Daniel Coronado
Manuel Acosta
María del Mar Cerbán
María del Pilar López

Editors

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With 8 Figures and 43 Tables

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Dr. Daniel Coronado
Dr. Manuel Acosta
Dr. María del Mar Cerbán
University of Cadiz
Department of Economics
Duque de Najera 8
11002 Cadiz
Spain
daniel.coronado@uca.es
manuel.acosta@uca.es
mariadelmar.cerban@uca.es

María del Pilar López
University of Cadiz
School of Business
Algeciras
Avda. de Arcos s/n
11405 Cadiz
Spain
pilar.lopez@uca.es

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Contents

Introduction

The quantification of the effects resulting from the provision of port infrastructure (understood in the widest sense, fixed capital plus services provided) in various studies of the Spanish and foreign ports has demonstrated the significant contribution of such investment to the economic development of the local area in which the port is located. The successes achieved in the evaluation made from such analyses have proved to be very useful for the economic and political decision making, and have consequently become an incentive for similar work to be undertaken on other parts of the Spanish port system. A Study of global economic impact of the Port of Algeciras Bay (PAB) was carried out some years ago on the initiative of the Port Authority. The results showed its strategic value as a driving force in the generation of employment, economic activity and general socioeconomic development in its area. The notable growth and consolidation of one of its activities – container traffic – now justifies a more specific research that may help to evaluate more precisely the socioeconomic importance of this activity undertaken by the PAB, not only for the inhabitants of the Algeciras Bay but also for the whole of Andalusia.

The PAB handled a volume of more than two and a half million TEUs in 2003, ranking the first position for container traffic in the Spanish port network and the second in all the Mediterranean ports. This figure justifies a specific study of the economic impact of these activities. The containerization process in its port phase involves a complex of interrelated economic activities whose effects on employment, value added, etc., spread through the entire chain of production and distribution of the local and regional economy. The assessment of the real wealth generated by the container traffic should consider the economic benefits to the users of the port, in addition to the wider social advantages (in terms of income and em-

ployment) generated by the presence of the container traffic at the PAB. Two well differentiated types of commercial activities coexist in the port based aspects of the containerization process: transhipment on the one hand, and export/importation on the other. The economic impact will be broken into these two markets.

The main objectives of this study of impact of the container traffic can be specified as follows:

1. To estimate the economic activity generated by the container traffic at the PBA, so that this information may be utilised as part of the criteria in strategic decision-making.
2. To evaluate the contribution of the Port to the economic development of the Algeciras Bay and Andalusia.

In other words, we will try to offer a detailed information of the principal magnitudes that demonstrate the importance of the Port's containerisation services an their multiplier effects.

From these general objectives, we set out the following specific objectives:

1. To calculate the number of direct, indirect and induced jobs generated by the process of containerisation.
2. To determine the principal economic magnitudes (incomes from employment, gross operating margins, taxes and sales volume) generated in the companies associated with the services of containerisation.
3. To obtain the gross value added that is produced from the containerisation activity and its contribution to the provincial and regional economy.
4. To identify the sectors that are most dependent on the containerisation activities.

In order to meet the general and specific objectives we have structured this study in four chapters. The first is the basic context or global framework, where in addition to the basic figures on the main trends of the containerisation business, the characteristics that currently condition this process are presented. In the second chapter the physical characteristics of the PAB in relation to this activity are explained, and the situation in respect of the physical and logistics infrastructure prevailing in the principal Mediterranean ports

is described. The object of the third chapter is to make a comparative analysis of the evolution of the container traffic, in order to situate the PAB in the contexts of both the Spanish ports and those of the rest of the world. In the fourth chapter the economic effects are determined; the economic impacts of the Port of Algeciras Bay and its economic relevance are derived from the application of the methodology employed, which is described in appropriate detail in Annex A.1. We obtain quantitatively the value of a series of economic magnitudes both for the transhipment of containers and for the relevant export/import activities; this data provides us a global picture of the economic significance of the containerisation activities in the Port of Algeciras Bay and in its hinterland.

