	881.90	21.29	843.30	20.36	819.20	19.77
- storage open space	91.60	3.38	91.60	3.38	264.70	6.40	264.70	6.40	264.70	6.40
Total	1162.	42.96	1127.50	41.66	1146.60	27.69	1108.00	26.76	1083.90	26.17
2) Urban orientation										
- Residential	0.55	0.02	0.55	0.02	0.0	0.0	0.0	0.0	0.0	0.0
- Offices and services	27.05	1.01	26.25	0.98	23.91	0.57	23.32	0.56	22.38	0.54
- Commercial (retailing)	5.71	0.21	5.43	0.20	4.56	0.11	4.56	0.11	3.45	0.08
- Warehousing (other than shipping)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Development open space	26.35	0.97	26.35	0.97	35.60	0.85	35.60	0.85	34.01	0.82
Total	59.66	2.21	58.58	2.17	64.07	1.53	63.48	1.52	59.93	1.44
3) Mixed orientation										
- Public admin & defence	7.10	0.26	6.90	0.25	5.04	0.12	5.04	0.12	3.74	0.09
- Transport (other than shipping)	1340.71	49.52	1367.39	50.52	1618.29	39.07	1513.38	36.56	1400.03	33.82
- Manufacturing and utilities	127.95	4.73	127.95	4.73	130.16	3.14	130.16	3.14	208.16	5.02
Total	1475.76	54.53	1502.24	55.50	1753.49	42.33	1648.58	39.82	1612.83	38.93
4) Vacant										
- Vacant and under-developed land	8.00	0.30	18.00	0.67	1177.64	28.45	1243.74	30.00	817.29	19.75
5) Others	0.00	0.00	0.00	0.00	0.00	0.00	78.00	1.09	567.85	13.71
GRAND TOTAL	2706.32	100.00	2706.32	100.00	4141.60	100.00	4141.60	100.00	4141.60	100.00

1960s and officially opened in 1973 (see Figure 6.7). This is considered to be the outcome of major programme of investment in the port. The closing down of the South Docks (sections S1 to S8) in 1972 is considered to be the main result of the rationalisation policy that affected the port (see Figure 6.8).

Many of the waterfront functions have changed in the last twenty years with the main direction of development being towards decline rather than revival. Exceptions to this general trend are the three functions of, storage open space, manufacturing and utilities, and vacant and undeveloped land.

The cargo handling function, represented by docks and associated warehouses and storage open space, made up the second most extensive land use after transport (other than shipping) during the period of the study. It should be mentioned that the amount of land related to this function has declined by 10 percent (from 1,162,900 sqm in 1965 to 1,083,900 sqm in 1985). These changes can be attributed to two substantial factors:

1. The world trade recession and, in particular, the downturn in UK imports and exports.

2. The changes in transport organisation and trading patterns, in particular the integration of UK traffic with that of continental Europe.

Although the official opening of the Seaforth terminal was coincident with the closure of the South Docks, the proportion of land devoted to the cargo handling function decreased dramatically from 42.96 percent to 26.17 percent of the total land use. This indicates the significance of the area of land occupied by the South Docks, which had been once designated for cargo handling.

Figure 6.7:
An aerial view of North Docks of Liverpool's deep sea, general cargo berths. The Royal Seaforth Complex can be seen at the top of this picture.

Figure 6.8:
Aerial view of the South Docks of Liverpool port which ceased operation in 1972.

The urban oriented functions and activities did not show many changes in the waterfront area during the study period. This was expected because of the absence of the warehousing (other than shipping) function, as well as the small proportion accounted for by residential areas which in 1965-70 represented only 0.02 percent of the total area. It is worth mentioning that the amount of land devoted to the urban orientation category has decreased by 0.77 percent (from 2.21 percent in 1965 to 1.44 percent in 1985). The differences in the land use functions of the waterfront are largely observed in the land uses of mixed orientation and vacant land.

The area of land devoted to the mixed orientation activities has decreased over the study period by 15.6 percent (from 54.5 percent in 1965 to 38.93 percent in 1985). The results obtained from using the absolute area of land (which is 1,475,760 sqm in 1965 and 1,612,830 sqm in 1985) can be misleading for the analysis process, because it gives the impression that this land use has revived rather than declined. This can be explained by the fact that the Seaforth Complex, which accounts for an area of 1,647,500 sqm, was included within the total area in 1985, and excluded in 1965.

The public administration and defence category has declined during the study period by a factor of 0.52 (from 7,100 sqm in 1965 to 3,740 sqm in 1985). This is consistent with the decline of cargo handling activities, because most of these public administration activities are customs offices serving the docks and their associated warehouses.

The transport (other than shipping), represented by railways and roads, has remained the predominant land use in the waterfront over the last twenty years. Although the actual area of land related to this function has grown slightly, using the percentage can give the right and consistent impression which is one of decline. This function's share has declined over the study period by 15.7 percent (from 49.52 percent in 1965 to 33.82 percent in 1985). This change can be explained by the closure of many of the railway lines related to the port, as well as most of the railway stations serving the port area. It should be noted that in 1965 the length of the rail lines was about 78 miles, while in 1985 it had reduced to only 12 miles.

In the area accommodating manufacturing and utilities, the change of the land use estate was remarkable. This area grew slightly during the first fifteen years (1965-80), but suddenly a high rate of increase is shown between 1980 and 1985. The increase can be attributed to the establishment of the North West Water Authority (NWWA) lower Mersey estuary sewage treatment station which is located in Sandon Dock (section N5), and considered to be a utility function.

The biggest change that occurred during the study period was in the vacant and undeveloped land uses. This category increased dramatically over the last twenty years, from approximately 8,000 sqm in 1965 to 817,290 sqm in 1985. The principal reason behind this change was the closing down of the South Docks in 1972. Although some minor activities remained active after the closing date, the majority of buildings and land were deserted and left vacant. In 1981 a new policy was adopted by the Merseyside Development Corporation aimed at the regeneration of the entire South Docks to create new commercial, residential, recreational, and industrial areas. Part of these works had been completed by the end of 1984, and two previous docks became recreation and commercial areas. These are the Albert Dock in section S1 (see Figure 6.9) and Dingle petrol terminal section (S8) which eventually became the location of the International Garden Festival in 1984 (Figure 6.10).

Some other activities which are not included within the previous four categories are combined together in one category designated "others". From this category it can be recognised that, in 1985 those two projects located in the South Docks accounted for up to 13.71 percent of the total area of waterfront. In 1980 there was another site located in Sandon Dock (section N5) in the North Docks which was used as a fish farm by Liverpool University from 1977 up to 1983. This location accounted for only 1.9 percent of the total waterfront area in 1980.

The similarities and differences in waterfront functions and activities in the last twenty years that emerged from this analysis are consistent with expectations. The port has expanded toward the north by establishing a major new terminal to cope with the development of the new shipping industry technology. Meanwhile, decline has characterised the state of the entire port, and the closure of the South Docks and part of the North Docks serve as a clear cut example of that.

As a consequence, the activities of the cargo handling function have been distributed among nine sections in the North Docks. More specifically, these activities remained concentrated from section N3 to N11. It should be mentioned that the MDHC's activities are restricted to the Seaforth Complex (N11) and Gladstone Dock (N10), with some short sea traffic in Canada Dock ~~of~~

Figure 6.9:
Albert Dock after the restoration process

Figure 6.10:
The International Garden Festival site after the official opening in 1984

(N7). The operation of the remaining active terminals at the North Docks is distributed among the private stevedores. On the other hand, there is a new strategy now adopted by MDHC, based on the 1977 "Plan for the Future", that is aimed at replacing outdated port infrastructure to produce facilities suited to modern requirements. The physical restructuring of the North Docks system is gradually taking place to create the wider quay margins and deeper berths for the new technology in handling techniques as well as the largest vessels. Also, new sites, suitable for cargo handling, Free Port and for port related industry, are being formed by the in filling of Alexandra Dock (N9) and Langton Branch (N8).

6.5.2 Land Use Specialisation in the Liverpool Port

The approach adopted to carrying out the systematic analysis of land use of Liverpool port waterfront was based on a method employed by McCalla (1983). This analysis is aimed at revealing the changing patterns of specialisation with respect to different types of land use. Location quotients were calculated from the standard formula:

$$qi = \frac{Si/S}{Wi/W}$$

where qi = location quotient for land use i

Si = area of land use i in a waterfront section

S = area of all land uses in the same waterfront section

Wi = area of land use i in the entire waterfront

W = area of all land uses in the entire waterfront

Two critical values (1.00 & 1.10) were adopted, in order to identify the areas in which a more distinct patterns of specialisation is found.

In Tables 6.2, 6.3, 6.4 and 6.5 the land use quotients greater than 1.00 and 1.10 are displayed by waterfront sections and the study years. The discrimination between the cargo handling activities and the urban activities is the main concern of this study of sectional specialisation. If a section has a location quotient greater than 1.00 in any of the urban activity land uses, it is said to be urban oriented. The cargo handling specialisation is shown by location quotient greater than 1.00 in docks and associated warehouses and the storage open space land use.

The critical value of 1.10 has been adopted as a more restrictive criterion, in order to remove the effect of those areas land use which have only a marginal degree of specialisation.

For illustrative purpose the analysis of the port of Liverpool will be divided into two portions. The first, is concerned with the northern part of the port, and the second deals with the southern part of the port.

The North Docks:

In the North Docks the urban oriented activities existed in all of the sections in the early stages of the study period (1965-70), with the exception of three sections, N4, N7 and N11, which did not show such specialisation. This can be explained by two reasons:

1. The predominance of the cargo handling function represented by docks and associated warehouses in sections N4 and N7.

2. The absence of the Seaforth terminal N11 at that time.

The legend of Figures : 6.2, 6.3, 6.4 and 6.5

- Docks and associated warehouses
- Storage open space
- Residential
- Offices and services
- Commercial (retailing)
- Warehousing (other than shipping)
- Development open space
- Public administration
- Transport (other than shipping)
- Manufacturing and utilities
- Vacant and undeveloped land
- Others

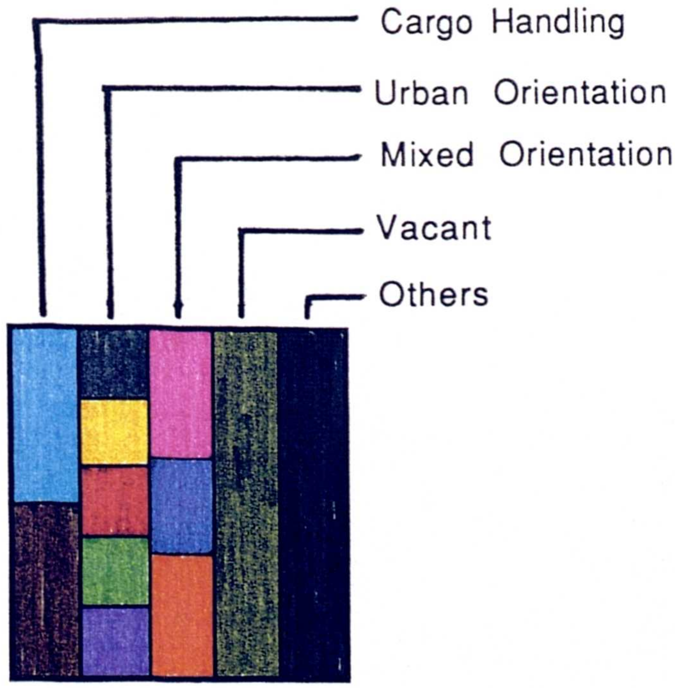


Table 6.2 :
Land use with location quotient > 1.0 Liverpool North Docks

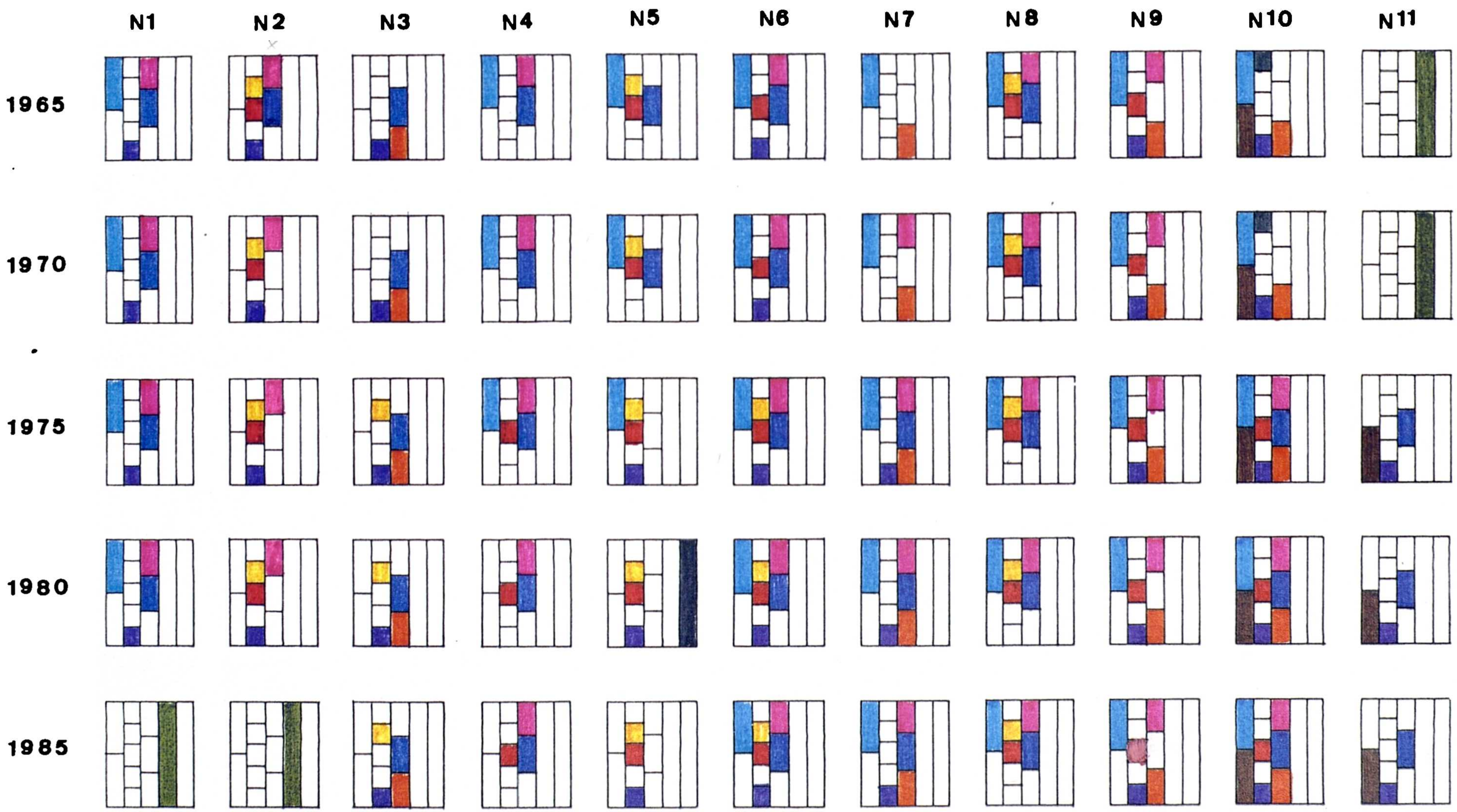


Table 6.3 :
Land use with location quotient > 1.0   Liverpool South Docks

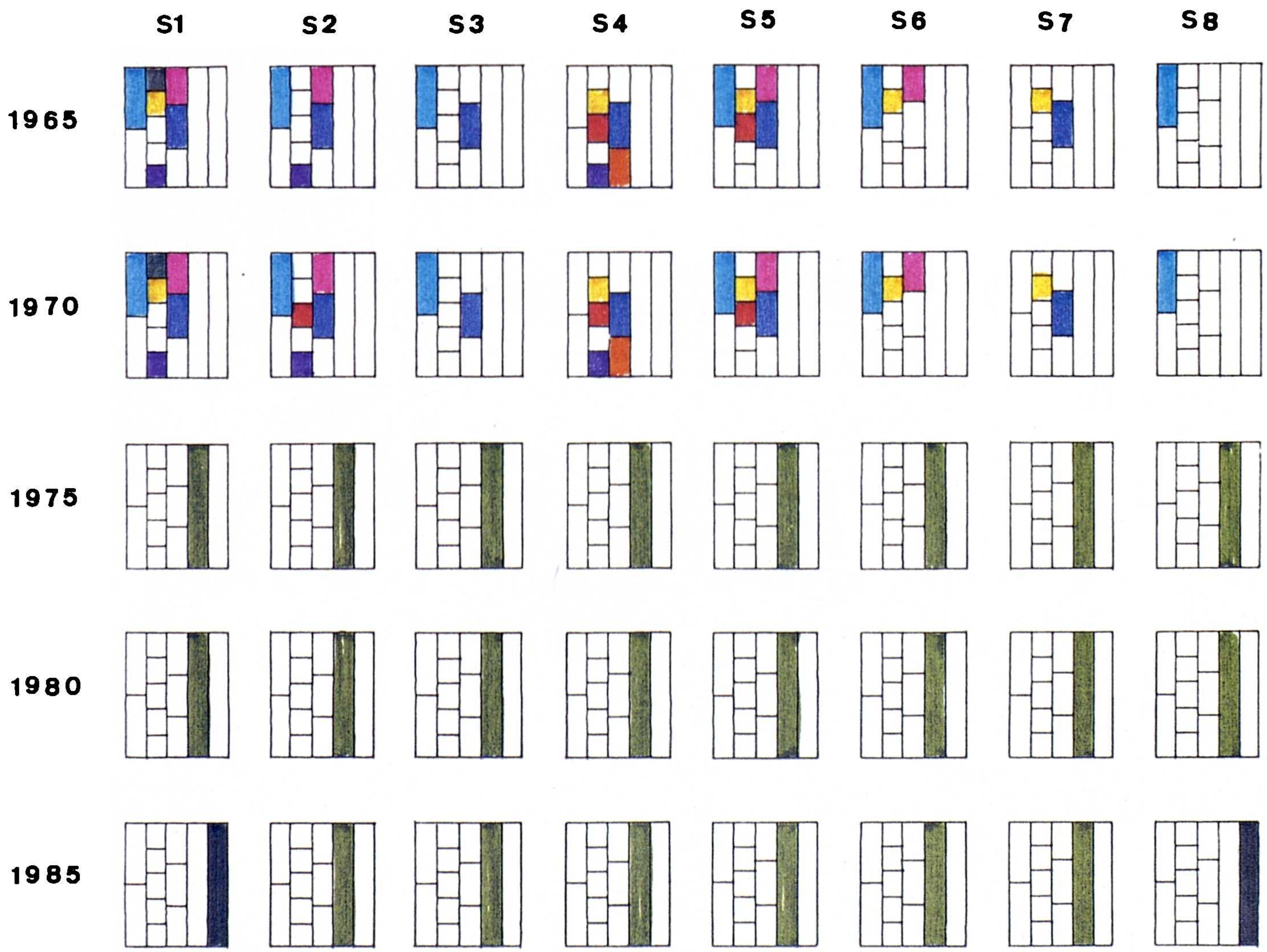


Table 6.4 :
Land use with location quotient > 1.10   Liverpool North Docks

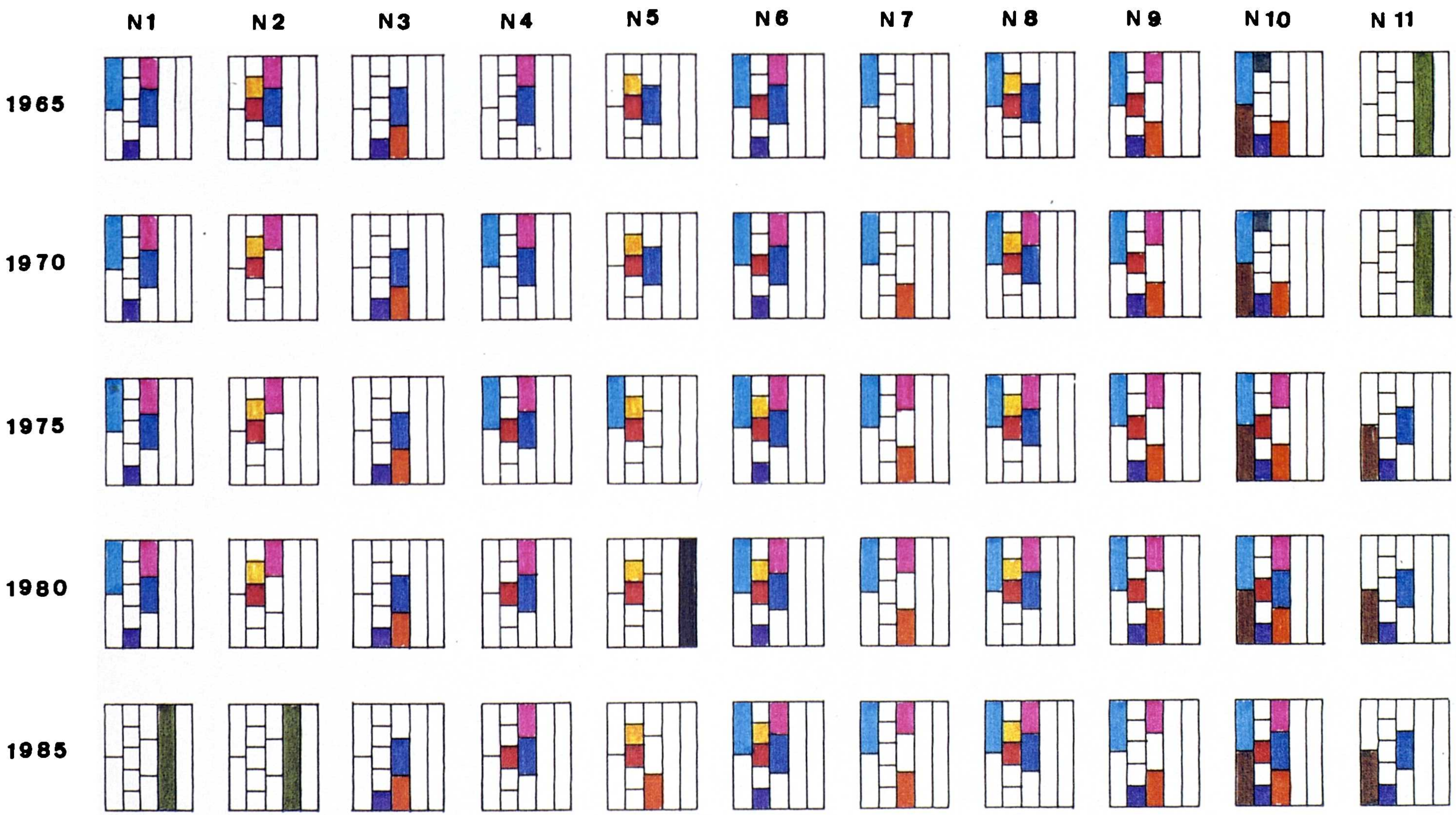
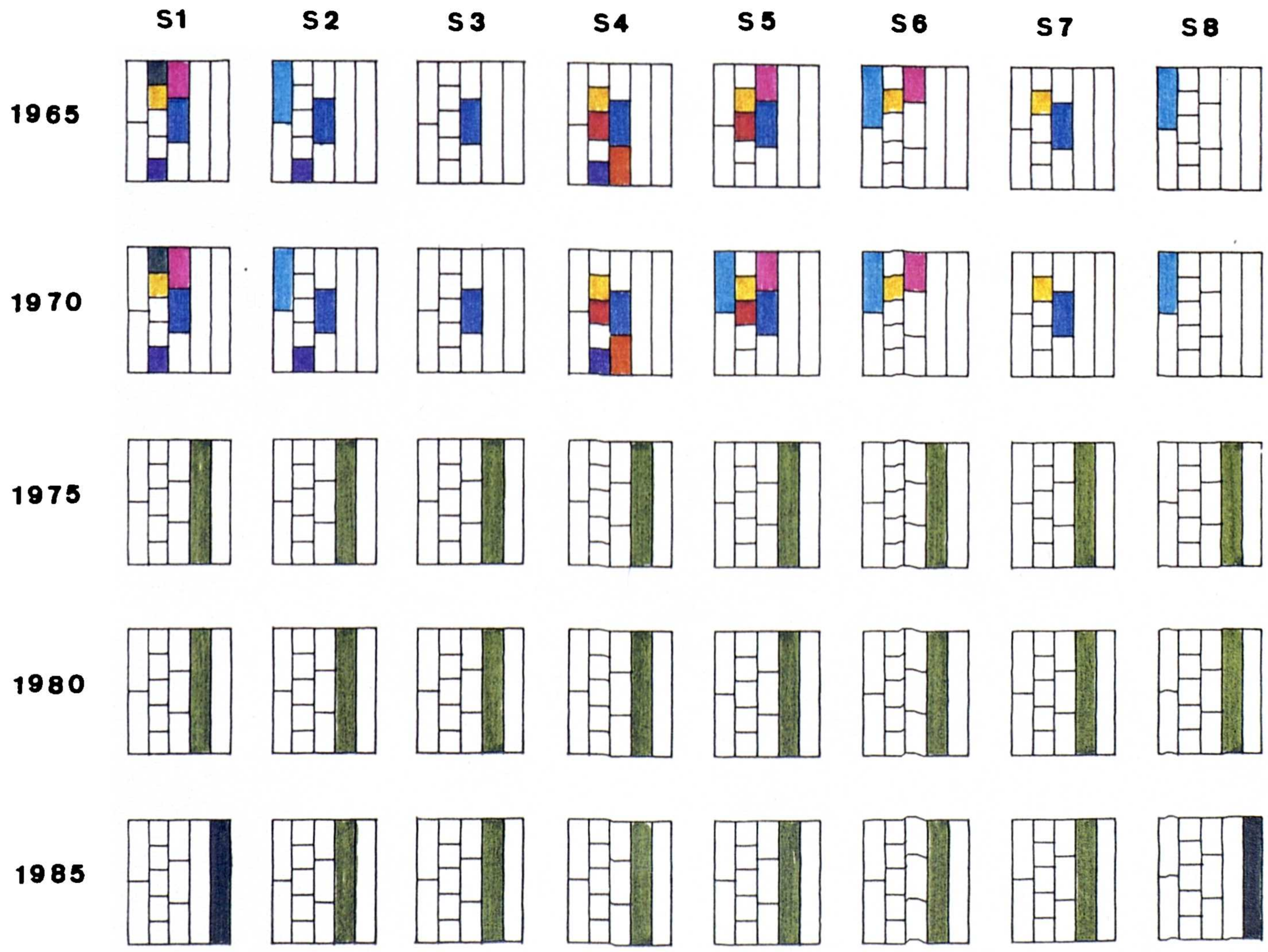


Table 6.5 :
Land use with location quotient > 1.10 Liverpool South Docks



From 1975 the urban orientation activities became common in all of the sections, and were concentrated with a high proportion in three sections N2, N5 and N6. It should be mentioned that these urban activities are represented by offices and services, commercial and development open space functions. This concentration can be explained by the following:

1. Section N2 is the one that is nearest to the city centre which is the central business district of liverpool.

2. In section N5, the marginal degree of specialisation accounted for by the cargo handling activities, in particular after the critical value 1.10 was applied, has allowed other urban activities, such as services, represented by the number of workshops, to appear more important in this section.

3. In section N6, the existence of the cargo handling function has created a demand for some services, such as canteens (which are treated as an urban function) to be established to serve the labour force of this handling function.

In the first ten years (1965-75), the cargo handling activities represented by docks and associated warehouses and the storage open space, were found in eight out of eleven of the North Docks sections. By 1975 this percentage had increased to 80 percent. This increase was caused by the establishment of the Seaforth Complex in 1973, with an area of storage open space of about 173,000 sqm. Between then and the beginning of 1980s, this function began to decline in some of the sections. More specifically in 1980 there were seven sections out of eleven which specialised in this particular function. In 1985 the number of sections had decreased to six. It should be noted that, in 1985, there were two sections (Princes Dock N1 and Waterloo Dock N2) completely closed as a consequence of the overall decline that had affected the port of Liverpool.

On the other hand, from the previous tables it can be seen that the decline did not effect the urban activities as much as the cargo handling. This can be clearly demonstrated by reference to the existence of the urban function and activities in almost all of the North Docks sections except those sections which, as mentioned before, have a high orientation of cargo handling activities.

The South Docks

The first seven years of the study period were considered to be active years for the South Docks. In that time, the predominant activities were the cargo handling functions, as illustrated in Tables 6.3 and 6.5. The urban functions come in the second grade. These urban oriented functions were distributed between almost all of the sections except two (section S3 and S8). This could be explained by the fact that, in section S3 (Queens Dock), the area of water is much more than the area of land. This encouraged the docks and associated warehouses and activities to be concentrated in this small proportion of land, leaving no place for other activities to exist. At the same time, section S8 (Dingle terminal) was serving as a petrol terminal and continued to serve the docks activity up to the closing date of the South Docks.

It is worth mentioning that the domination of the cargo handling function in section S3 was accounted for by a very marginal degree of specialisation because the location quotient exceeds the critical value 1.00 by a very small percentage (only 0.05 percent). Then when the critical value 1.10 was applied the dominant activity in this particular section became transport (other than shipping) which is considered to be a mixed orientation activity.

It should be noticed that there was only one section in the South Docks which displayed a robust specialisation towards the urban activities. In section S1 the urban oriented specialisation is indicated by the existence of three of the urban categories, which are residential, offices and services, and developed open space. This is interpreted in terms of the fact that this section is the more adjacent section to the central business district of Liverpool. On the other hand, it can be considered that this section contains the three main docks (Albert, Canning and Salthouse) which were the former nucleus of the port.

The continuity of the distribution of cargo handling function compared with the urban oriented functions in all the South Docks sections became more fragmented. In the first two of the five study periods the predominance of the docks and associated warehouses was accounted for by very small land use proportions. Then when the critical value 1.10 was applied, this specific function was concentrated in 1965 in only three sections, and in four sections in 1970. This concentration of the cargo handling function permitted some urban and mixed oriented functions to take place. This can best be seen in section S4, as it has become an important location for offices and services, commercial, developed open space represented by car park areas as well as some manufacturing workshops.

However, it should be mentioned that after the official closing down of the South Docks in 1972, some activities remained in operation, but in such a minor proportion that they did not influence this analytical study of these docks. Such activities can be identified as some workshops in section S4, in addition to some storage functions in section S5. Those activities were not sufficiently important to be considered.

When the South Docks ceased operation, all of the land use remained idle during the period up to the beginning of the 1980s. In 1981, attention was given to the South Docks by the Merseyside Development Corporation (MDC). A massive engineering programme got under way for the reclamation and servicing of the entire Liverpool South Docks system, as well as the riverside. Rapid progress has also been made on the phased revival strategy for almost all of the area extending from Albert Dock (section S1) up to the end of the Dingle terminal (section S8). Dramatic environmental improvements are also taking place above ground. The restoration of Albert Dock warehouse buildings in section S1, is now near completion. The redundant transit shed buildings have been demolished to be replaced by residential areas on the Kings Dock site (section S2). The first stages of the riverside walk extending from Pier Head to Otterspool at the end of section S8 have been completed, including the promenade/esplanade works at Otterspool and Herculaneum Dock (section S7). The fruit of this successful strategy was the International Garden Festival which opened in 1984 and occupied part of Dingle terminal site (section S8).

Although this development strategy adopted by the MDC is concerned with the entire South Docks, many of the projects included are still under construction, with the exception of two projects: the Albert Dock which is located in section S1 and the Garden Festival site in section S8. These two projects were largely completed before 1985. For illustrative purpose those two enterprises are the only restoration work taken into account in this analytical study concerning the port of Liverpool.

As mentioned before, the entire South Docks remained vacant in the period from 1972 to 1980. In the last five years the specialisation of land use of the previous two sections ranged from vacant to recreation areas. It is also to be expected that the rest of the South Docks sections will be changed to urban orientation activities represented by residential, commercial and development open space, in addition to some general and light industries in the next five years.

The separation of port functions from the urban functions is indicated in Tables 6.2, 6.3, 6.4, and 6.5. However, to facilitate the differentiation between the overlapping urban oriented functions and the cargo handling function in each section, it was necessary to prepare Tables 6.6 and 6.7. From a first glance, it is obviously noticeable that the decline in the frequency with which sections with a specialisation in the cargo handling function coincides with case which have specialisation in some other land uses. For example, in Table 6.6, in 1965, there were thirty nine overlaps, eighteen of them with urban oriented land uses. In 1985 this number was reduced to twenty four overlaps, with eleven of them with urban oriented land uses. However, when the critical value 1.10 is applied, Table 6.7 reveals that in 1965 there were twenty two overlaps and eleven of them were with urban orientation, while in 1985 there were twenty one overlaps with just nine of them with urban oriented land uses. Also in the previous tables, it can be noticed that there was a slight revival in the land use specialisation during the first five years of the study time 1965-70, as

Table 6.6:

Separation of the port function from other land uses as shown by number of times docks and associated warehouses and storage open space and other land uses have location quotient more than 1.00 in the same waterfront sections.

	R	O	C	W	DS	PA	T	M	V	H	Total
1965	2	5	5	0	6	9	9	3	0	0	39
1970	2	5	5	0	6	10	9	3	0	0	40
1975	0	3	6	0	7	7	6	3	0	0	32
1980	0	2	4	0	6	6	6	3	0	0	27
1985	0	2	4	0	5	5	5	3	0	0	24

Table 6.7:

Separation of the port function from other land uses as shown by the number of times docks and associated warehouses and storage open space and other land uses have location quotient more than 1.10 in the same waterfront sections.

	R	O	C	W	DS	PA	T	M	V	H	Total
1965	1	2	3	0	5	4	4	3	0	0	22
1970	1	3	4	0	5	7	6	3	0	0	29
1975	0	3	6	0	5	7	5	3	0	0	29
1980	0	2	4	0	5	5	5	3	0	0	24
1985	0	2	3	0	4	5	4	3	0	0	21

Abbreviations

R = Residential.
O = Offices and Services.
C = Commercial.
W = Warehouses (other than shipping).
DS = Developed Open Space.
PA = Public Administration
T = Transport (other than shipping).
M = Manufacturing and Utilities.
V = Vacant.
H = Others.

indicated by the number of the overlaps in both the two tables. These changes can probably be explained by the fact that the introduction of the new technology of the shipping industry in that time had a great influence on the land use specialisation of Liverpool port, particularly after the introduction of the Ro-Ro and container systems.

6.6 SUMMARY OF FINDINGS

The introduction of the new technology in both sea and land transport was accompanied by considerable changes in cargo handling techniques. Both of the two revolutions have had substantial influences on the land uses of many ports. As a response to these changes, some ports have taken up new locations and expanded in size inside or outside there areas. Others have shrunk and contracted in size.

The port of Liverpool has received this message of new technology a bit later than other UK ports. Its responses were a combination of investment and rationalisation. Thus, when the confrontation between the new technology and the port began in the mid 1960s, the state of different parts of the port varied between revival and decline.

In the period extending from 1965 up to 1973, many of the land use characteristics of the port were transformed. The big investment was in the establishment of the Royal Seaforth Complex at the far north of the port, while the rationalisation can be represented by the closure of the entire South Docks.

In spite of the short time of the analytical study concerning the changing function of land use of the port, the outcome was obvious and clear. Decline is the dominant feature of at least 50 percent of the port estate. An obvious consequence of the adoption of new technology was the concentration of the most of cargo handling activities in the northern part of the port, where the new techniques were established, while the rest of docks faced dilapidation.

The study also revealed that the urban function in the waterfront area did not experience many changes during the study time. Before 1972 this function existed in remarkable proportion, especially in the areas adjacent to Liverpool city centre. However, after the closing down of the South Docks the activities with an urban orientation decreased. At the same time, these activities distributed among all the surviving docks in the North Docks area. Other activities, such as manufacturing and utilities, showed some development during the period of the study.

From this study it can be seen that there was specialisation in the land use function of the waterfront. However, at the same time, the separation between the port functions and other urban functions was not clear. This means that in almost all of the waterfront sections which display a high degree of specialisation in cargo handling function, there were also some specialisation in one or two urban functions.

This can better be explained by the fact that, because of the huge amount of land devoted to the cargo handling activities in each section, the port has had to adapt itself in order to serve the principal port function, by providing supplementary activities. These may be represented by customs offices, canteens, and parking areas, which are considered to be urban activities.

At the beginning of 1980s, the idea of ulitizing the abandoned South Docks was pursued. A series of ambitious projects have been introduced by MDC which are aimed at the restoration as well as the rehabilitation of the entire South Docks area. This redevelopment strategy will be discussed in greater detail in chapter Seven, section 7.5.3.

Now, many of these works are still in progress, but the fruit of this successful strategy have already matured in two locations in the South Docks - the Albert Dock Complex and the International Garden Festival site which opened in 1984. At the same time, the port of Liverpool has also adopted a new policy to push on the process of readjustment and redevelopment of the current dock estate located in the North Docks.

6.7 THE IMPACT OF THE PORT ON THE CITY LAND USE

As mentioned earlier in the theoretical section, there are five principal port related activities which represent the direct and indirect impact of the port on the land use of the city. These activities are considered to be, port related employment, transportation and its related activities, commerce, services, and manufacturing industry. An examination of these five activities in the cityport of Liverpool will enable the delineation of the actual impact placed by the port on the land use and the changing characteristics of the city.

6.7.1 Port Related Employment

According to the 1977 Annual Census of Employment, the port of Liverpool and its related industries accounted for a significant number of employment opportunities locally (as indicated in Table 6.8), representing 12.8 percent and 11.5 percent of the employment in Liverpool and Merseyside respectively. However, throughout the recent history of the port, the employment patterns have met radical changes, especially in the 1960s and early 1970s (Gilman, 1982 and Stoney, 1984).

Three fundamental factors have contributed to such changes. In summary, the first is related to the demand for labour in terms of casual employment. This was the main feature of the traditional handling methods before the introduction of new technology. The second is concerned with the transition from a labour intensive industry into one which relies on a smaller labour force and, at the same time, employs large capital resources to undertake work with different characteristics. The third factor has been the decline of traditional stevedoring activity (Gilman, 1982, p.34).

In the last twenty years or more the problem of casual dockers, as well as the port related employment as a whole, has been searching for a solution. Many attempts, mainly in the form of redundancy schemes, have been introduced. All these schemes aimed to improve the regularity of dock work, and at the same time to reduce the number of casual dockers.

Three main schemes have been introduced, and were the principal factors behind the enormous reduction that has befallen port employment. The first, introduced in 1965 under the name of the Devlin Committee of Inquiry, included recommendations for the substantial reduction in the number of dockers. These recommendations were implemented in 1969 through the second scheme which was called the Revised Dock Workers Employment Scheme. In

Liverpool, this scheme resulted in at least 1,700 dockers losing their jobs.

Table 6.8:
Employment in Port activities and Port-related industry for Liverpool and Merseyside in 1977

MLH	Industrial Activities	Liverpool No	Liverpool %	Merseyside No	Merseyside %	Liverpool as % Merseyside employment
706	Port and Inland Water Transport	9,763	3.3	11,595	1.9	84.2
705	Sea Transport	6,233	2.1	9,510	1.5	65.5
709	Miscellaneous Transport & storage	5,813	2.0	7,920	1.3	73.4
482	Packaging Products	3,150	1.1	4,965	0.8	63.4
240	Tobacco	2,882	1.0	2,882	0.5	100.0
214	Bacon curing, etc.	2,079	0.7	4,846	0.8	42.9
216	Sugar Refining	1,860	0.6	2,390	0.4	77.8
217	Cacao, Chocolate and Sugar	1,641	0.5	5,410	0.9	30.3
221	Veg. & Animal Oils	1,139	0.4	2,249	0.4	47.7
370	Shipbuilding	1,106	0.4	8,823	1.4	12.5
274	Paint	881	0.3	1,024	0.2	86.0
229	Other Food Indust.	786	0.3	3,413	0.5	23.0
219	Animal and Poultry	437	0.1	1,141	0.2	38.3
211	Grain Milling	395	0.1	880	0.1	44.9
275	Soap and Detergents	126	0.04	4,030	0.6	3.1
	T O T A L :	38,291	12.8	71,078	11.5	53.9

Source: Annual Census of Employment 1977.

The third scheme was the Aldington-Jones Severance Scheme, which was introduced in 1972. This scheme was the first in a series of severance schemes aimed at reducing the number of redundant dock workers as a solution to the problem of chronic surplus of labour force. The port lost 2,800 dockers and as a result for a time even suffered a serious labour shortage.

As a result of the complete introduction of the new technology, the port was compelled to take further steps to get rid of surplus employment. This action has been achieved through policies adopted by the MDHC, and followed in the footsteps of the earlier severance schemes (Gilman, 1982). Table 6.9 records for the period 1965 to 1986 the changes in the numbers of the registered dock workers of Liverpool port as well as the major events and number of redundancies caused by these events.

From the analytical study of port related employment it appears that the employment structure has changed dramatically toward decline from the 1970s. This decline has had a considerable impact on the city land use patterns. This impact can best be perceived through the housing demand placed by the city's population. In the 1970s, there has been a combination of fertility decline and net outward migration of population (Lawton, 1982 b, p. 162). Consequently, as the number of people declined the demand for housing has also been reduced substantially in the last decade, especially in the inner areas. This became evident from the number of abandoned and deserted houses, particularly in the inner areas adjacent to the South Docks. So, one has to recognise that the port related employment has had a marked effect on the land use characteristics of Liverpool city. Furthermore, the decline that has affected the port and its related employment has led in turn to a loss of jobs in other parts of the local economy associated with the city's maritime trade, including railways, haulage, insurance and banking sectors (Chape, 1982, p. 170).