1 Container Traffic from an Economic Perspective: Analysis, Trends and Prospects

1.1 Introduction

It is well known that the terms globalisation and international competition dominate discussion of the international maritime transport of containers. The growth of this traffic on the world scale, as the direct consequence of the internationalisation of the economies of almost all countries, and of the intensive search for efficiency in the handling and transport of goods, has resulted in more intense competition and the adoption of new strategies by all the agents involved in the process of containerisation. The adoption of these strategies in order to survive in a sector of fierce competition – between ports specialized in container traffic and between suppliers of associated services – is causing rapid and profound changes in world maritime commerce, with significant consequences for the design and planning of port policy. Some of these transformations, their trends and consequences have been emphasised in the recent scientific literature: the development of new mergers and strategic alliances (Slack et al., 2002); new methods of port management (Baird, 2002; Choi et al. 2003; Martin and Thomas, 2001); the effects of technological innovations (Cullinane and Khana, 2000; Steenken el al., 2004); the strengthening of the quality of services (Ha, 2001; 2003); the evolution of the intermodal transport and of logistics (Notteboom and Winkelmans, 2001; Panayides, 2003) and, finally, the identification of the determinants of competitiveness between ports specialized in containers and the description of competitive strategies (Lirn et al., 2004; Song, 2003; Song and Yeo, 2004; Notteboom, 2002). We deal in this chapter with these essential features of the current and future context of the process of containerisation.

The supporting documentation used to draft this chapter is constituted by the scientific literature, the specialized journals in containerisation activities, and the information gathered from the principal port operators of the PAB. There are two objectives: on the one hand, to describe the agents, interrelationships and activities of containerisation, and on the other, to provide the necessary context and complement for the quantitative economic effects of the process of containerisation that will be detailed in the next chapters.

In the following sections we first review the concepts utilised in the field of containerisation, the agents involved and their relationships; secondly, we provide figures indicating the principal trends in the business of containerisation over recent years; thirdly, we refer to the characteristics that are currently conditioning the process of containerisation, and particularly their repercussions on port policy; and lastly, the principal conclusions are drawn.

1.2
The Containerisation Process: Concepts, Resources and Relationships

1.2.1
Containerisation and Intermodality

There is apparently unanimous agreement among users, political decision-makers and researchers that, of all recent innovations in transport, containerisation is the most significant in its effect on the global system of transfer of merchandise, in developed and developing countries. Although the use of standard containers is a relatively recent activity, having begun barely forty years ago, its rate of progress has been spectacular.

What is generally understood by the term "containerisation" is an intermodal system of transport for cargo of many kinds that uses standard containers capable of standardised methods of handling, which can be rapidly and easily transported and stored, and interchanged between ship, railway wagon and truck. The ISO container is now established as the essential element of the logistics revolution that transformed the handling of most types of cargo (other than very

large bulk loads like petroleum) in the 20th century. At the beginning of the 1930's Malcolm McLean promoted the idea that merchandise should only be handled twice: at the point of origin loaded into a container of standard size, and at its destination, unloaded from the same container. This idea was put into commercial operation with the acquisition of a shipping line, the Sea Land Company, and the adaptation of its merchant ships for the transport of containers. Within a decade intermodal transport had become a generalised practice.

The basis of the containerisation concept is the standardisation of cargo in homogeneous units or containers. Container is the generic term utilised to designate a box in which merchandise is transported, strong enough for frequent reutilisation, stackable and fitted with standard lifting points to facilitate transfers between modes of transport. The International Standards Organisation (ISO) obtained agreement on a range of standard measurements for the dimensions of containers. The most frequent standards in Europe for measuring the capacity of container-carrying vessels or cargo loading and unloading activities in ports are: containers of 20 feet (6.10 m), or TEU (equivalent unit of 20 feet); an equivalent unit (TEU) is therefore equal to a standard container (20 ft × 8.5 ft × 8.5 ft), with a volume of approximately 40.92 m^3. Since the 1960's numerous standard dimensions have been proposed for containers. One of the first, however, the initial ISO dimension of twenty feet (about six metres) in length, remains in force. This is the most popular, and tends to be used to quantify traffic movements and the maximum load capacity of container-carrier vessels. Other common units are those of 40 feet length and the refrigerated containers, of both 20 feet and 40 feet size, and commonly termed *reefers* (these have doors at one end and a refrigeration unit incorporated).