Table 6.9: The Registered Dock Workers employed in the port of Liverpool with the number of redundancy each year

Year	No. of R.D.W.	No. of Redun.	Remarks
1965	13,400	—	
1966	13,300	—	
1967	12,214	1,700	1967 Dock Worker
1968	11,900	—	Employment scheme
1969	12,200	—	
1970	11,400	—	
1971	10,800	—	1972 Aldington-Jones
1972	10,700	2,800	Severance Scheme and
1973	8,700	—	the South Docks closed
1974	7,800	—	
1975	7,700	—	
1976	7,500	426	Off
1977	6,800	—	
1978	6,600	240	Off (Policy of
1979	6,200	684	... the M.D.H.C)
1980	5,400	421	...
1981	4,800	1,188	...
1982	3,600	1,063	...
1983	2,500	167	...
1984	2,300	236	...
1985	2,100	68	...
1986	2,000	230	...

Source: National Docks Labour Board

6.7.2 Transportation and Associated Activities

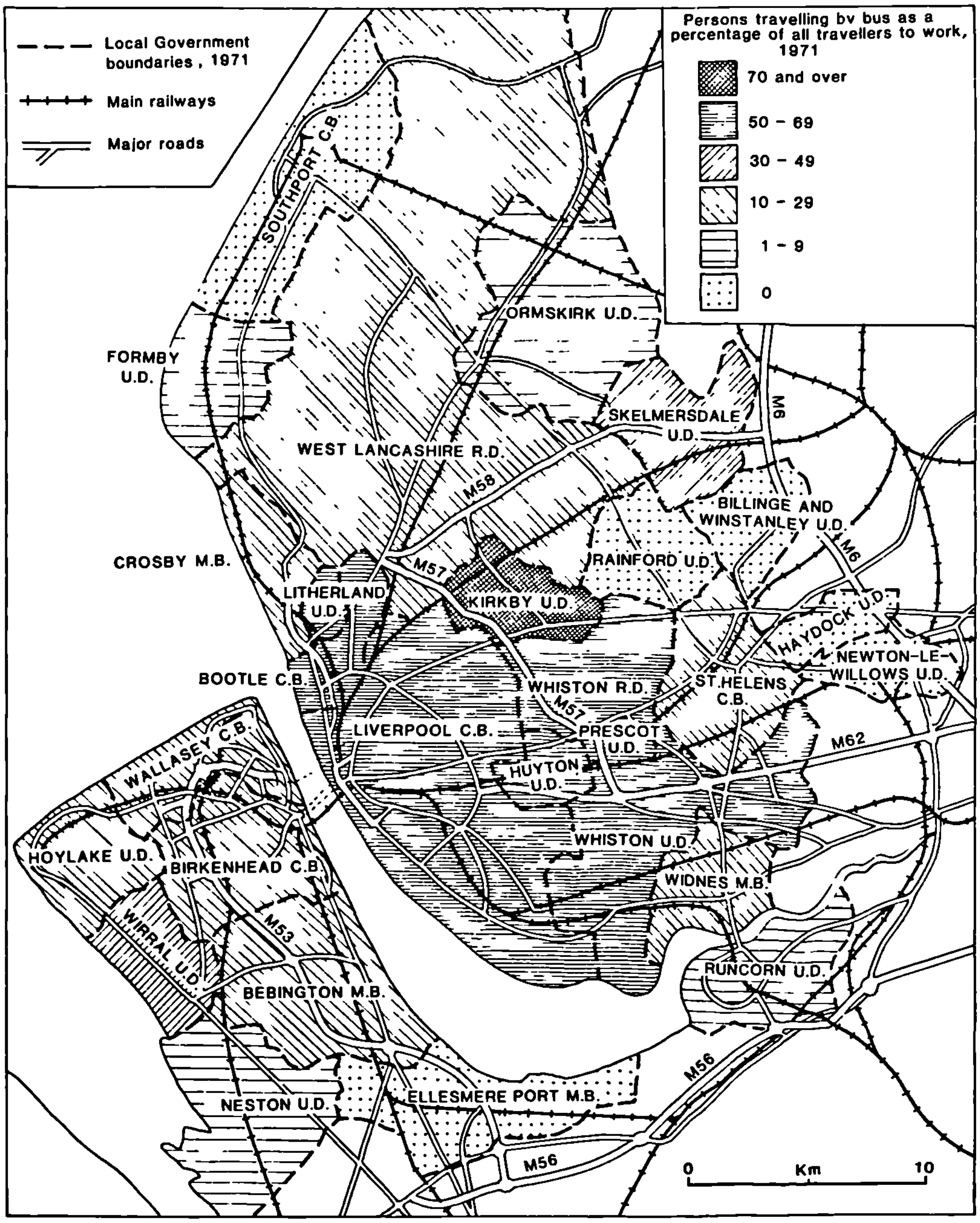
"Liverpool's position as a port ensured the development of a radiating pattern of inter-urban routes, strengthened by recent investment in trunk routes" (Halsall, 1982, p.69). The location of Liverpool on the west coast has put some restrictions on its connection to the motorway network. Liverpool ranks twenty-eight (equal to Cambridge and Darlington) and Birkenhead twenty-third in relative accessibility rankings of thirty-nine British major towns connected by motorway network of the mid 1980s (Williams, 1977). Merseyside in general and Liverpool specifically now have three motorway links with the M6, the M58 and two major east-west routes (M62 and M53/M53/M56) to Manchester and beyond. In addition, local rail facilities are well connected with the rest of Britain as indicated in Figure 6.11.

However, the traffic generated by the port is mainly carried by road transport, and only a small proportion by rail. This road traffic does not have a significant affect on the city land uses because, according to the roads improvement policy, these road networks have to by-pass areas of congestion (although this is no longer a serious problem); to provide good access to industry; and to relieve environmental problems in older areas with an inadequate local road system (Halsall, 1982). Meanwhile, other port related communications are well established and do not have any notable impact on Liverpool's land use patterns.

6.7.3 Commerce

Although the port of Liverpool is a great seaport in the north west with a wide potential hinterland, the impact of the commercial

Figure 6.11: Merseyside; basic transport infrastructure, 1982, and journeys to work to Liverpool city centre by bus, 1971 (based upon Ordnance Survey map).

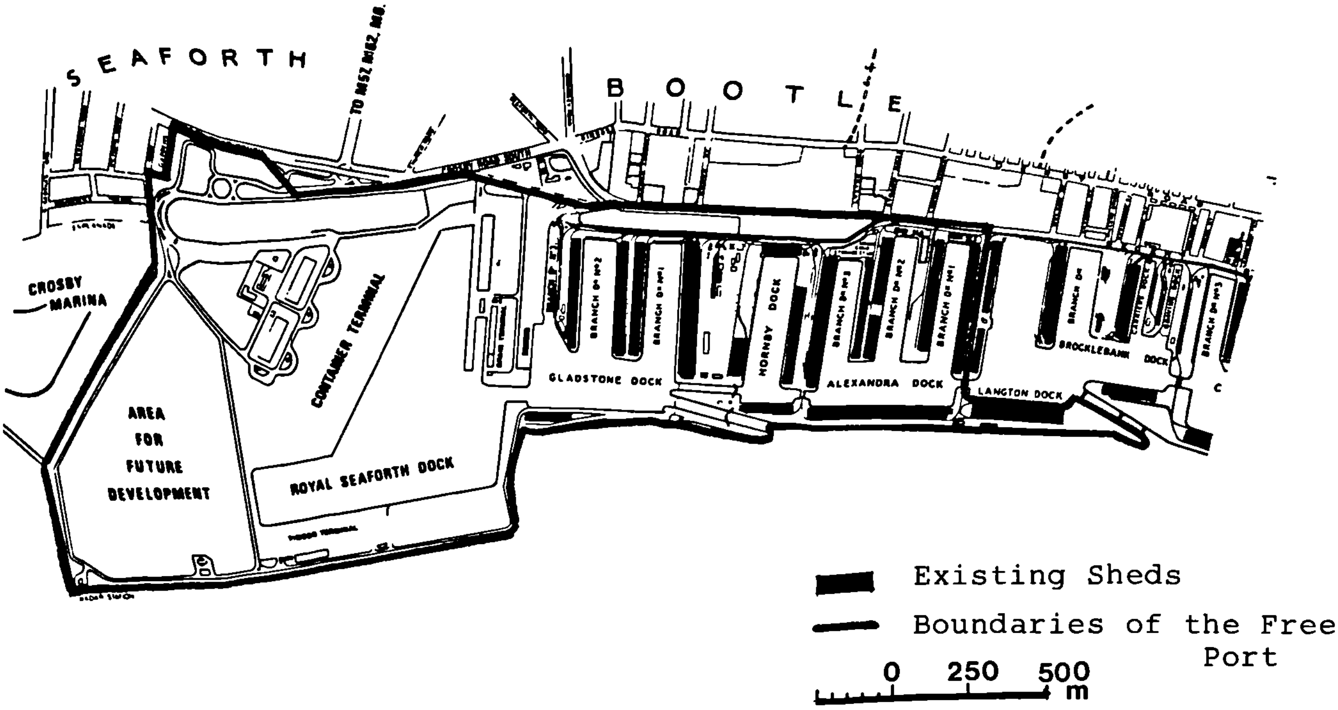


Source: Halsall, 1982 p. 70

activities in terms of distributional and wholesaling functions on the city land use may be considered extremely negative. However, after the recent conversion of the northern part of the North Docks to the role of a Free Port, Liverpool has entered a new era of distribution and wholesaling trade. In general terms a Free Port is an area where manufacturers, traders and agents can function without payment of customs' duties. Therefore, because of this great benefit, Free Ports are always expected to attract industrial and commercial development. Furthermore, in some cases, especially in developing countries, free zones have been established primarily to encourage industrial exports; in other cases, especially in North America, the main objective has been to increase employment, frequently related to manufacturing or processing of goods ultimately imported (Pollock, 1981, p. 37).

The latter objective is consistent with the main objective behind the establishing of the Liverpool Free Port. This Free Port is a 650 acre zone comprising Alexandra Dock, Gladstone Dock and the Royal Seaforth Complex. It has also nearly 30 acres of land available for both industrial and commercial development. In addition, the~~s~~re are ~~to~~ more than 200,000 sq feet of sheds and warehouses for storage facilities (as illustrated in Figure 6.12). The advantage of the modern port facilities on one hand, and the organised roads and railways network on the other, will contribute much in promoting the important role of this Free Port. Consequently, the role of both the distributional and wholesaling function will be enhanced.

Figure 6.12: The site of Liverpool Free Port



Source: Mersey Docks and Harbour Company

6.7.4 Services

The traditional typical location of Liverpool port, close to the city centre, has encouraged most of the port related services to be concentrated in the central zone between the South and the North Docks, in the area known as "Pier Head". The headquarters of many shipping lines and shipping agents are located in the Port of Liverpool Building. Other port related services, such as insurance, marine consultants and some miscellaneous business, are dispersed between the offices located in the Cunard Building and the Royal Liver Building. The financial services as well as other related activities occupy floor space in different office buildings in other parts of the city centre.

The repair services, on the other hand, are concentrated on the Birkenhead side, although some are found in Bootle and Seaforth areas in front of the Free Port on the Liverpool side. However, it should be mentioned that before the closing down of the South Docks some small firms and repair services were located in Strand Street and Sefton Street in the south part of Liverpool.

From the previous review it seems that the impact of the port related services on the land use characteristics of the city of Liverpool has taken two directions. In the first, these services have continued positively their impact on the areas around the central and northern part of the port. In the other direction, the services have had a negative impact on land use patterns as they have left derelict land in areas located in the south of Liverpool, after the South Docks ceased operation.

6.7.5 Manufacturing Industry

In Liverpool the manufacturing industries or the port oriented industries are principally located within the port frontier or just across the main dock road. These industries are mainly related to food processing. For example, Kelloggs Mill and Allied Mills are located in front of the grain terminal which is part of the Seaforth Complex. The Contisoya Plant is situated in Gladstone Dock, while the United Molasses Tank Farm occupies a location outside this former dock. In addition, Alexandra silos are located in Alexandra Dock. Other port related industries, notably, United Molasses pipeline/berth, Huskisson Transit Conveyer berth, A.S. Jones Tank

Farm, and J. Bibby and Son's facilities are distributed among terminals extending from Waterloo Dock to the Alexandra Dock in the North Docks, as was indicated in Figure 6.3.

Meanwhile, it is recognised that the impact of these manufacturing industries on the city land use can be largely ignored because of the modest scale of these industries in relation to overall city land use patterns.

Finally, it is evident that Liverpool city and the county of Merseyside have great potential as areas of car manufacturing as illustrated by the development of Ford at Speke and Vauxhall at Ellesmere Port, plus associated motor components firms, notably at Kirkby. Thus it is perhaps surprising to find that the main car manufacturer which relies upon the port for exporting its products to the USA is Jaguar, which is located in the Midlands.

6.8 SUMMARY AND CONCLUSION

This chapter is the second relating to the empirical aspects of the research. It has concentrated principally upon the analysis of the case study of Liverpool cityport. The chapter was initiated by a comprehensive historical review of the port. This provides an understanding of how a number of factors have been associated with the evolutionary stages of development of both the city of Liverpool and the county of Merseyside in connection with the development of the port. A general overview has been outlined of the changes that have affected the employment structure of the city as well as the economic conditions.

The study of the port structure and facilities has revealed that, according to the technological changes have affected the maritime industry, the port has lost almost 50 percent of its land use activities with the closure of the entire South Docks. Meanwhile, it appears that among the major benefits of this new technology was the opening of the up to date Seaforth Container, Timber and Grain Complex, in the far north part of the port. Meanwhile, the description of port related activities has indicated that all the port's activities are now concentrated in the North Docks and in part of the Birkenhead side of the Mersey.

A detailed land use analysis of the port waterfront, extending over the last twenty years, has shown that Liverpool port has experienced enormous changes in the land use characteristics as a response to the new technology. This response was a combination of investment and rationalisation. The establishment of the Seaforth Complex was the big investment, while the ceasing operation of the South Docks was the main feature of the rationalisation that affected the port.

The ambitious regeneration programmes introduced by the Merseyside Development Corporation at the beginning of 1980s have mapped out a future for the entire South Docks. These programmes are aimed at the restoration as well as the rehabilitation of the abandoned and idle docks and deserted warehouses. The practical application of this redevelopment policy can be seen in several locations within the South Docks. However, the most notable projects remain the International Garden Festival and the Albert Dock.

The final section of this chapter dealt with the impact of the port as a component of the set of functions that influence the land use patterns of the city. This impact has been identified through the examination of the five fundamental activities which drew attention to the relation between the port and its city in terms of land use implications.

As a main finding, it has been found that the port of Liverpool has a substantial impact on the city land use patterns. The examination of this impact has revealed that, the decline that befell the port employment sector has been reflected in turn in housing demand which has reduced dramatically, especially in the inner areas of the city. Also it has been found that other port related activities, such as services, have two diverse impacts on the land use of the city. These service activities continued their positive impact on the land use of some areas around the northern part of the North Docks, while they left negative impact in the form of derelict land around the South Docks.

Other port related activities, such as transportation, commerce and manufacturing industry, are considered to have had a negligible impact on the land use patterns of the city.

CHAPTER SEVEN

CHAPTER SEVEN

COMPARATIVE STUDY: LIVERPOOL AND ALEXANDRIA

7.1 INTRODUCTION

The role of comparative analysis in planning studies has been the theme of many controversies among planners for at least the last thirty years. The interpretation behind using these methods has varied, but it can be summarized and defined as "the study of planning problems and the practical value of solving these problems in different countries in relation to the institutional context of respective countries" (Masser, 1984, p.140). In other words these comparisons can be either related to the benefits of learning from the experience of others in dealing with specific planning problems, or to helping to establish and develop general planning theory on an inductive basis.

It is with these theories in mind that this chapter discusses the impact of the technological changes in the maritime transport industry and the cargo handling techniques on the land use patterns of the two ports of Alexandria and Liverpool. The materials obtained from the previous two case studies, together with the technique of comparative analysis, have been adopted in order to find out whether there are particular similarities or differences in the general characteristics of land use patterns or functional differentiation of the two ports and the urban spaces linked to these port systems. The principal aim is to identify the lessons which can be derived from the experience of Liverpool port in dealing with particular land use problems. The extent to which these lessons are likely to be both relevant and beneficial to Alexandria will be considered.

This cross national comparison is presented under four main headings, which are as follows:

Evolutionary stages of port development;
General parameters;
Technical parameters; and
Lessons to be considered.

7.2 EVOLUTIONARY STAGES OF PORT DEVELOPMENT

The two cities of Alexandria and Liverpool were initially established as port cities. There is no synchronization between the construction of the two of them, as Alexandria was founded by Alexander the Great in 332 B.C. while Liverpool was established according to King John's charter in 1207. Through the main stages of development of the two ports there are no striking similarities as each followed its own historical sequence. Only one aspect of similarity can be noted. In both the ports, the original site did not change. In Alexandria the location of the port was the same from the day of establishment. Similarly in Liverpool, the nucleus of the port has never migrated more than six hundred yards from the site it first occupied (Bird, 1963, p. 277).

The breakthrough stages of the two ports began with the introduction of the industrial revolution in the late eighteenth and early nineteenth centuries. In Alexandria, the exporting of cotton to England and the establishment of the ship building yard were the principal signs of that revolution. In Liverpool, the impact of the industrial revolution took the shape of opening up new areas of trade with the Caribbean and North America, as well as the construction of the first industrial and commercial dock system (Lawton, 1982, p.1). While Liverpool was taking its rate of growth from the establishment of the great industrial, export, and import zone that was its hinterland, Alexandria was less advanced in terms of port development. The construction of a new integrated port system took much longer to achieve than the corresponding system in Liverpool.

It was not before the late 1950s and early 1960s that the two ports had to meet dramatic changes in their evolutionary profile. In Liverpool the beginning of the 1960s was the time at which the new technology was introduced. This has led the port to face changes in traffic, employment, land uses and economic conditions. Alexandria with its less advanced facilities was facing an enormous growth in the volume of trade and traffic passing through it, especially after the Suez Canal crisis in 1956, and the shifting of seaborne trade from the canal zone.

The further turning point for the two ports occurred simultaneously at the beginning of the 1970s. In Liverpool many of the physical characteristics of the port changed dramatically. This began with the closing down of the South Docks in 1972 and the opening of the up-dated Seaforth terminal. Meanwhile in Alexandria the situation was different as the port had to face a mass of problems in the form of congestion and huge accumulation of cargo, particularly after the 1973 War. The new economic policy adopted in 1974, known as the Open Door policy, made conditions in the port even worse.

The period from the mid 1970s up to the early 1980s is considered to be a period of great contrast between the two ports. Liverpool lost much of its trading share, and there was a distinct drop in the tonnage of traffic passing through the port. Thus, the port began to suffer from extreme decline. Alexandria, on the other hand, had to face the introduction of new technology which has compounded the problems which were created before and increased the underlying deficiencies of the port.

Since 1982 and up to now, the active area of the port of Liverpool has contracted to half of its former size. All the activities are now concentrated in the North Docks. In contrast, in Alexandria the disturbing nature of the magnitude of the problems outlined above is likely to be solved by the establishment of the new port of El-Dihkeila located just a few kilometres from the original port.

Throughout this chronological development there have been points in which both ports have had to meet significant and remarkable changes which have had inevitable affect on their future.

7.3 GENERAL PARAMETERS

In order to compare the ports of Alexandria and Liverpool in terms of general parameters it is necessary to examine measures which define the geographical location, site and situation, areas and patterns of trade as well as the socio-economic factors affecting each port.

7.3.1 Geographical Location

The two ports in question are located in cities within very different countries. Each of them is located next to a significant body of water. Alexandria is located on the Mediterranean sea at the western end of the Nile delta, while Liverpool is situated on the River Mersey in the North West England. The two ports occupy quite considerable areas of land, faced or bounded by an enormous areas of water. Alexandria's land area is about 1,063,000 sqm, and the water area accounts for 7,500,000 sqm. This represents a ratio between land and water of 1:8. In contrast, the port of Liverpool occupies about 4,416,000 sqm, and the water area is 2,145,000 sqm, making the ratio between land and water about 2:1. This makes the area of Liverpool four times that of Alexandria.

7.3.2 The Site and Situation

The early traditional ports were generally located close to the centre of the coastal cities they served. In Alexandria, the functional activities of the city centre waterfront became associated with activities with a port orientation. In addition, the port is naturally sheltered by an offshore reef running roughly parallel to the shoreline. In the absence of any significant tide or littoral drift, this was beneficial to the construction of berths and quays to take advantage of the natural harbour.

In Liverpool the site of the port in relation to the city centre is similar to that of Alexandria. Yet, there are differences in the construction of the docks. The quay system is designed in such a way as to provide the operational land needed without wasting coast line by using the pier-type configuration. Furthermore, the estuary of the River Mersey is considered to have a large tidal range. Thus, it was necessary to create impounded water for port operation by using a system of locks.

7.3.3 The Areas and Patterns of Trade

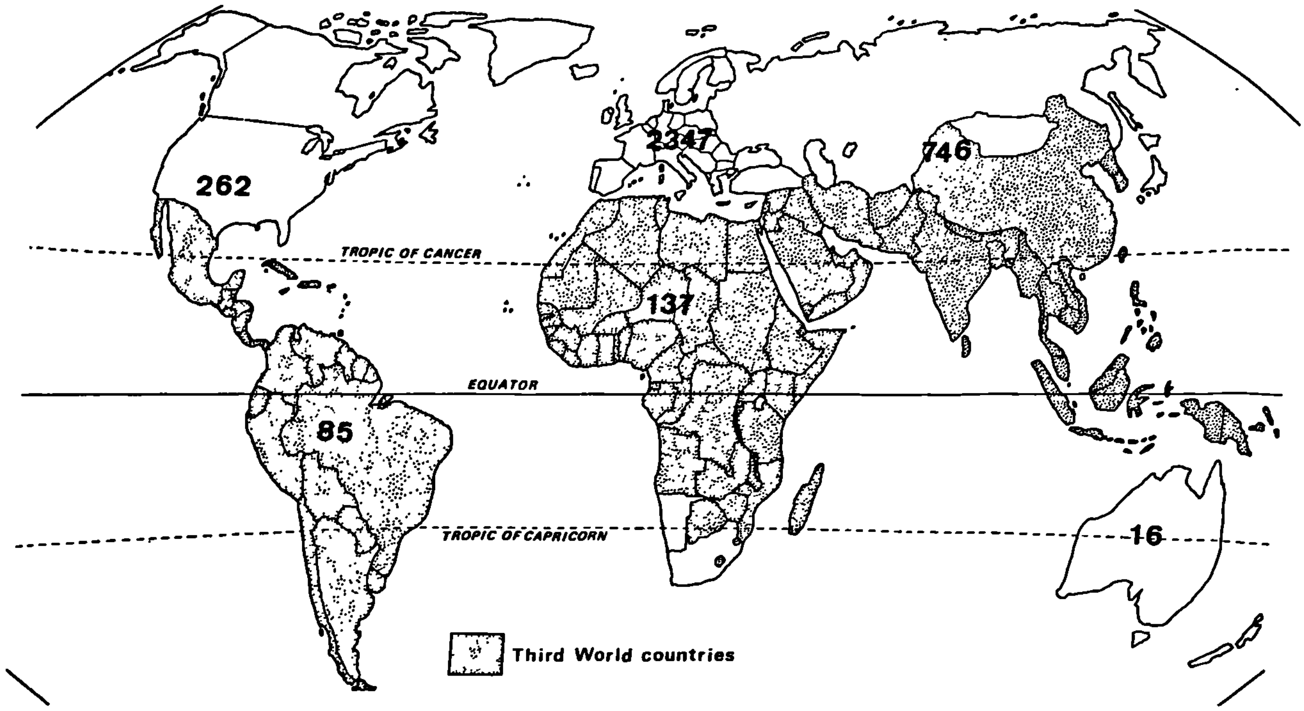
Alexandria is considered to be mainly a short sea general cargo port. Because of its location on the Mediterranean, more than 65 percent of its foreland deals with Europe, 20 percent with Asia and the rest distributed among the Americas, Africa and Australia. In Figure 7.1 the map shows the number of ships calling at Alexandria according to the geographical distribution of the continents.

A major feature of the port of Liverpool used to be its role as a deep sea general cargo port. However, partly as a result of geographical factors and partly as a result of its performance, Liverpool has lost its market share within the deep sea port sector (Gilman, 1982, p.29). Currently the areas of traffic can be considered to be near sea, which includes Ireland and some of the west coast of Europe, short sea, which includes North Europe and the Mediterranean, as well as what remains of the traditional deep sea which includes, South, East and West Africa, the East and far East of Asia, the Americas, Australia and some of the Atlantic Islands (Stoney, 1984, p.46). The map in Figure 7.2 showing the world trade through Liverpool and indicates the proportion of trade to and from Europe as well as the deep sea.

A comparable characteristic of the two ports is that both are mainly general cargo ports. They also share characteristics of commodities which can be referred to as, break bulk cargo, bulk and semi bulk cargo, containerised cargo, and ro-ro cargo. Considering the similarities in the trade patterns of the two ports, the hinterland of each one is substantially different and varied in definition.

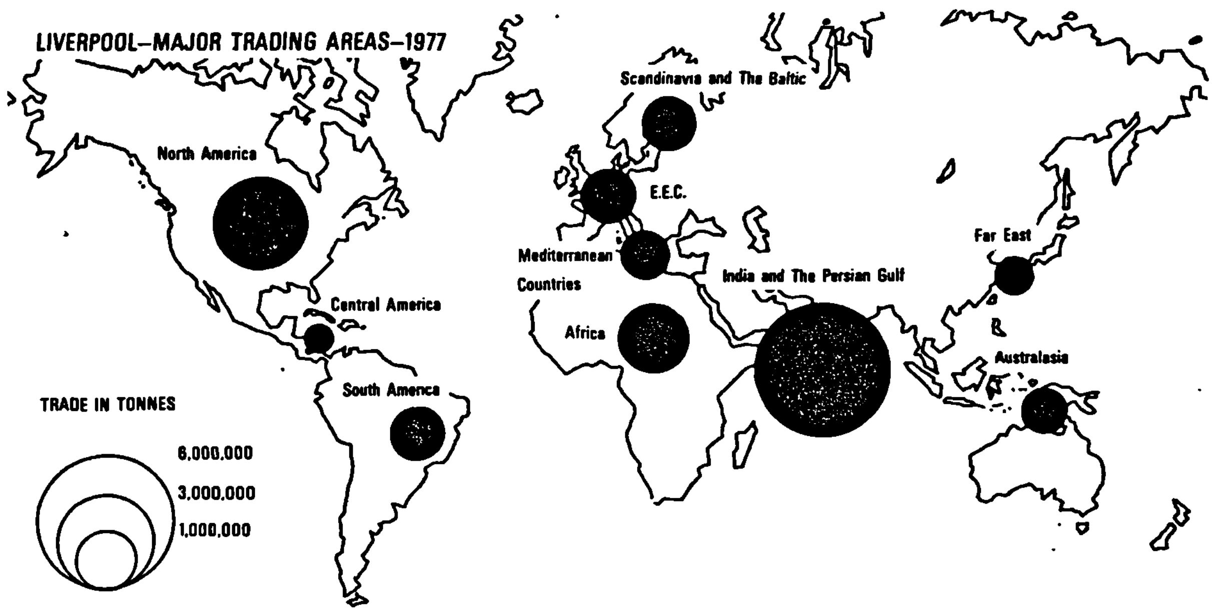
Alexandria is Egypt's main port. It handles about 70 percent of the country's foreign trade. Therefore, the hinterland of Alexandria port can be defined not only as the city and its suburbs

Figure 7.1: Number of ships calling at Alexandria port in 1984 according to the geographical distribution of the continents of origin.



Source: Alexandria Port Authority year book 1984, p.34

Figure 7.2: The port of Liverpool's major trading areas in 1977



Source: Stoney, P. 1984, p.49

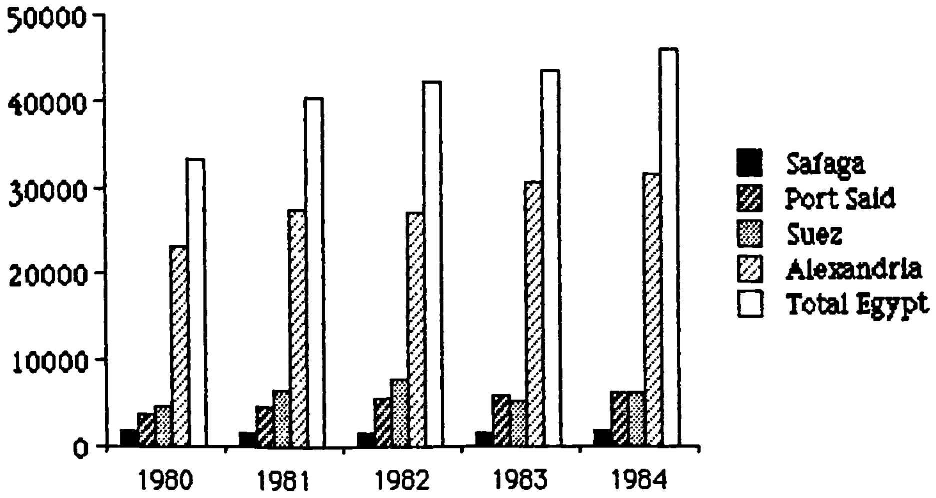
and the surrounding region, but also the entire country. Figure 7.3 illustrates the volume of the Egyptian foreign trade passing through the four main gateways of Egypt over the five year period 1980-1984.

The Liverpool condition is different. In the past the port was considered to be the second in importance to London (Lawton, 1982, p.3). However, after the introduction of the new technology on one hand, and the disadvantage of the geographical location on the other, Liverpool lost part of its importance as a major port. Consequently, part of its hinterland has been reduced, especially when the integration between U.K. and Continental European routes was established, and U.K. joined the E.E.C. Table 7.1 shows that Liverpool's share of GB trade has fallen substantially in the last six years.

The hinterland of Liverpool can be defined according to the route of cargo and its origin. For example, for routes to the Mediterranean, Liverpool has an extensive hinterland encompassing the main exporting areas of the Midlands. On the other hand, there is a much more limited hinterland on routes to Rotterdam, and very tight hinterland on the routes to Scandinavia (Gilman, 1983, p.29). Meanwhile, Liverpool's deep sea trade, especially the North Atlantic, continues to serve a broad area of the North West and most of the Midlands.

It has been found that Alexandria's trade areas are restricted mainly to the short sea routes, while Liverpool deals mostly with a combination of near, short and deep sea trading areas. Although the structures of hinterlands of the two ports are different, this reflects the level of importance of each port within the national context of both Egypt and U.K.

Figure 7.3: Egypt seaborne trade 1980 - 1984
in (000) of tons



Source: Alexandria Port Authority year book 1984

Table 7.1: Liverpool's share of G.B. trade 1979-1984
in (000) of tons

	1979	1980	1981	1982	1983	1984
Liverpool	13.106	12,968	11.912	9.800	11.256	10.753
All G.B. Ports	184.358	377.113	370.068	419.692	427.021	445.626
Liverpool as a % of G.B.	3.4	3.4	3.2	2.3	2.6	2.4

Source: The National Port Council

7.3.4 Socio Economic Factors

In the port city system, employment represents one of the principal ways in which the port might be perceived as a contributor to city growth. Other interdependence linkages also involve considerable flows of capital which, in their turn, ultimately generate city growth with an economic revival. These two factors have had and continue to have a significant impact on port efficiency and its development as well as city growth of both Alexandria and Liverpool.

There are differences between the operating activities of the ports, in terms of the employment opportunities that they create. In Alexandria, as was mentioned before in chapter Five, the port operation has been distributed among the Port Authority, and eight different companies assembled together under the authority of the Public Sector Organisation for Maritime Transport (PSOMT). This division of operational responsibility has caused the related employ-ment rather scattered not only spatially but also functionally. In contrast, in Liverpool, the relationship between the port and its city in terms of port related employment is more accentuated. The port and associated industries accounted for 13 percent of all jobs in Liverpool (Evans, 1983). However, the total number of workers has dramatically changed in the last twenty years, partly as a result of the severance schemes, and partly as a policy of the Mersey Docks and Harbour Company (MDHC), (see chapter Six, section 6.7.1). In figure 7.4, the comparison between the total number of workers in both the ports reveals that, the employment in Alexandria had dramatically increased since 1975 following to the adoption of the economic policy known as the Open Door policy.

In contrast, the number of port employees in Liverpool has substantially declined.

Parallel to the changes in port employment, in Alexandria the Open Door policy has also had a substantial influence on the economic structure of the port and the city. The changes in the volume of exports and imports passing through the port in the last twenty years reveals that there was a slight increase in imports in the first nine years (1964-73). Then as a consequence of the Open Door Policy, the rate increased suddenly after 1974 by 3.2 million tons, while the rate of exports decreased by 0.6 million tons, as indicated in Figure 7.5.

On the national level, between 1973 and 1981, merchandise impacts increased more than fivefold. The average growth rate comes out at 24 percent per annum and even exceeded this between 1973 and 1978. During this five years period, exports only doubled (a growth rate of 14 percent annually nevertheless) (Daniels, 1983, p.70). In Figure 7.6 the discrepancy between the total exports and imports have been displayed. The trade gap between them occurred as consequences of the Open Door policy adopted by the government at that time.

The economic condition of Liverpool port provides some justification for the use of the severance schemes and similar measures adopted by the MDHC. The total tonnage handled by the port in terms of exports and imports fell dramatically, as shows in Table 7.2. This indicates that the total foreign and coastwise traffic of the port fell from 31.6 million tons in 1965 to only 10.8 in 1984, a decline of 66 percent (including petroleum).

Figure 7.4: Employment in Alexandria and Liverpool

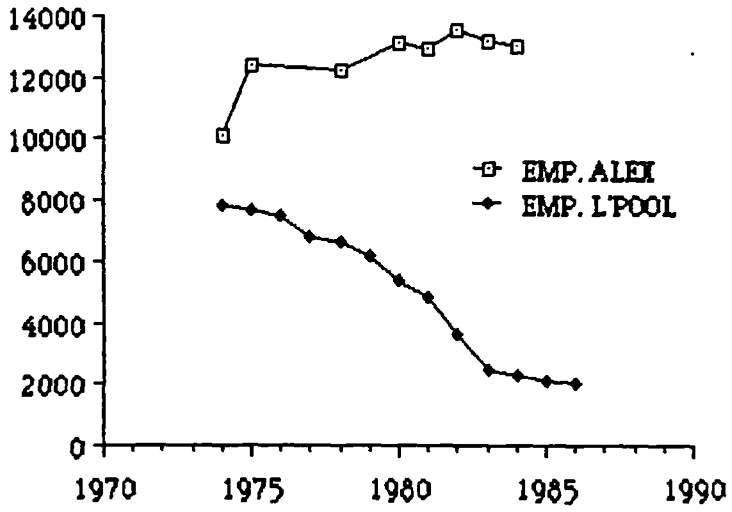
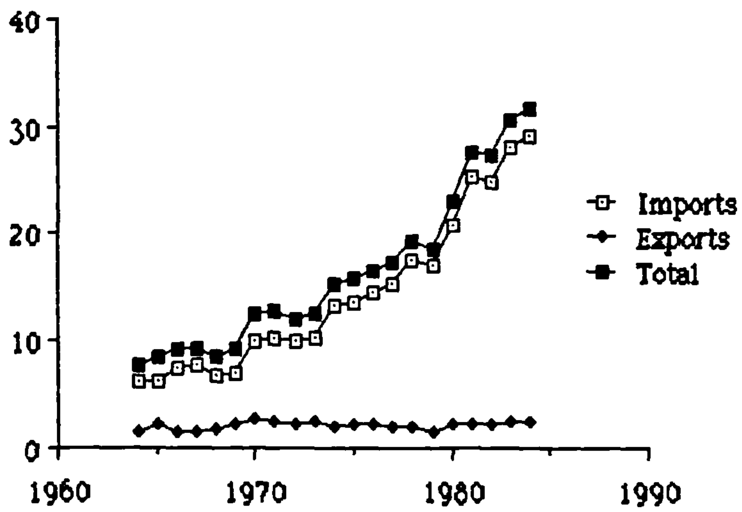
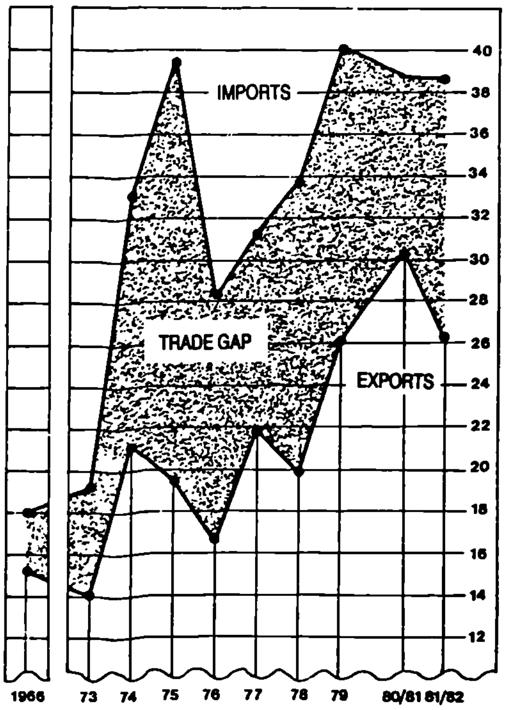


Figure 7.5: Imports/Exports through Alexandria port 1964-1984 in Million of Tons



Source: Alexandria Port Authority year book 1984

Figure 7.6: The macroeconomic outcome of the Open Door policy



Source: Daniels, C. 1983, p.50

Table 7.2: Total foreign and coastwise traffic passing through Liverpool* between 1965-1984 in (000) of tons

Year	Foreign Traffic			Coastwise Traffic			Total
	Import	Export	Total	Inwards	Outwards	Total	
1965	19,893	5,038	24,931	3.527	3.202	6.729	31,660
1966	19,608	4,831	24,439	3,495	2,530	6,024	30,463
1967	18,500	4,186	22,687	3,287	2,044	5,331	28,018
1968	20,099	4,523	24,622	3,162	1,427	4,589	29,211
1969	19,435	4,640	24,076	3,161	1,608	4,769	28,844
1970	19,678	4,349	24,026	3,184	1,640	4,825	28,851
1971	23,316	4,342	27,658	2,601	1,053	3,655	31,312
1972	20,082	3,365	23,438	2,500	1,024	3,523	26,961
1973	20,886	3,342	24,228	1,930	1,098	3,027	27,255
1974	22,168	3,172	25,340	1,410	1,049	2,459	27,798
1975	18,399	3,404	21,802	968	953	1,921	23,723
1976	17,575	3,162	20,737	498	995	1,493	22,230
1977	13,090	3,043	16,133	491	1,032	1,523	17,656
1978	10,273	2,984	13,257	491	1,028	1,519	14,775
1979	7,938	2,453	10,391	1,557	1,157	2,715	13,106
1980	5,950	2,163	8,113	3,738	1,117	4,855	12,968
1981	5,251	2,689	7,940	2,707	1,265	3,972	11,912
1982	5,311	1,743	7,054	1,876	871	2,747	9,800
1983	5,431	2,019	7,450	2,657	1,149	3,805	11,256
1984	5,146	2,339	7,485	2,427	841	3,268	10,753

* Including Birkenhead, Bromborough Dock and Gareston.
Source: National Port Council

The analysis of the port related employment of the two ports reveals that in Alexandria port the labour force was changed once by a political decision. In Liverpool, three political decisions have contributed to these changes in this sector. On the other hand, it seems that Alexandria port's dependency on labour supplied by the city is relatively constant. While in Liverpool this relation has declined as the decline affected the port, and the city no longer relies on the port as an employer. Furthermore, although Alexandria is smaller than Liverpool in terms of port area and less advanced in technology, the number of workers in Alexandria is much greater than Liverpool. This discrepancy can be attributed to two main reasons: First, the port of Alexandria is suffering as any public sector in Egypt from hidden unemployment, which means that the number of workers registered are fictitious and do not represent the true needs of the port. Second, the less advanced technology of the port permitted some conventional handling and transport methods to exist. Such methods still rely upon manpower.

In terms of economic conditions, the sum of imports in both the two ports is rather considerable in comparison to the exports. The traffic lost in Liverpool in the last twenty years is contrasted with the traffic gained in Alexandria in the same period.

7.4 TECHNICAL PARAMETERS

Throughout the above discussion of general parameters, the aspects of similarity and difference between the two ports have yielded certain common factors which contribute to the changing image of each port. Also it was notable that the two ports differ substantially enough from each other on some equally important variables. This makes the comparative analysis of their contemporary state and emerging problems fruitful and understandable. While some of these existing differences may be irreconcilable, others allow one to trace their emergent differentiation.

In this technical parameters section an attempt will be made to identify the similarities and differences between the ports in terms of the changing land use patterns, together with review of factors which account for such changes.

7.4.1 The Changes of Land Use Patterns

In the contemporary period, the survival of any commercial port is dependent on its response to technological changes affecting the maritime industry. Such responses are likely to have a great impact on the land use characteristics of these ports. In this sense, the responses of the two ports Alexandria and Liverpool to these technological changes have been reviewed and examined individually in the previous chapters Five and Six.

In this section a comparison between each individual category of the land use categories representing the land use patterns of the two ports will be carried out. The principal aim is to identify the similarities and differences between the two ports in terms of land use function and activities of each category. The land use problems which exist in both the ports will be displayed in order to set up the approach to the lessons which could be derived from the examination and the assessment of the solutions adopted in Liverpool port and their relevance to port and the city of Alexandria.

The responses of Alexandria and Liverpool have been combinations of similarities and differences. With respect to size, as mentioned earlier the area of Liverpool port is four times that of Alexandria.

The similarities between the two ports take the following four forms:

A. The two ports have grown substantially in area over the last twenty years. Much of this growth has taken the form of in-filling in the harbours to create large areas of land for cargo handling functions. For example, in Alexandria, the creation of the new container terminal in the middle side of the port, and the construction of the fertiliser quay in the west side, were the outcome of this process. Meanwhile in Liverpool, the establishment of the Seaforth terminal in the north side is the clearest evidence. The factors of increase in both ports are very similar as Alexandria grew by a factor of 1.45 (from approximately 733,000 sqm in 1965 to 1,063,000 sqm in 1985). For Liverpool the factor of increase was 1.53 (approximately from 2,706,320 sqm in 1965 to 4,141,600 sqm in 1985).

B. In 1965 the most predominant land use in both ports was the land devoted to transportation (roads and railways). However, in the period from 1970 up to 1985, in Alexandria port the dominant land use became the land for cargo handling function. In Liverpool the transportation activities continued to predominate. This discrepancy between the two ports in this period can be explained by the fact that, with the introduction of the new technology in land transport, the traditional transport modes represented by railways began to be reduced from both ports. In Alexandria, part of the land dedicated to this activity has been transferred to serve as storage open spaces which is cargo handling function. Meanwhile in Liverpool, much of the land which was dedicated to railway activities has been transferred to roads for use by vehicles, lorries and trucks.

C. Relatively little land in either Alexandria or Liverpool ports has had strictly urban orientations, and the proportion of land dedicated to such activities has declined over the study period. This in turn largely reflects the absence of the residential land use from Alexandria, and the dramatic decline affecting this category in Liverpool. On the other hand, the decline of warehousing (other than shipping) in Alexandria and the disappearance of this activity in Liverpool reflects the small share of this urban oriented category.

D. In the mixed orientation category (related to either the port or the urban activities), the land uses devoted to manufacturing and utilities show some similarities between the two ports in that an increase in both ports. However, in Alexandria there was a sudden increase in this function in the first five years of the study period, which can be related to the establishment of the ship building yard. In Liverpool, in contrast, this increase was gradual over the study period.

The three main differences between the ports are mainly observed in the public administration and vacant land uses, as follows:

A. The public administration land use has increased in Alexandria over the study period by a factor of 2.6 (from 4,770 sqm in 1965 to 12,670 sqm 1985). In Liverpool the same activity has declined by a factor 0.52 (from 7,100 sqm in 1965 to 3,740 sqm) over the same period. These changes were expected, since the main feature of

Alexandria port is development or expansion, hence, the need for more customs and excise offices was the principal reason behind the increases in this public administration land use. In Liverpool the decline of this activity was consistent with the port's decline.

B. A broad discrepancy was found in the vacant and undeveloped land. The successful policy adopted by Alexandria Port Authority, which was aimed at the utilisation of the vacant land as storage open space has contributed to an enormous reduction in the proportion of this land over the study period. Meanwhile, the decline affecting Liverpool port has had a great influence on the increase of vacant and undeveloped land inside the port.

C. It appears that, during the last five years of the study period (1980-85), some activities have come into prominence in Liverpool. Such activities can be identified as recreation and residential areas. These activities have been introduced as an outcome of the development strategy adopted by the M.D.C.(Merseyside Development Corporation), which was aimed at the reuse as well as the reintegration of all the abandoned and disused warehouses and deserted dock lands of Liverpool South Docks.

The similarities and differences in land use functions and activities between the two ports have revealed considerable variations and contrasts in the land use problems which exist in each port. The recent introduction of the new technology in Alexandria has imposed great demands for more areas to be used for the cargo handling function and its associated activities. The proportion of this function has therefore grown at the expense of other land uses or through shoreland reclamation. At the same time, the increases in the import rates, together with port mismanagement and the distribution of the operational activities have led to severe congestion and accumulation of cargo inside the port. These problems inside the port have "exported" traffic problems into the urban road network of Alexandria, and particularly the areas around the port. All these problems affecting the efficiency of Alexandria port are likely to be reduced if entirely solved, after the completion of the new port.

On the other hand, the problems which have befallen the port of Liverpool are mainly associated with the economic condition of the port. Decline became the main feature of the port. The extensive unused docklands and the dilapidated warehouses are the principal land use problems which were created as a consequence of this decline. The best solution was the idea of trying to identify new uses for these idle lands and warehouses. The practical application took place in several locations within the South Docks, most notably in the Garden Festival site and Albert Dock.

In spite of the great contrasts between the land use problems of the two ports, one has to recognise that there may be some lessons of experience that could be transferred from Liverpool to be considered in Alexandria. These lessons are derived as a result of the new technology which applied in Liverpool earlier than Alexandria. Such lessons could be either beneficial to the development of Alexandria port, as well as the port city relationship, or may be irrelevant in the Egyptian situation. Nevertheless, the philosophy and guiding principles behind these lessons may themselves be more readily transferred to other major ports with the same circumstances.

7.5 LESSONS TO BE CONSIDERED

Through the examination of the parameters which are outlined in the preceding comparative analysis, some important lessons may be derived from the experience of Liverpool in dealing with particular land use problems. The elements which comprise the material of these transferable lessons of experience can be summarised as follows: port management, the responses to new technology and finally the redevelopment strategy.

7.5.1 Port Management

The management of most ports in the world is vested in a port authority. The constitution and objectives of these bodies differ quite considerably from one country to another (Thomas, 1976, p.95). In both ports the management structure is clearly defined. The APA (Alexandria Port Authority) is the legislative body which owns most of the land and controls much of the port's operational work. In Liverpool, the MDHC (Mersey Docks and Harbour Company) owns much of the land and its jurisdiction prevails over most of the port's operational system. The differences between the two ports are related mainly to two major elements, the administrative arrangements and governmental control.

There is no general pattern of a best possible form of administration for all the ports of the world. Diversity rather than uniformity is and should be the prevailing rule (Nagorski, 1972, p.154). In Liverpool the port has adopted modern, flexible administrative techniques. These techniques needed radical changes of the entire administrative system. In Alexandria, in contrast, the absence of modernisation coupled with inflexibility, and the bureaucratic administration caused by the distribution of responsibility, make the port operation work more complicated.

However, what would be advantageous for Alexandria from the consideration of Liverpool experience in this field, is not full adoption, or copying the same administrative system with some modifications, rather to consider what basic type of port administration has given the best results in Liverpool, and which would be relevant to the Egyptian case.

In terms of governmental control, the two ports are dependent on governmental aid and subsidy. Yet, the system in Alexandria resembles that of most developing countries in that the port is owned by the government. Still more important than the ownership is the fact that the port is considered a vital and effective instrument of national economic policy.

In Liverpool the port is somehow independent from the central government. This independence has allowed an autonomous form of port administration to exist. However, what would be beneficial for the case of Alexandria, and any similar port under the same system, is not to follow the example of Liverpool by recommending that the government should abandon responsibility for the port in favour of independent public bodies. It is the form and shape of administration and management that must be different from forms applied to usual governmental activities. For example, a wide latitude of freedom should be left to the port to find sufficiently experienced and qualified candidates to fill the main administrative posts of the Authority, including members of the Board. Furthermore, the fundamental aim of governmental control should consist in insuring that the port will be managed and developed in accordance with the economic policy of the country (Nagorski, 1972, p. 156).

7.5.2 Responses to New Technology

Since the introduction of new technology in the shipping industry at the beginning of the 1960s, many ports have seen substantial changes in their land use characteristics as a responses to this technology. These responses vary from one port to another among developed and developing countries. At the same time, there are similar variations within developed or developing countries.

In Liverpool, the response was a bit later than that in other UK ports (e.g. Felixstowe and Southampton). However, it was obvious and sound. The initial effects took the shape of the considerable increase in the speed of cargo handling and berth throughput. The picture was completed with the establishment of the Seaforth container, grain and timber complex.

Meanwhile in Alexandria, as in many ports in developing countries, the response to the new technology took much time. There were struggles with the problems which accompanied the process of transition from the traditional handling methods, to the more modern and mechanised techniques. These problems still exist and are making this transition slower than in developed countries.

Fifteen years after the accomplishment of the new technology in the port of Liverpool, the port is suffering from many problems on top of the decline which has befallen at least 50 percent of the port's main activities. The most notable features of this decline are the reduction in the port labour force and the considerable areas of disused and abandoned land in the South Docks.

Thus, it can be anticipated that these problems affecting the port of Liverpool after two decades from the initial introduction of new technology, are very likely to affect the port of Alexandria as well. These effects probably will take place after the new technology has been completely introduced. The change accompanying these effects may not be compatible to Liverpool, because of the differences in political, physical, economical, and social circumstances. However, the concept of changes in the land use activities of Alexandria port must be contemplated, and the experience of Liverpool should be considered in order to avoid such misuse in the utilisation of land use patterns of Alexandria port in the future.

7.5.3 Redevelopment Strategy

The development strategy adopted by the Merseyside Development Corporation has mapped out a future for the South Docks. This strategy is based on three principal interrelated regeneration programmes, designed in accordance with the requirements of the structure plan of Merseyside. These programmes are to achieve the following;

A. Physical restoration involving the acquisition of land, the assembly of sites rehabilitation of docklands and buildings and the provision of roads and services.

B. Economic regeneration involving the introduction of new economic activities besides the support of existing industry.

C. Social renewal-which depends on co-operation with local authorities, community and voluntary bodies, in order to formulate action programmes and provide facilities for the unemployed and for the provision of training for better and more varied skills (Merseyside Development Corporation, 1982).

Although the aims of this strategy are mainly concerned with the development of Liverpool waterfront on one hand, and providing solutions for social problems on the other, such a strategy would be worthy of consideration for Alexandria, or any other port under the same conditions. Considering the idea or philosophy behind this strategy, it will be beneficial to highlight and extend the scope of programmes which may be needed in the future for the redevelopment any idle waterfront land use.

7.6 SUMMARY AND CONCLUSION

This chapter has been based on reviewing the study material that emerged from the analysis of the two case studies concerns the ports of Alexandria and Liverpool. The technique of comparative analysis has been adopted in order to examine and assess the changes of land use patterns that have occurred in the two ports as a response to the introduction of new technology in shipping industry on one hand, and to deduce lessons which could be learnt from the experience of Liverpool in dealing with these responses on the other.

The cross national comparison has been achieved through the assessment of four main issues. It began with a brief review of the stages of evolution of the two ports, with a chronological summary of events that affected their development. Similarities and differences between the two ports are identified.

This evolutionary review was followed by a study of general factors affecting each port, including geographical location, site and situation, areas and patterns of trade, as well as socio economic factors.

The similarities and differences noted from these general parameters have yielded certain common factors which have contributed to the changing image of each port. Also it is revealed that the two ports differ substantially from each other on some significant variables.

The changing characteristics of land use patterns of the two ports over the last twenty years are examined and assessed through the presentation of the technical parameters. The assessment of similarities differences in the land use functions and activities has revealed considerable variations and contrasts in the land use problems which exist in each port.

Throughout the proposed solutions of these land use problems, some crucial lessons have been derived from the examination of the experience of Liverpool in dealing with specific problems concerning port management as well as port and cityport planning. The elements which comprise the material of these transferable lessons of experience can be considered as, port management, the responses to new technology, and the redevelopment strategy.

Some of these lessons are likely to be directly beneficial to the development of Alexandria while others are not. However, the philosophy and guiding principles behind these lessons may themselves be more readily transferred to major ports under the same circumstances in other parts of the world.

CHAPTER EIGHT

CHAPTER EIGHT

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

8.1 INTRODUCTION

In the introductory chapter of this thesis, the principal aims of the study were identified as being to investigate the following issues: first, the new technology introduced into shipping, cargo handling techniques, and maritime transportation; second, the impact of this developing technology on port land use patterns; and finally, to identify the functions and activities of the port which place a demand on city space and influence the land use characteristics of the city.

In this final chapter an attempt is made to overview the main findings together with the outcomes derived from the theoretical approach that has been adopted and the empirical work which has been carried out for the two case studies of Alexandria and Liverpool, and the comparative analysis. This outline of results points to a number of fundamental issues and problems associated with the planning process of the cityport of Alexandria. An attempt is also made to anticipate the changes that are likely to take place within the port area as a result of the complete introduction of new technology, and which in turn are very likely to affect the land use planning of Alexandria. Proposals which may contribute to solving the existing problems will then be presented and discussed. Recommendations concerned with land use policies for both short and long term planning will then be considered, in an attempt to provide the suitable environment for land use planning methods and techniques for Alexandria and other cityports under the same circumstances.

Finally, a number of issues are highlighted which have not been covered satisfactorily in this research but which are considered to be suitable topics for further research in the future.

8.2 SUMMARY OF THE MAIN FINDINGS

From the different stages of the research, a number of substantial findings have been derived. These findings have already been reviewed and discussed in detail independently in the previous six chapters. In this section, these findings are grouped together and reintegrated in order to identify the key issues and problems that are associated with the land use planning of Alexandria cityport. These findings are set out below under the following subtitles:

1. The Introduction of New Technology
2. Hinterland and Foreland
3. Changes in Port Land Use Patterns
4. Port and City Inter-relationships
5. Cityport and the Economic Dimensions
6. Cityport and the Urban Environment
7. Cityport and Political Influences

8.2.1 The Introduction of New Technology

The significant changes that have occurred in the shipping industry and cargo handling techniques, as well as in the field of inland transportation, have transformed the character and appearance of the world's major ports. The technological innovations of the 1960s and early 1970s have had a great impact not only on the economic condition of the ports, but also on the labour requirements and land use patterns of these ports. However, in many ports the application of this new technology has been accompanied by different responses - some negative, some positive - in terms of their impact on the land use characteristics of these ports.

In Alexandria the port has had to expand in size to cope with this new technology. This expansion has taken the form of creating new berths and quays in order to provide new land for the cargo handling function and its associated activities. In spite of this increase in area, the port has remained on its original site, and the process of growth of land area has mainly taken the form of in-filling of harbour water. Furthermore, the rate and volume of trade in terms of imports/exports has increased dramatically as well because of this new technology. The increasing rate of trade growth exceeded the increasing rate of land conversion. Thus, the result was the problem of extreme congestion and accumulation of cargoes inside the port as well as road congestion outside the port. Eventually this affected the efficiency and the performance of the port of Alexandria .

The idea of establishing a new port in the El Dekheila suburb to the west of Alexandria emerged to provide a practical solution to the current problems existing in the old port. Although this new port is not yet in full operation, it may be considered to be a good example of this type of locational shift in response to the introduction of new technology.

In Liverpool, the response to the new technology was a bit later than that in a number of other U.K. ports, such as Felixstowe and Southampton. However, it was obvious and clear. The initial effects took the form of a considerable increase in the speed of cargo handling and berth productivity. The complete response was a combination of investment and rationalisation. The establishment of the Royal Seaforth Complex was the biggest single investment, while the closing down of the entire South Dock complex was a clear-cut example of rationalisation.

Since the full introduction of this new technology, the port has lost more than 50 percent of its estate. Decline became the main character of the port. Dilapidation, abandonment, and disuse became the predominant characteristics of all of the South Docks as well as part of the North Docks. The solution to the problem represented by these dramatic conditions began to take place with the adoption of the new Development Strategy. This strategy took the form of a series of ambitious schemes which were aimed at the restoration and the rehabilitation of the entire disused South Docks area. The success and appropriateness of such a strategy for adoption in Alexandria are summarised in section 8.2.3 below.

8.2.2 Hinterland and Foreland

The conceptual definition and aspects of the delineation of both hinterland and foreland have been discussed in thorough detail in the first part of chapter Three. When these definitions were applied to the two case studies, it appears that the hinterland of Alexandria port can be defined not only as the city and its suburbs and the surrounding region, but also the entire country of Egypt. The principal transport modes connecting the port with its hinterland are roads, railways, and waterways. These networks have made the port well connected with other parts of the country.

In Liverpool, the port was considered to be the second in importance to London, with a large potential hinterland. Yet, partly as the result of new technology and partly because of the disadvantage of its geographical location, Liverpool has lost part of its significance as a major port. Consequently, part of its hinterland has been reduced, especially after UK entered the E.E.C.

The hinterland of Liverpool port can be defined according to the route of cargo and its origin. For instance, Liverpool has an extensive hinterland which includes the main exporting areas of the Midlands, with respect to routes to the Mediterranean. In contrast, there is a very limited hinterland on routes to Rotterdam, and a very tight hinterland on the routes to Scandinavia.

The foreland of Alexandria is mainly restricted to the other European ports located on the Mediterranean, with a very small proportion with Asia, the Americas, Africa and Australia. This may be contrasted with the foreland of Liverpool which is classified under the broad headings of near sea, which includes Ireland and the west coast of Europe, short sea, which includes the Mediterranean and north Europe, and deep sea, which includes the traditional routes to the Americas, Africa, and East and Far East Asia.

8.2.3 Changes in Port Land Use Patterns

The analysis of the two case studies has revealed some crucial findings regarding the changes in land use patterns. In Alexandria, the land use dedicated to the transportation activities (roads and railways) was the most dominant land use in 1965, at the beginning of the twenty year study period. This predominance has changed to the land use devoted to the cargo handling function, and this function has remained dominant up to the end of the study time. Also it has been found that the urban oriented land use inside the port did not show any significant change because of its limited proportion. While the land uses devoted to manufacturing experienced a sudden increase in the first five years of the study period because of the establishment of the shipbuilding yard. The public administration land use has also increased over the study time because of the need for more customs offices to cope with the considerable increase of trade. During this process of change, some land became vacant. Some of this land has been brought into active use again according to the policy adopted by APA (Alexandria Port Authority) which was aimed at the utilisation of most of the vacant spaces as open storage areas. This transformation has contributed much to reducing the proportion of land in this category over the study period.

In Liverpool the situation was similar in that the land dedicated to transportation activities was the predominant land use. However, after the introduction of new technology in land transport, the traditional transport role represented by the railways began to be reduced. Nevertheless, the transportation activities have continued to predominate, but much of the land which was dedicated to railway use has been changed to roads for use by vehicles, lorries and trucks. On the other hand, the urban oriented land use has shown a gradual decline over the study period. Furthermore, after the decline affected the port and the South Docks ceased operation, the proportion of vacant and undeveloped land inside the port increased substantially. Because of the development strategy, much of this land has been transferred to other uses, such as commercial, recreational, residential as well as general and light industrial. The adoption of this strategy has entirely changed the characteristics of the South Docks land use pattern.

The comparison between the similarities and differences in land use functions of Alexandria and Liverpool ports has revealed a significant contrast in the land use problems of each port. While Alexandria was suffering from severe congestion and accumulation of cargo inside the port, plus road congestion outside the port, Liverpool was facing substantial decline which affected the entire South Docks.

In spite of the wide discrepancy between the land use problems of the two ports, it was possible to identify three important lessons which may be derived from the experience of the application of the new technology in Liverpool earlier than Alexandria. Such lessons could be worth considering in Alexandria for the development of the port as well as the port city relationship. These lessons of experience can be summarised as follows:

Port Management

The differences between Alexandria and Liverpool ports in terms of port operation and management are mainly related to two major elements, the administration arrangements and governmental control. Liverpool port has adopted modern, flexible administration techniques, which facilitate the process of port operation and management. In contrast, Alexandria is suffering from the absence of modernisation, inflexibility and the bureaucratic administration which make the port operation quite complicated. However, Alexandria could benefit from the experience of Liverpool in this field, not necessarily by the full adoption and copying the same administration system, rather by considering what basic type of port administration has given the best results in Liverpool, and then identifying those aspects of the approach that best match the requirements of the Egyptian case.

In terms of governmental control, Liverpool port is independent from central government. This independence has allowed an autonomous shape of port administration to exist. In Alexandria, in contrast, the port is owned by the government and considered to be a vital economic tool of national economic policy. What would be learned from the experience of Liverpool in this specific field, and which would be for the benefit of Alexandria, is the shape of administration and port management that must be different from forms applied to usual governmental activities.

Responses to New Technology

The responses to the new technology in the maritime industry vary from one port to another according to the countries' economic condition. In Liverpool, the response to this technology was earlier than in Alexandria where it is still in progress. As a consequence of the complete introduction of this technology in Liverpool, the port is suffering from the decline which has befallen at least 50 percent of the port's main activities. As a result, the port labour force has reduced dramatically, and considerable areas of dockland became abandoned and disused in the South Docks.

Therefore, it can be expected that, in time, these problems are very likely to affect the port of Alexandria as well, especially after the new technology has been completely introduced. However, it is most likely that the changes that accompany these effects may be different in detail from those observed in Liverpool. Neverthe-less, the concept of a similar scale of change in land use activities of Alexandria port must be contemplated, and consideration must be given to the experience of Liverpool in order to anticipate or, avoid of possible, any misuse of the land in the Alexandria port area in the future.

Redevelopment Strategy

The Merseyside Development Corporation has adopted a new development strategy which is aimed at the restoration and the rehabilitation of the entire docklands and buildings of the idle South Docks. The physical, economical and social aspects of the strategy are considered through three corresponding programmes which were designed in accordance with the requirements of the structure plan of Merseyside. The aims of this strategy are mainly concerned with the development of Liverpool docklands on one hand, and providing solutions for social problems on the other. However, aspects of the strategy may well be of benefit for Alexandria. Consideration should be given to the ideas behind this strategy so that advantage can be taken by Alexandria of the opportunity to outline and extend the scope of programmes which may be needed in the future for the redevelopment of any idle docklands.

8.2.4 Port and City Inter-relationships

The subject of the port-city interface has attracted the attention of geographers and planners relatively very recently. This attention has been directed specifically to the problems and policies associated with the port-city confrontation and to the problems posed by the retreat from the waterfront and the consequent need to redevelop abandoned areas (Hoyle, 1987). The symbiotic relationship between the port and its city has been underlined from different viewpoints except the one which identifies the co-ordination between the port and city in terms of land use implications and spatial demands.

In spite of the scarcity of relevant literature on this specific point, it was possible to set out the direct and indirect relationship between the port as a producer of activities and the city land use patterns. This interdependent relationship has been identified schematically in a diagram presented in chapter four. Five main port-related activities were identified, and which represent the impact of the port as a dynamic function on the city land use patterns. These activities are port related employment, transportation and its associated activities, commerce, services and manufacturing industry. Detailed discussion of these activities and their impact on the land use of the city has been made earlier in chapter Four.

When these relationships identified in the previous diagram were examined in Alexandria cityport, some important issues were identified. These can be summarised as follows;

1. The distribution of authority in Alexandria port has made the port related employment more fragmentary. At the same time, the figures representing this employment, when compared with U.K. figures, indicate that there is a big difference in terms of advanced technology, economic conditions, throughput, and management. However, it seems that Alexandria port is suffering from hidden unemployment which means that the numbers of workers in the port are fictitious and do not indicate the actual needs of the port. Furthermore, the impact of the port employment on the city

land use in terms of housing demand and location is well recognised in the four residential districts surrounding the port.

2. The modal distribution of cargoes reaching and leaving the port is highly oriented to road transport. Heavy trucks and lorries serving the port are using the ordinary road networks of the city without any adequate provision for such specialised traffic. This port related traffic when it enters or leaves the port from certain gates, normally causes traffic congestion outside these gates. This problem of congestion together with the traffic waiting to enter the port or waiting to load or unload at the warehouses outside the port clog up the free flow of traffic on the urban roads.

3. Although Alexandria is Egypt's main port with a very large potential hinterland, the commercial activities in terms of distributional and wholesaling activities are not well structured. The existing activities are mainly oriented toward individual business rather than large scale commercial organisation. In addition, there is no specific area dedicated to such activities.

4. Alexandria is the second administrative city after Cairo and most of the services are related to the city rather than the port. The port services, however, are concentrated around the port area as well as mixed with other services in the central business district of the city.

5. The manufacturing industries dependent on or related to the port are principally seen in two types of industries. Those are petrol and its associated industry, and cotton pressing industry. These are located in very close proximity to the port zone. Other small industries related to the port are dispersed around the port.

When the same issues of port related activities were examined in Liverpool, a substantial contrast was found. The findings can be summarised as follows;

1. The port related employment has faced drastic decline from the 1970s. This decline has been reflected in both the falling demand for housing in the areas adjacent to the port as well as the deterioration of housing conditions, especially in the inner areas.

2. The port is well connected with its hinterland by a network of motorways and, most of the traffic generated by the port is carried by road transport. This traffic does not have any impact on the land use patterns of the city. This can be attributed to the effects of the road improvement policy which has aimed at establishing a road network which by-passes the congested areas.

3. The distribution and wholesaling activities related to the port do not place any demand on the city land use because of its marginal impact. However, the establishment of the new Free Port zone in the North Dock is likely to bring these activities into the commercial market again.

4. The impact of the port-related services on the land use patterns of the city has taken two directions. On the one hand, there has been a positive impact in the form of refurbished office floor space and service workshops in the area around the central and northern part of the port. On the other hand, there have been negative impacts in the form of derelict land in the area to the south from which these activities have disappeared.

5. The impact of the manufacturing industries related to the port on the land use of the city can be largely ignored as these activities have had only very minor affects.

8.2.5 Cityport and The Economic Dimensions

The role of the cityport in relation to the national and international economy is quite significant. Within the structure of these two economic systems the significance of a cityport is mainly attributed to the important role played by the port as a function and component of different activities.

As it is the first and major port of Egypt, Alexandria has a substantial impact on the entire national economy of the country. However, on the local level, the economic base of Alexandria cityport depends more on the industrial sector rather than the port sector. This paradoxical situation is due to the fact that the local authority has no share in the financial output of the port as income passes directly to the central government. Yet, the contribution of the port to the local economy of Alexandria can be perceived through the direct and indirect impacts posed by the firms and companies involved in the port's business life, and which can be considered as the expenditures and multiplier effects of the money spent by these bodies.

Other impacts can be felt on the national economy through the varied condition of the different types of industries that are related to or dependent on the port. The prosperity of these industries has meant a revival in the economic condition of the country. On the other hand, the transportation systems related to the port have also quite significant role to play in relation to the national economy. Any deficiency in the transportation chain inside or outside the port will cause delay in cargo handling, which ultimately creates the problem of congestion, which affects radically the economic condition of the country.

In terms of international economy, any disturbance of the exporting or importing process will contribute much in creating the problems of ship delays and accumulation of cargo. This in turn can have a measurable affect upon cargo transport costs and thus the international market and the economy.

8.2.6 Cityport and The Urban Environment

The interaction between cityport development and the environment can always be measured through four fundamental environmental components of the land situation and water situation, and land site and water site. When these components were considered in the context of Alexandria cityport it has been found that, the very close proximity of the port to the urban environment has caused quite considerable environmental problems. Water pollution affects the beaches eastward of the port. Industries related to the port have also contributed significantly to the problem of air pollution, which in turn poses a hazard for the adjacent residential zones. Although the water pollution problem has been considered in the planning program of the new port, it is expected that some contamination will affect the westward beaches. The new steel mill complex that is to depend on the new port will contribute further to the environmental problems that already exist in Alexandria.

8.2.7 Cityport and Political Influences

The central government of most (if not all) countries exert direct or indirect influences on the planning process. The variation of this influence is due to many factors, including the economic characteristics of these countries. This influence varies in particular from developed to developing countries.

In the case of the cityport planning process, the role of the central government is associated with two other political bodies. These are the port authorities or port trusts, and the local government which is represented by the municipality, local political parties and public participation. However, again the structure of the decision making process differs between developed and developing countries. In the developed countries, the process of taking decisions that are related to either the port or the city tend to be independent of the central government. Such decisions are always taken by the port authority or the local government or as a result of co-operation between the two of them under the supervision of the central government. In contrast, in the developing countries, the crucial decisions are taken almost inevitably, by the central government, and the role of the other two participants is rather diminished. This can be expected since the port is considered to be such a vital economic resource for the country.

Thus, in the cityport of Alexandria the planning decisions related to the port are always taken directly by the central government or indirectly through the port authority which is eventually answerable to central government (as indicated before in chapter Five section 5.11). On the other hand, the planning decisions related to the city are usually taken by the local government (the governorate) and its planning department. In practice, common decisions to which both political bodies give their consent, are often quite difficult to achieve.

8.3 CONCLUSIONS RELATING TO KEY ISSUES AND PROBLEMS

Throughout the review and examination of the main findings derived from the research, together with the assessment of the current situation and the desired one, some light has been shed on a number of substantial issues which contribute much to the present problems which exist in both the port and cityport of Alexandria. Some of these issues can be defined as port related, and concerned with port operation as well as the land use of the port. Others are considered to be city related and mainly involve the city's land use patterns and the responsibilities of local government and the decision making process. However, the essential issues upon which discussion is to focus here can be identified as follows:

1. Adopting new technology.
2. Port operation and management.
3. City-port inter-relationships.
4. Environmental control.
5. Local government participation.

1. Adopting New Technology

The new technology in maritime industry and cargo handling techniques has been introduced in Alexandria port since the late 1970s, and the take up is still neither complete nor universal. The absence of up to date modernisation in handling equipment, together with the lack of maintenance facilities, have led the port to experience serious problems of congestion and accumulation of cargo as well as the delay of vessels. The establishment of the new port seems to be a step towards more technology, more modernisation and more efficiency and to providing, at the same time, a practical solution to the majority of problems that exist in the old port. Yet Alexandria port needs to enhance its program of port renewal to overcome the inadequacy of present port facilities on one hand, and the effects of years of neglected port maintenance and improvement on the other.

2. Port Operation and Management

Apart from the Alexandria Port Authority, there are eight different companies operating inside the port of Alexandria. These companies, as indicated before, are assembled together under the authority of the Public Sector Organisation for Maritime Transport. This distribution of operational activities, coupled with the public sector behaviour, has made the co-ordination between the port authority and these companies, and among these companies themselves, significantly weak to the extent that the port has continued to suffer from an inflexible and bureaucratic administration. At the same times, the absence of full jurisdiction of the port authority has accentuated the problems of congestion and accumulation outlined before. This distribution of authority has also made the port related employment more fragmentary, and created some sort of hidden unemployment problem which eventually affects the efficiency of the administrative work related to the port.

3. City-port Inter-relationship

Throughout the examination of the interdependent relationship between the port of Alexandria and city land use, some crucial issues emerged in which problems connected with transportation, commercial activities, interlinked services, and manufacturing industries were identified as having critical importance. These issues are as follows:

3.1 Transportation Problems

Earlier discussion has verified that most of the transportation problems that exist in the urban road network outside the port of Alexandria are mainly attributed to the heavy traffic generated by the port. The causes of many of these problems are partly the lack of adequate provision and availability of general and specialised roads for this traffic, and partly because of the location of warehouses outside the port zone. Generally speaking, traffic congestion and clogging up of the traffic flow outside the port gates are the main transport problems effecting the urban land use of the city, and which inevitably need to be considered in any land use planning policy related to Alexandria.

3.2 Commercial Activities

In Alexandria port the commercial activities, in terms of distributional and wholesaling functions, are not well recognised because of the disorganised role played by them. Yet, the port has a remarkable and strategic geographical location which qualify it to act as distributional and wholesaling centre, not only for Egypt, but also as one of the major centres in the middle east. Thus, these two functions need much consideration in order to promote the role of the port in relation to the national and international economy.

3.3 Service Interlinkages

Many of the services activities related to Alexandria port are located in distinct areas. Some are concentrated around the port, while others are situated in dispersed converted office buildings in the central business district, Both locations are relatively close to each other on one hand, and close to the port on the other. However, the absence of new communication technology has made the links between these services and the port, and among these services themselves quite difficult. Thus, the adoption of new technology in the communication field will contribute significantly to increasing and promoting the efficiency as well as the integration of these activities.

3.4 Manufacturing Industry

Although Alexandria's economic base relies mainly on the manufacturing industry activities, there are only two industries considered to be port related. Alexandria as a cityport has good qualifications to establish planned industrial zones in the coastal area. The advantage of the developed industrial nucleus together with the existence of port facilities are provide a suitable environment for such zones to be planned.

4. Environmental Control

The urban agglomeration and the pleasure beaches in Alexandria are suffering from water pollution which results from ships passing or waiting to enter the port. Air pollution as well is generated from different industries and has an essential impact on the urban environment of the city. These two types of pollution effecting the city are principally due to neglect in applying and enforcing the law and regulations prohibiting such environmental offences. Solid enforcement of these measures is needed in order to protect the urban environment of Alexandria.

5. Local Government Participation

Within the global system of Alexandria cityport, the decision making process is principally in the hands of two political powers. While the central government has a direct contribution regarding the policies affecting the port, local government on the other hand, has an influence regarding the city and its planning system. Nevertheless, neither central or local government have an effective contribution when the subject concerns common decisions for both the port and the city. The port as a dynamic element in the planning system of cityports needs to be considered in the formulation process of their planning policies. This can only be accomplished through the effective participation of local government regarding any planning decision related to the port. Theoretically, in Alexandria cityport, this latter point has been achieved (see chapter Five). However, practically speaking the involvement of the local government in any port planning act is rather diminished. The crucial decisions concerning the port and its planning system are always taken by the central government without proper attention to the impact of these decisions on the city planning system. Therefore, more real authority, and more active participation must be given to the local government in the planning policy formulation related to the port.

8.4 FUTURE PREDICTIONS

A number of scenarios are presented in order to illustrate the range of possible futures in which certain decisions concerned with land use planning of Alexandria cityport may need to be taken. These scenarios consist of the outcome of speculation that is based on reason and judgement. "They are built up from hypothetical sequences of events constructed for the purpose of obtaining imaginative insights into problems and focusing attention on causal processes" (Thornley, 1974, p. 643-644).

With this sense in mind, two main scenarios are constructed to indicate some of the future expectations regarding the changes of the land use characteristics of the port, which will probably take place as a consequence of the complete introduction of new technology. These changes will have a lesser or a greater affect on land use planning in the city. However, proposed solutions and consideration of such changes will be beneficial for the formulation of land use policy in Alexandria.

8.4.1 Traffic Forecast

The volume of Egypt's seaborne trade will continue to increase in the future because of the rapid economic growth (see chapter Five, section 5.11.6). Also it has been expected that after the completion of the new port "El Dekheila", and after its merging with Alexandria has taken place, the national share of trade of the Alexandria/El Dekheila complex will meet some decrease because of the availability of additional other ports facilities (e.g. Damietta).

In the light of these expectations, this scenario envisages the likely port land use changes which may occur in Alexandria as a result of these changes mentioned above. It has been concluded before (chapter Five, section 5.9) that the rate of increase in land is much less than the rate of increase in traffic. Therefore, the expected increases of traffic volume will be confronted by shortage and inadequacy of land for the particular cargo handling function. This predicted problem might have a solution after the completion of the new port. However, after the full merging between Alexandria and El Dekheila, the two ports will become an integral port. It is very likely that the port function and activities will be attracted towards the west where the new technology and the new port are located. Examples of such attraction can best be seen in Liverpool port after the establishment of the Seaforth Complex, as well as in Southampton after the construction of the Prince Charles Container Port. In the Alexandria Port Complex, this locational shift, together, with the expected decreases in the traffic volume will impose strains on the port functions, some of which are likely to disappear from certain locations, notably in the east and north east parts of the original port. Although this shifting process may occur only in the long run, the expected outcome will be idle berths and derelict land in these areas.

8.4.2 Consequences of the New Technology

It has been concluded before in the comparative analysis between Alexandria and Liverpool case studies (chapter Seven, section 7.5.2) that the responses to new technology varies from one port to another. Also it has been noted that after the introduction of new technology in Liverpool, the port suffered from many problems on a top of decline which resulted in at least a 50 percent decrease in its main activities.

In this scenario an attempt is made to anticipate what will be happen after the complete and full introduction of new technology in Alexandria port. The new technology began to be introduced in

Alexandria in the late 1970s. New land has been created notably in the central and western portions, in order to accommodate the new container terminal, the new fertiliser quay and the new petrol berth (see chapter Five, section 5.8). The problems which accompanied this introduction were mainly seen in terms of congestion and the accumulation of cargo inside the port.

It can be predicted that after the complete introduction of the technology, the port of Alexandria may face certain problems related to the labour and the land use patterns. New technology often accompanied with reduction in workers and job losses. The existence of such technology in the central as well as the western parts of the port will persuade some port functions and activities located eastward to be shifted towards the centre or the west. So, traditional port activities will decline and disappear from the east part, leaving their locations free to accommodate other urban activities. Thus, contemplation of such consequences of the new technology will reinforce the case for drawing up a strategy for the future which is directed towards avoiding any misuse of land use in the port area of Alexandria.

8.5 LAND USE POLICY: PROPOSALS AND RECOMMENDATIONS

From the overview of the key issues and problems involved with the port and the cityport of Alexandria, a number of proposals and recommendations are derived. In this section, these outcomes are presented in an attempt to provide suitable context in which land use planning policy can be formulated. Short-term planning is desired, in order to provide guidance for the solution of current and urgent problems. Other anticipated changes need long-term planning. The proposals and recommendations related to the short as well as the long term planning policies are now presented.

8.5.1 Short-Term: Proposals and Recommendations

1. Enhancement of restoration and renewal programme of the port.

In recent years the Alexandria Port Authority has undertaken a general programme of port renewal in which it has also attempted to overcome the effect of many years of neglect of port facilities. The programme's completion was scheduled for 1983/84. What has been implemented so far has been enough to alleviate urgent and immediate problems. Yet, the port authority should thrust on with its restoration programme in order to meet the increasing rate of trade. More radical rehabilitation is required to achieve compatibility between the unsuitable old fashioned berths, and the new facilities which will be provided as part of the new port project.

2. Port operation and management should be more, organised, modernised, flexible, and more control must be given to the port authority.

The best planned port cannot be really successful unless it is properly organised. Port planning and port organisation are two main and equally important pillars on which the efficiency of a port is based. In order to achieve the optimum in the operational and management fields, the port of Alexandria needs a radical change in its organisation system. "Organisation should permit the best possible use of existing installations but it cannot create miracles. Organisation cannot survive without a fresh and modern administration system. Ports with a vigorous, enlightened and full of initiative administration are usually prospering, even under unfavourable geographic conditions" (Nagorski, 1972).

Modernisation in port management must be coupled with flexibility in the administrative arrangements. Alexandria port is stifled by bureaucratic routine and by a maze of unrealistic regulations, and it is unable to take full advantage of its possibilities.

The port must be given a free choice to adopt the form and shape of administration and management that must be different from forms applied to usual governmental activities. The port authority must be given more power and more free control inside the port in order to bridge the regulation boundaries of the other eight companies operating inside the port, and to impose its jurisdiction over the entire operational system of the port.

3. More attention and considerations must be paid to the proposals related to the transportation problems generated by the port traffic.

Many studies have been made which have attempted to provide reasonable and practical solutions for the transportation problems outside the port. The most reliable proposals have been suggested in the master plan of Alexandria (Comprehensive Plan, 1984), and the Italian consultant Transystem (Alexandria Transport System, 1985). Non of these suggestions, however, has been taken up by the local authority. The congestion of the road network outside the port must be considered among the highest priorities as one of the most urgent problems that need to be solved.

More consideration must be given to implementing these proposals. Immediate action should be taken regarding financing the proposed projects, in order to alleviate the seriousness of these chronic problems.

4. <u>A planned and organised distributional and wholesaling system should be provided.</u>

In order to take full advantage of the strategic geographical location and significance of Alexandria port, emphasis must be put on establishing a national distributional and wholesaling centre. The encouragement of the establishment of such a function in a systematic framework could change the entire trading balance of the country. This function could be located in the city, but it would be preferable for it to operate either directly from the port area, or just outside the city - in part to reduce the impact of the additional load on the local transport system that this would impose.

5. <u>An updated technological system of communication networks must be provided to link the port related services.</u>

It is essential to establish an appropriate and high-tech communication network in order to link the port related services together. Access to data and information about the different shipping companies, shipping agencies, and port operation should be provided at all times. Communication between these different agencies and the port will sustain the achievement of integration of their activities. Links between the national and international port related services should exist in order to facilitate the exchange and control of data, and for the ultimate control of national and international trade.

6. <u>The need for more environmental control.</u>

The ships which are passing by or entering the port are causing oil contamination to the majority of the beaches eastward of the port. According to the international convention for the prevention of pollution from ships in 1973, "The Mediterranean is a special area which has a total prohibition on the discharge of oil and garbage into the sea". However, there is no vital and effective enforcement of such regulations. There is an essential need to implement and follow-up these regulations in order to protect the urban environment from such pollution.

7. <u>More effective participation of the local government.</u>

The integration between the varied attitudes of the central and local governments towards the cityport planning policy is essential, in order to provide an appropriate policy formulation which can suit the port on one hand, and the city on the other. In this sense, it is important to attain the ratification of these two different political powers on any decisions concerned with the port land use planning. This will be implemented through the involvement of the local government in the decision making process. The local government should have, for example, the power to participate effectively and positively in any short term planning programme related to the port. This effective participation will close the gap between the two political powers, as well as providing a means of reconciliation between the goals and objectives of land use policies related to either the port or the city.

8.5.2 Long-term: Proposals and Recommendations

1. A comprehensive detailed study of the traffic generated by the port must be considered as a next step towards the solution of the transportation problems caused by the port.

On the short term recommendations emphasis was made on the immediate consideration of the different proposals suggested by the master plan of Alexandria and the Italian consultant, in order to alleviate the transportation problems generated by the port traffic. In this section, a suggestion of a comprehensive detailed study is proposed as a fundamental step towards the radical solution of these chronic transportation problems. The extended scope of such a study should be;

i. To examine, in an organic and co-ordinated way, all the aspects and components influencing the traffic generated by the port;

ii To draw up a general plan, based on the guidelines of the transport master plan, to cope with the problems caused currently by heavy traffic and with the growth of this traffic which can be expected;

iii. To examine the feasibility of the single projects forming the general transport plan suggested by the consultant, and to specify the projects which are feasible.

In the initial stage of this proposed study, a number of considerations should be taken into account, such as:

- Future structure and organisation of the Alexandria/El Dekheila Complex.
- Organisation of the activities composing the port cycle (loading/unloading, customs, consignment of commodities, storage cycle, consolidation and grouping etc.).
- Present situation and possible modifications of typology and packaging of goods and of the handling equipment.
- The comprehensive transport plan for Alexandria, which was prepared by the consultant (Transystem) in 1984.

After defining the sectorial plan for the reorganisation of the traffic in relation to the port, viability and feasibility of the various projects forming the study should be assessed and carried out. In this sense, the projects which should form the focus of the study include;

i. A reserved road connecting the port directly to the main highway network.

ii. The reorganisation and expansion of the railway transport services to the port.

iii. Suitable parking areas for lorries and trucks waiting to be loaded.

iv. Reorganisation of the access to the port terminals and the main traffic circulation system inside the port.

v. A wholesaling and distributional centre for the commodity supply to the city and the region beyond (as suggested in the short term plan).

vi. Relocation or reorganisation of the structure of warehouses in the vicinity of the port.

vii. A provision of additional areas for empty containers and for full containers awaiting customs inspection or reconsignment and which are handled outside the container terminal.

viii. Simplification of the operational procedures and information.

All these projects and suggestions should be considered in order to obtain the optimum and desired reorganisation of the traffic generated by the port on the long term plan.

2. Taking into account the possibility of establishing a load centre in the future, handling and management.

The idea of load centre for containerised traffic has emerged very recently. A detailed overview of this centre and its impact on the hinterland has been discussed in chapter Three. Yet, Alexandria port with its strategic geographical location on the Mediterranean, and with its extensive hinterland, has the prime qualifications which could promote it to be one of the few load centres in the world.

3. Consideration must be given developing the concept of MIDAs system.

The concept of the MIDAs (Maritime Industrial Development Areas) has been introduced in the last twenty five years in western Europe and Japan (see chapters Three and Four).

According to the recommendations of Alexandria Master Plan, a developed industrial area could be located south of lake Maryut, and it would be connected with the port by the waterway canal. Hence, with some modification to the dimensions of this canal, this designated area could be developed to be one of the few MIDAs in the world, and it would be the first in the Middle East.

4. Future consideration of a development strategy.

It has been predicted that after the integration of the two ports of Alexandria and El Dekheila, and after the full and complete introduction of the new technology in Alexandria port, there will be some sort of locational shift in the port function towards the central and western parts of the Alexandria port. This movement of port function and activities will leave some areas east of the port in need of redevelopment.

In this context, the need for a development strategy in order to regenerate these derelict and abandoned dockland areas is inevitable. Such a strategy should have the extended scope to cover aspects as diverse as social, economical, and environmental requirements. This strategy should be based on a series of programmes which in turn are in accordance with the requirements of the comprehensive master plan of Alexandria cityport.

8.6 POSSIBLE FUTURE RESEARCH

It is hoped that this research has succeeded in covering the interdependent relationship between the port and the city. It is also hoped that the study has fulfilled its aims and objectives in a way which will have contributed to underlining the significant impact of the port on the land use patterns of the city. The useful lessons which have been learned from the cross national comparative study are hoped to be of value for other port cities which share similar circumstances.

As most research studies raise more questions than it can be hoped to answer, this particular research has studied the land use policies in a cityport with special reference to Alexandria. The research achieved its principal purpose and intentions, yet there are other aspects of the research which it was not possible to pursue as fully as would be desirable. The research has drawn attention to a number of crucial issues which call for study in greater depth in order that they can contribute further to our understanding of the impact of ports on their cities.

The first of the topics that requires further more detailed research is the study of the impact of port related employment on the city land use patterns. A detailed study of the type proposed would enable accurate information to be assembled about the actual extent of port related employment, the nature of the jobs of employees, the locations where they live, the transportation means they use and the impact that this transportation method has had on residential locations relative to place of work. In order to carry out this study, a questionnaire survey is required. This survey will help to determine the different impacts imposed by this employment sector on the city land use patterns in terms of housing demands as well as transportation requirements. This represents one of the main aspects of the port and city inter-relationship.

The second research topic that requires further study is the more detailed assessment of the transferable lessons of experience that can be derived from the comparative analysis in relation to the physical, economical and social aspects of Alexandria city. The purpose of this study is to arrive at what has happened and what is happening in Liverpool (or any similar example of dockland redevelopment) before and after the accomplishment of the development strategy adopted. In this study aspects as diverse as financial requirements, investment regulations, social and political implications and, above all the planning procedure adopted to control the implementation of such a strategy would require special attention. This will help to indicate the likely consequences of policies adopted in the future in order to avoid uncritical application of foreign techniques when there is the need to establish the basic principles of the development strategy in Alexandria to redevelop the dockland.

A third possible topic is the impact of the new technology on specific types of commodity or groups of commodities, and the impact of this on the land use patterns of terminals dedicated to these commodities in the port of Alexandria. This study will help to identify how far the increasing or decreasing rates of trade might affect the port land use in terms of expansion or contraction and which in turn will influence to the greater extent the city land use patterns. In order to carry out such a study, it would be necessary to assemble more accurate data than were available for use in the current study relating to the rates of exports/imports of individual commodities as well as projections of these rates.

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APPENDICES

APPENDIX ONE

Table T1.1:
A Broad Classification of General Cargo Ships

Pure Container System

The cellular container system.

Cellular container ships using lo-lo and ro-ro in combination.

Full ships lots of containers with ro-ro handling.

Specialised System Based on Bulk or Semi-Bulk Trades

Open hatch bulk carriers.

Vehicle carriers.

"Skaugen" class ro-ro.

Bulk/Container.

LASH.

Flexible Systems for Mixed Cargos

Semi-container.

Super-liner.

Container/ro-ro.

Full ro-ro.

Trailer ro-ro.

Modern Barge Carriers.

Bo-ro.

Conventional

Tramps and Liners with limited container capability.

Source: Gilman, 1980, p. 7

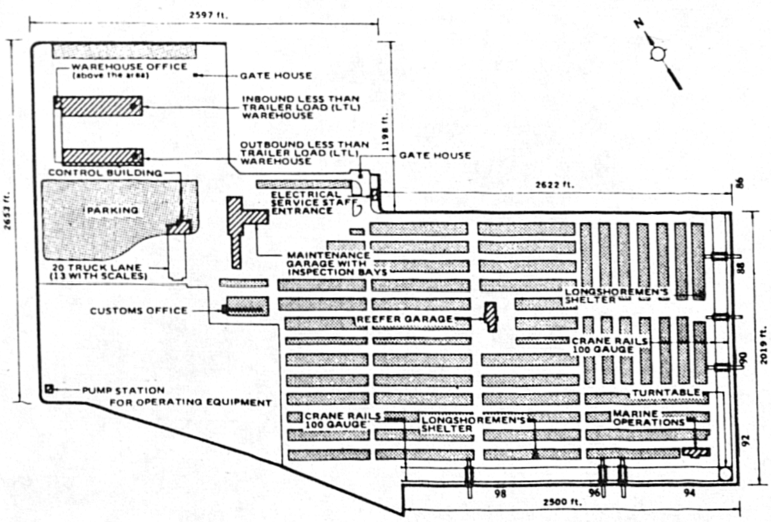
Table T1.2: Typical container characteristics
All containers 8 ft wide (2.44 m)

Type	*Length, ft (m)*	*Height, ft-in (m)*	*Internal capacity, m^3*	*Tare weight, tonnes*	*Max. cargo payload, tonnes*	*Max. gross weight, tonnes*
Dry freight, aluminium	40 (12·19)	8–0 (2·44)	63·3	2·80	27·68	30·48
Dry freight, aluminium	40 (12·19)	8–6 (2·59)	67·0	3·40	27·08	30·48
Dry freight, aluminium	40 (12·19)	9 6 (2·89)	75·0	3·90	26·58	30·48
Dry freight, steel	40 (12·19)	8-0 (2·44)	63·0	3·40	27·08	30·48
Dry freight, steel	40 (12·19)	8-6 (2·59)	67·0	3·60	26·88	30·48
Dry freight, aluminium	35 (10·67)	8-6½ (2·60)	59·2	2·50	22·67	25·17
Dry freight, steel	30 (9·12)	8-0 (2·44)	46·0	3·00	22·40	25·40
Dry freight, aluminium	20 (6·06)	8–6 (2·59)	33·0	1·90	18·42	20·32
Dry freight, steel	20 (6·06)	8–6 (2·59)	33·0	2·20	18·12	20·32
Dry freight, steel	20 (6·06)	8–0 (2·44)	31·0	2·00	18·32	20·32
Dry freight, steel	10 (2·99)	8-0 (2·44)	14·7	1·30	8·86	10·16
Open top, steel	40 (12·19)	8-6 (2·59)	65·0	4·30	26·18	30·48
Open top, steel	40 (12·19)	4–3 (1·30)	27·0	3·90	26·58	30·48
Open top, steel	20 (6·06)	8–0 (2·44)	29·3	2·10	18·22	20·32
Insulated	40 (12·19)	8 6 (2·59)	61·0	4·50	25·98	30·48
Insulated	20 (6·06)	8-0 (2·44)	27·0	2·30	18·02	20·32
Refrigerated*	40 (12·19)	8-6 (2·59)	56·0	5·80	24·68	30·48
Refrigerated*	20 (6·06)	8–0 (2·44)	24·0	3·30	17·02	20·32
Tank	40 (12·19)	4-3 (1·30)	21·4	4·20	18·48	22·68
Tank	20 (6·06)	8–0 (2·44)	19·1	2·80	20·85	23·65

* Integral refrigerating unit.
Note: Nominal dimensions in feet, actual in metres.

Source: Buxton, Daggitt and King, 1978, p. 303

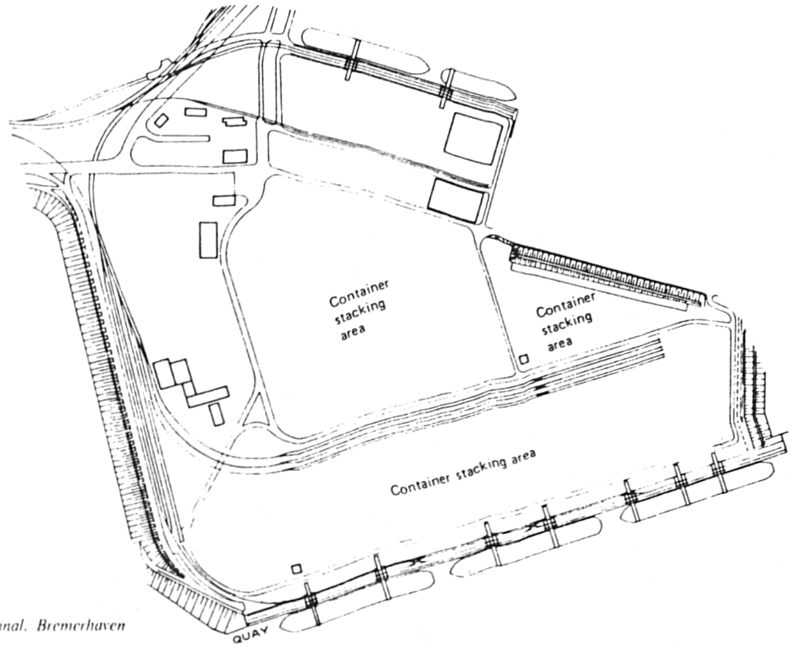
Figure F1.1: Example of trailer storage container terminal layout



General plan of new sea-land terminal at Elizabeth, New Jersey. (Parking space 3,757 35 ft containers and 2,498 40 ft containers.)

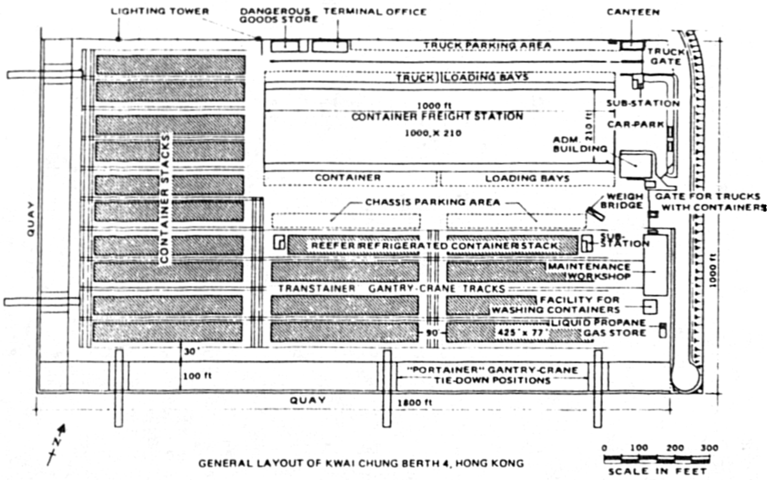
Source: UNCTAD, 1978, p. 130

Figure F1.2: Example of straddle-carrier terminal layout



Container terminal, Bremerhaven

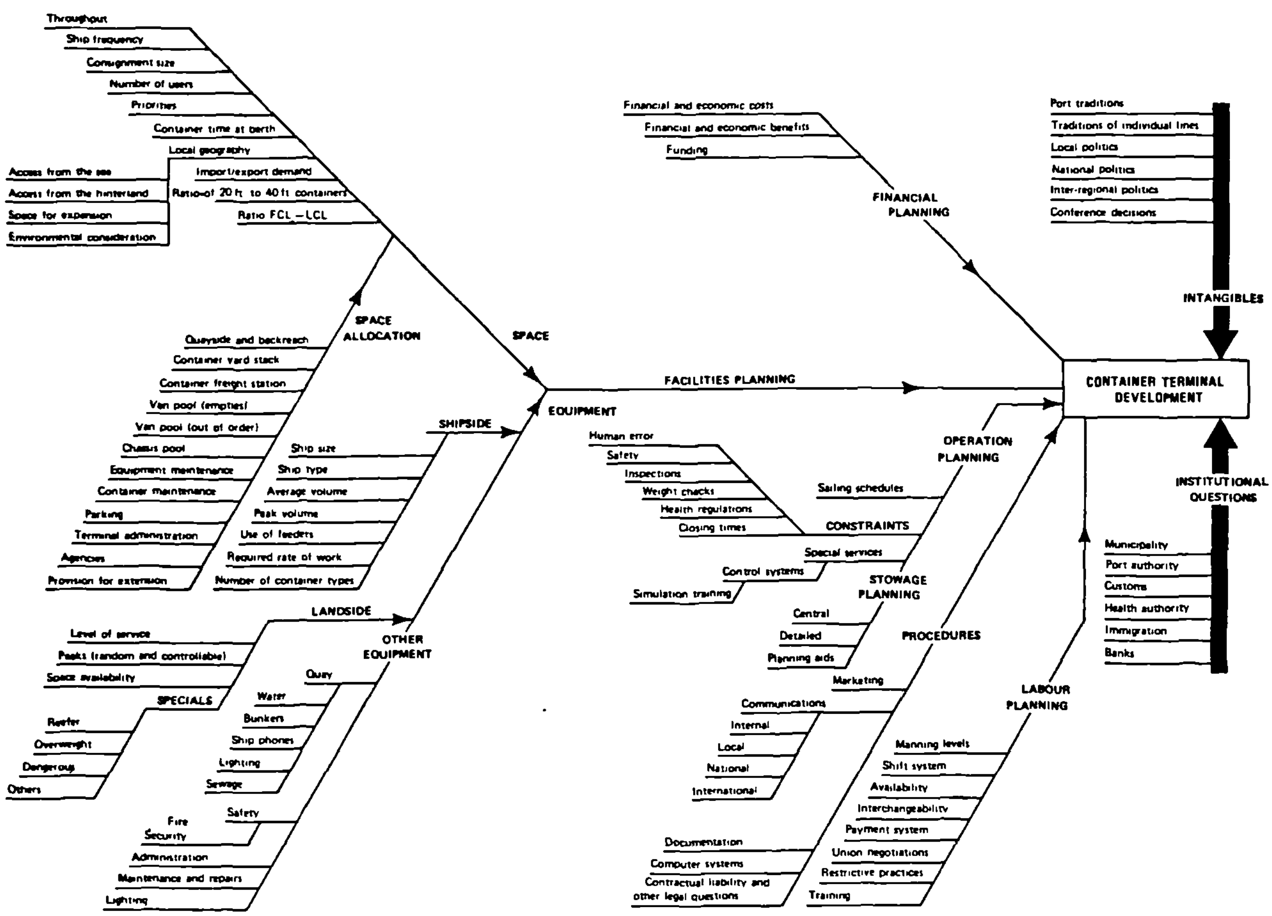
Figure F1.3: Example of gantry-crane container terminal layout



Source: UNCTAD, 1978, p. 131 and 132 respectively

Figure F.1.4 :

Dependency tree for container terminal planning



Source : UNCTAD, 1978, p.129

Table T1.3: Principal barge-carrying-ship dimensions

Operator and vessel	Dwt	Over-all length (metres)	Over-all width (metres)	Full load draught (metres)	Barge-carrying capacity	Container capacity (without barges) (TEUs)	Ro/ro deck space (without barges)
LASH FLEET							
Central Gulf Lines							
Acadia Forest, Atlantic Forest	48 306	261.4	32.6	12.1	73	—	—
Green Harbour, Green Valley, Green Island	46 890	272.3	30.5	12.4	89	—	—
Combi Line							
Bilderdyk, Munchen	44 799	261.4	32.3	11.3	83	—	—
Delta Steamship Lines							
Delta Mar, Delta Norte, Delta Sud	41 048	272 3	30.6	11.6	89	1 740	—
Pacific Far East Line (all to be converted to container vessels)							
Australia Bear, New Zealand Bear, Golden Bear, Japan Bear, Pacific Bear, Thomas F Cuffe	30 298	249 9	30 5	10 7	74	1 200	—
Prudential Lines							
Lash Atlantico, Lash Espana, Lash Italia, Lash Pacifico, Lash Turkiye	30 293	249.9	30 5	10 7	74	1 200	—
Waterman Steamship Corp							
Robert E Lee, Sam Houston, Stonewall Jackson	41 578	272 3	30 6	11 6	89	—	—
SEABEE FLEET							
Lykes Lines							
Almeria Lykes, Doctor Lykes, Tillie Lykes	39 026	267 0	32 4	11.9	38	1 800	13 570 m²
USSR							
Two on order	36 600	210 0	35 0	10 0	26	n a	n a

Table T1.4: Barge dimension

Type	Length (metres)	Breadth (metres)	Full load draft (metres)	Carrying capacity (tons)	Bale capacity (m^3)	Grain capacity (m^3)	Weight of hatch cover (tons)
BACAT	16 82	4.65	2 5	140	164	169	1 3
LASH	18 76	9 50	2.7	370	554	569	2.5
SEABEE	29 72	10 67	3 2	844	1 108	1 138	2 6
USSR	38.25	11.40	3.3	1 070	1 300	1 335	n.a.

Source: UNCTAD, 1978, p. 153

APPENDIX TWO

LIQUID AND DRY BULK CARGO

Both of these types of cargo have special treatment, handling and storage requirements. Set out below are statements of the general requirements of these two categories, togather with selected examples of thedetailed requirements of each drawn from the UNCTAD (1978) handbook for planners. These are included simply to illustrate the wide range of requirements that need to be accommodated in each case.

A2.1 LIQUID BULK CARGO

In general terms the liquid bulk terminal needs a different kind of equipment and requires a larger number of quays than the traditional terminal. This is mainly because of the need to segregate the invariably large numbers of grades of the same liquid commodity. Thus, the number of storage tanks and other equipment required depends more on the number of different grades than the total quantity. "Generally, the rate of discharging liquid cargo is governed by the capacity of the ship's pumps rather than the port's handling equipment" (UNCTAD, 1978).

A2.1.1 Crude Oil and Oil Products

Large crude oil loading and discharging ports are usually located in quite separate and isolated points, normally far from densely inhabited regions. However, in the case of the import of oil products, or small amounts of crude oil for local refineries, an oil zone inside the commercial port is necessary, with some special considerations and provisions. The crude oil commodity and oil products have different properties. According to UNCTAD, this commodity can be divided into two main groups.

a) Black oils, which include crude oils, furnace oils and heavy diesel oils.

b) White oil, which include motor spirits, aviation spirits, kerosene and gas oil.

Separate sets of handling and storing equipment are required for each group of oil, or each product, or sub-group of product within a group, to avoid contamination. Because the crude oil and oil products are hazardous to handle and discharge, security is required, by providing separate berths, jetties or single buoy moorings, completely isolated from other berths, and all the equipment used must be suitable for operating in a hazardous atmosphere. A network of pipelines connects the berth with the storage tanks area.

Two distinct groups of welded mild steel tanks are required for storage, one group for black oils and the other for white oils, each group being surrounded by bonded walls with sufficient height. There are two types of tanks, one type with a floating roof and the other with fixed cone-roof. This former type reduces evaporation losses while the oil is in storage.

The capacities of tanks are normally between 500 and 200,000 cubic metres, but can be even larger, depending on requirements. The weight and height of the tanks is restricted by the soil conditions in the area in which they are located. For the heavy black oil it is necessary to a store in lagged tanks in temperate climates.

A2.1.2 Liquified Natural Gas

Liquified natural gas, commonly known as LNG, is transported at approximately atmospheric pressure with a temperature of -161 C. It is different from the liquified petroleum gas (LPG) which is produced in conjunction with petroleum refining and oil field production, and it need, to be transported under pressure. The hazardous nature and very low temperatures of LNG necessitates special facilities entirely isolated from the rest of the port. A variety of equipment is required for liquefaction, storage, refrigeration, loading, unloading and regasification of LNG.

A2.1.3 Vegetable Oils

The variety of vegetable oils is wide. For example, they include cotton-seed oil, palm kernel oil and coconut oil, all of which have different properties and specific gravities. Some of these oils are in a solid state in a temperate climate and require heating. The process of handling and storing requires equipment with special temperature controls. Vegetable oils are usually stored in welded mild steel tanks with a suitable internal lining. The tank capacity is normally around 1,000 tonnes or less, and the tank must be filled from the top.

2.1.4 Molasses

Molasses is a viscous, dark-brown syrup drained from sugar during refining. Temperature control is important in both handling and storage since below 32 C the product solidifies and above 38 C it caramelises (become sticky like toffee). The specific gravity is 1.34. The handling and storage of molasses differs from that for vegetable oils (UNCTAD, 1978). Because of the high specific gravity of the liquid the storage requires specially designed welded mild steel tanks with fixed roofs, without internal lining.

A2.2 DRY BULK CARGO

Dry bulk cargos are varied in their shape, handling equipment and storage characteristics. Detailed information about the dry bulk terminals, and their equipment requirements are provided in the UNCTAD handbook for port development. In this section selected dry bulk commodities are used to illutrate differences between the different types of commodities according to their requirements These are, iron ore, grain and coal, each is discussed briefly and separately as follows:

A2.2.1 Iron Ore

Iron ore is the most important of all dry bulk commodities that are transported by sea. Approximately 300 million tonnes are now shipped annually. According to UNCTAD, iron ore represents almost 20 percent of total dry cargo shipments by weight. Iron ore varies in composition according to its place of origin. It includes ores such as magnetite, hematite, limonite, siderite and roasted iron pyrites. The ore shipped has a stowage factor which varies between 0.3 and 0.8 cubic metres per metric ton.

In recent years, many new loading ports and discharging terminals have been constructed to meet the requirements of the growing iron ore trades and the development of new sources. Conveyers and chutes are used for loading, and rates of more than 6,000 t/h are common. Grabs are usually employed at discharging terminals, and at typical installations they may each have a capacity of 20 tonnes and operate with a 40-second cycle (about 2,000 t/h) (Buxton, Daggitt and King, 1978).

A2.2.2 Grain

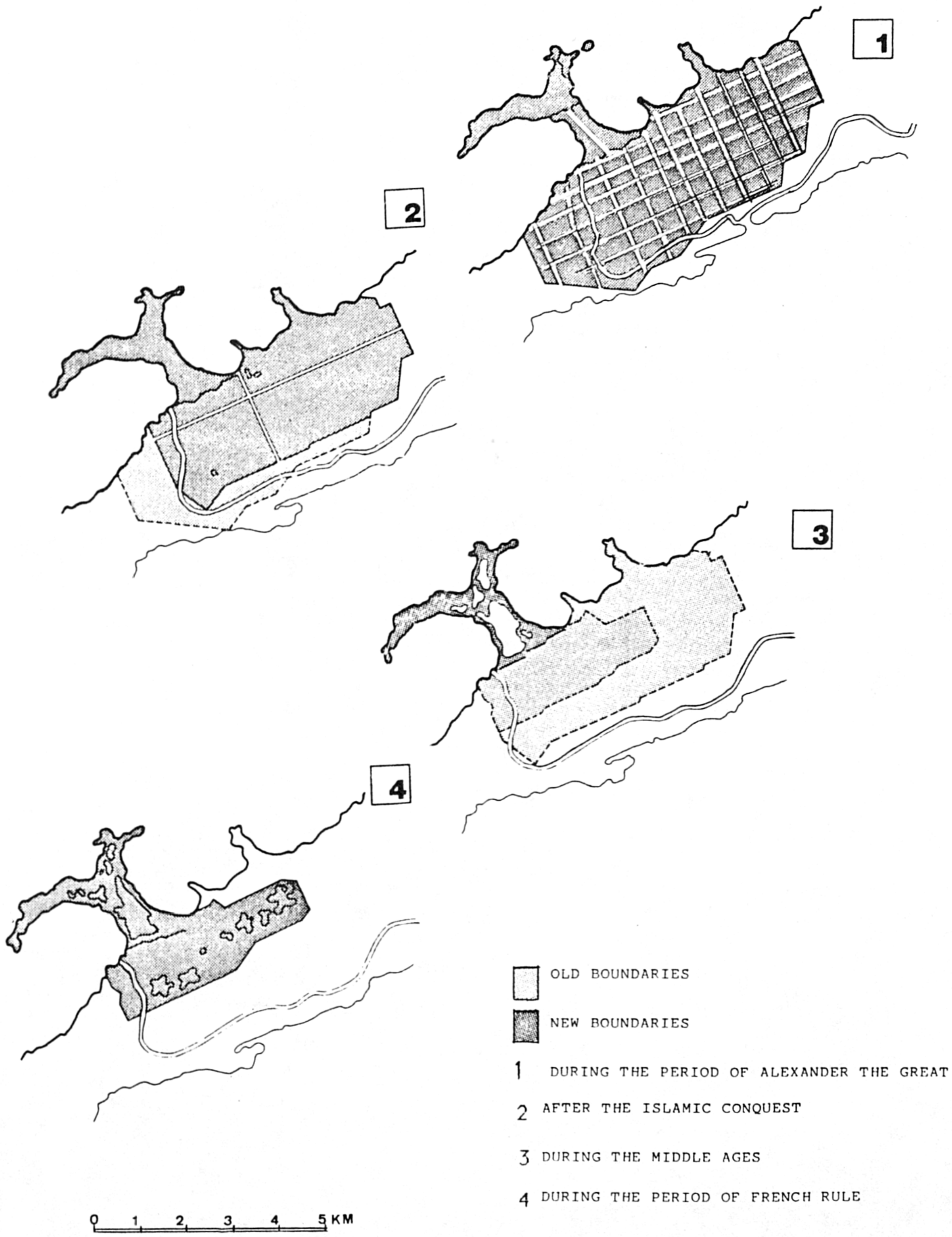
The term "grain" include wheat, maize, oats, barley, rye and a variety of other seeds of which more than 130 million tonnes form about 9 percent in 1975 of the dry bulk cargo are transported annually by sea. Both the supply and demand of grain cargo vary from one year to another because of unpredictable factors such as the effect of weather conditions on the local crops. The main areas of grain exporting are the USA, Canada, Australia and South America. Most other regions of the world are considered to be importers. In the past grain is used to be transported by tramps carriers. Currently, many small and medium size carriers are employed in its carriage. Grain is invariably loaded by conveyers and chutes and at most ports it is discharged pneumatically. However, in some ports grabs (sometimes attached to the ship's own derricks or cranes) or even manual labour may be used (Buxton, Daggitt, King, 1978).

A2.2.3 Coal

The seaborne coal trade has increased dramatically since the 1960s, and in 1975 reached a volume of 127 million tons, almost eight percent of the total dry bulk cargo shipments in tonnes (UNCTAD, 1978). The principal exporting areas are Eastern Europe, USA and Australia. The handling provisions are similar to iron ore, and the cargo mainly carried by carriers of more than 40,000 dwt.

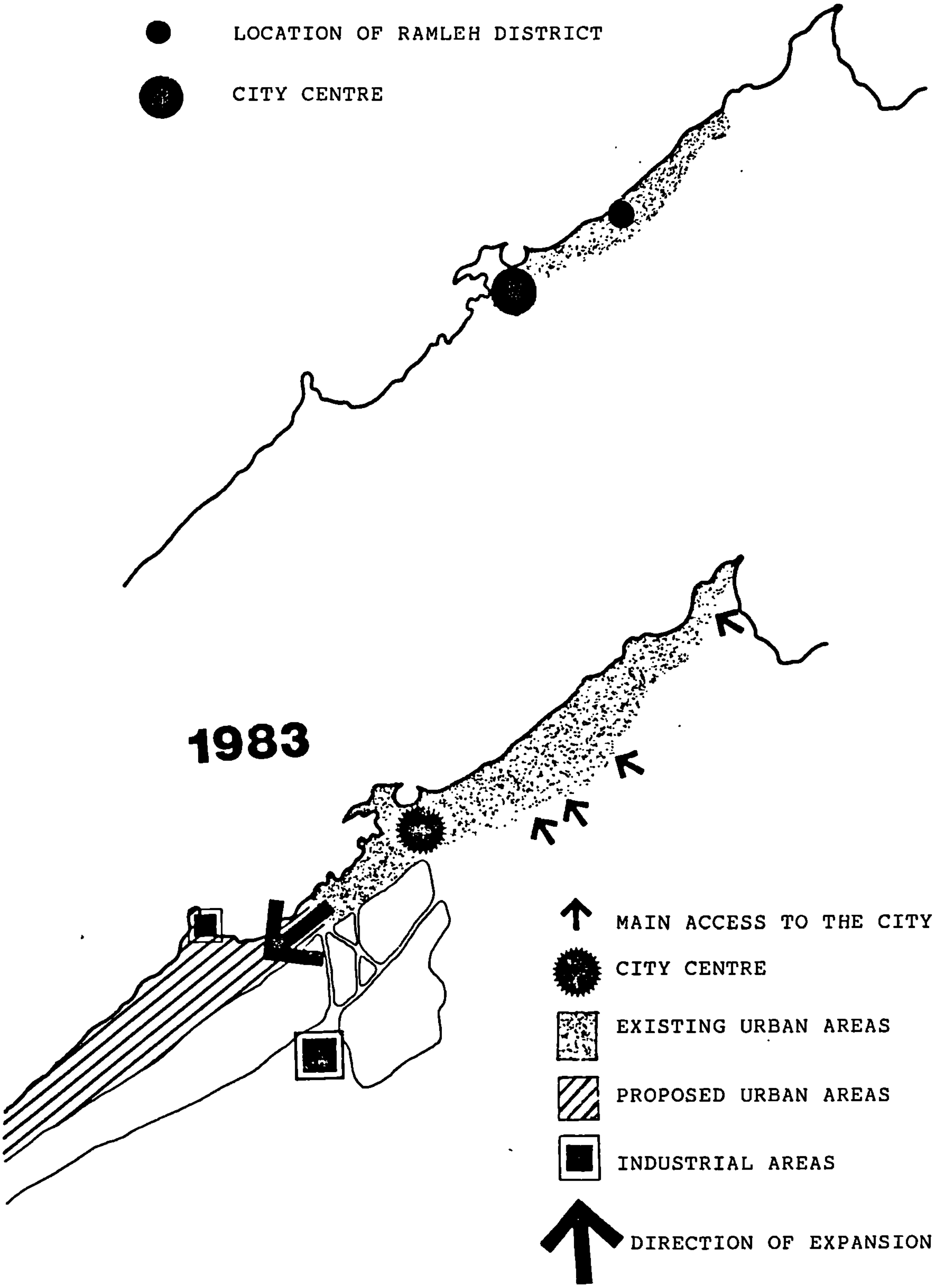
APPENDIX THREE

Historical Development of Alexandria City



Source: Comprehensive Plan, 1984

Alexandria During the 19th and 20th Centuries, and the Recent Growth up to 1983



Source: Comprehensive Plan, 1984

Methods Adopted in Carrying out the Analysis of the waterfront of the two case studies

It was not possible to obtain full and accurate land use maps covering the entire waterfront areas and their land uses for the last twenty years. This was a particular problem in the case of the port of Alexandria. However, with the aid of documentary sources, it was possible to obtain a complete list of the projects and enterprises which took place in the waterfront areas during the period of study. This information was plotted on copies of a relatively recent base map. It was these maps that served as the principal source of data that were used in the subsequent analyses of changes in the pattern of waterfront land use areas.

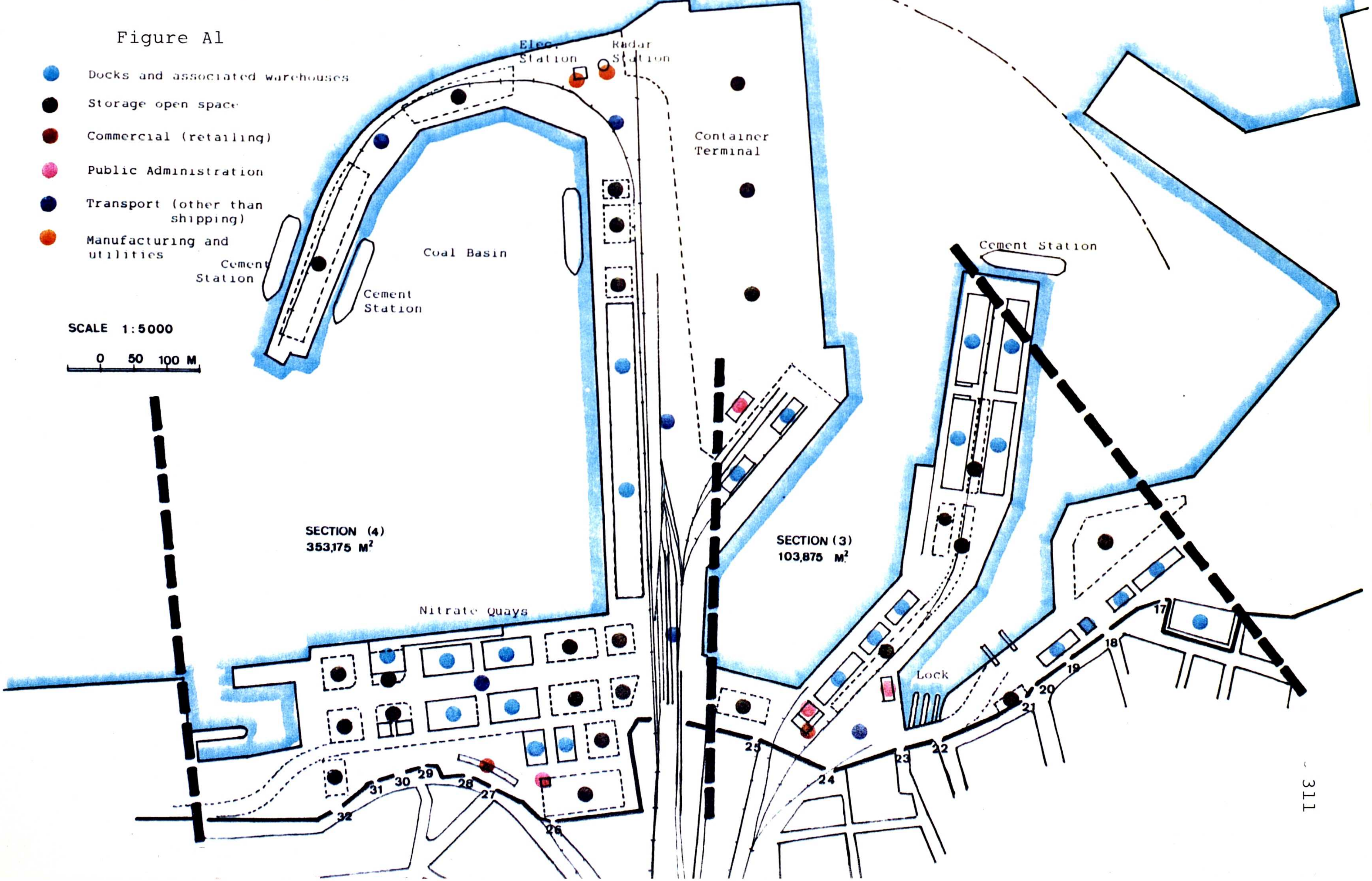
Thus, a land use map was prepared for each individual year of the five study years with respect to the dates of establishment and completion of each project. A full and detailed land use map was also drawn that illustrates the current state of the two waterfront areas.

After dividing the two waterfront areas into appropriate sections, it was possible to use a planimeter to estimate the area of each section. The area of each facility located in these sections has been measured either directly from the land use maps or based on information obtained from the documentary sources.

An example of the type of the detailed land use map, relating to Alexandria, that was employed in carrying out this analytical study, is provided in Figure A1 below.

LAND USES FOR SECTIONS 3 and 4 OF ALEXANDRIA PORT

Figure A1



Alexandria Port Modernisation Plan

Main Objectives

The main objectives behind the modernisation plan are to assist APA in:

1. The continued modernisation of Alexandria port in order to meet the new technological changes.

2. The improvement of the main arteries to the port of Alexandria/El Dekheila.

3. The integration of port services offered by Alexandria and Dekheila and cargo allocations within both parts of the enlarged port.

4. The future development of both ports to 1990 with particular reference to the designation of land for port related use.

5. Recommendations for the entrance channel to Alexandria, to be effective when port facilities at Dekheila come into operation.

6. A review of siltation within the Alexandria/Dekheila port complex and any recommended remedial measures.

Details to be taken into account in carrying out the above objectives should include, but not necessarily be limited, to the following:

1. Alexandria Modernisation

Taking account of the current programme for modernisation of the port of Alexandria already prepared and being executed by APA, to review and incorporate this work as appropriate into an updated comprehensive modernisation programme providing recommendations for timing of all important elements such as renewal of quays and demolition of unsuitable sheds and other facilities.

2. Transport Improvements to the of Alexandria/Dekheila

Taking account of the development proposals for road, rail and water transport already contained in the Ministry of Transport's General development schemes, to prepare for the port of Alexandria /Dekheila and the city of Alexandria, specific phased proposals to relieve congestion at present port entry and exit gates. These recommendations should be made in the light of town planning measures already submitted and currently being studied and shall have due regard to the development concerns of Alexandria Governorate.

3. Alexandria/Dekheila Integration

(a) Recommendations for the optimum traffic allocation between these two ports of Alexandria port to ensure maximum efficiency in container-handling operations, and modern facilities for bulk imports such as grain and coal.

(b) Proposals for future traffic allocation within the greater Alexandria port complex based on the forecast of the Ministry of Transport - Port Sector review by consultants Nedeco, and having regard to port development at other Egyptian ports.

(c) Proposals for the most economic development of facilities for both ports of greater Alexandria port area having regard to the outline master plan for Dekheila prepared in 1977 by consultants BCEOM/WYP/PAM.

4. Future Land Use and Development

Recommendations shall be made for the use of land within the boundaries of land already ceded to the domain of Alexandria port and having due regard to the industrial land use and urban plans of Alexandria Governorate.

5. Access Channel

Recommendations for a new or improved access channel to Alexandria based on an analysis of sub-soil conditions and navigational factors in view of the cancellation of plans to dredge an alternate pass and in view of the present development plans for Dekheila.

6. Siltation

A review of siltation within the boundaries of the sea area between Alexandria and Dekheila and recommendations for any subsidiary studies or analyses to minimise siltation, if in the opinion of the consultant such studies are warranted.