One of the fundamental reasons for the rapid expansion of containerised merchandise transport lies in the concept of intermodal transport. This is defined as the shipment of unified cargo by the coordinated use of more than one mode of transport, in such a way that the comparative advantage of each mode employed is maximised and the chain of transfer of merchandise is conducted in a unique way (Panayides, 2002). Intermodal transport is, therefore, a broad concept, referring to units of cargo that can be transported by various

means, semi trailers or mobile cases. It is also considered for other types of merchandise.

The advantages offered by an intermodal transport structure have ben recognised since the 1980's. The potential benefits extend to the whole economy, and indeed to society as a whole: increased numbers of companies involved, better coordination and management; economies of scale in door-to-door transport operations that lead to cost reductions and increased profits. For shipping lines the principal benefits of containerisation are those derived from economies of scale. The construction of large and specialized container vessels has reduced both fixed and variable unit costs. However, these large ships are inherently expensive to build and operate, hence the shipping companies that own or operate them understand that it is essential to reduce considerably the time spent in port, for loading/unloading and for maintenance or repair (Martin and Thomas, 2001). In addition to the opportunities for improved efficiency, the other principal beneficiaries of containerisation and intermodal transport are the consumers of the goods transported. Before the emergence of transport by containers, maritime transport represented between 5% and 10% of the cost of a product. After containerisation had become general practice, with the improvements in corresponding port technologies and the increased efficiency of container carriers, it is estimated that maritime transport now represents between 1% and 1.5% of the product cost. On the other hand, the containerisation of merchandise for its transport also has some drawbacks: a large initial capital investment is required before the transport by containers can begin (major cost items are the containers themselves, the ships, the terminal installations, and handling equipment); there are some important classes of merchandise that are not suitable for transport by container, due to their physical characteristics or for economic reasons; there are tendencies towards the concentration of the business in fewer companies, and the formation of oligopolies can alter the functioning of the market for containerised merchandise.

From the point of view of the port activity, it is well known that in the general merchandise trade, the functional unit is the dock, and that most of the economic activities are centred on the quay where the vessel is loaded and unloaded; however, with traffic container, the series of traditional activities involved in the process of transfer

of merchandise between ship and shore is extended to several other shore-based activities beyond the dock itself (Clayton, 1989, Martin and Thomas, 2001). The growth in the process of containerisation is increasingly altering the economic activities involved in the shipping business. Significant changes have taken place in the routes and itineraries of the vessels, in the handling of the cargo, in the equipment and installations required, and other aspects. Furthermore, with the development of intermodal transport, certain shore-based have come to play an essential role in the process of containerisation (inland transport, cargo terminals, commercial procedures and practices, systems of information and communications, etc.). In the next section, we consider the agents and activities involved in the containerisation process and the interrelationships between them.

1.2.2
Agents and Activities Involved in the Containerisation Process

In general terms, the principal port agents involved in the process of containerisation have been well described in the specialist literature. Considering these port services grouped under the headings customarily used, the following groups of activities intervene in the process:

– The Container Terminal. As referred to in the legislation, the merchandise handling terminal is understood to be an installation intended for transferring merchandise between the maritime and land modes of transport, or for maritime transit. These installations may include areas apart from the port, where merchandise and vehicles are deposited and where operations necessary for the transfer between modes or for maritime transit are carried out. A terminal dedicated to private use is one that has been granted a concession or authorization, not open to general commercial traffic, which handles merchandise owned by the company owning the terminal, or by its shareholders or participants with effective influence in the management or control of the terminal, or by the group of companies to which it belongs, or from which vessels employed

exclusively by the shipping companies of the terminal owner, or of its group of companies, are operated. In economic terms, the name terminal is currently applied to the installations that provide a range of specialized services to users. This term is used to indicate that the installations undertake integrated activities in the provision of services to the clients, also to importers, exporters and transport operators, and to the shipping line (Martin and Thomas, 2001). All the activities from the arrival of the container by sea or land, until to its departure are controlled from the Terminal. The systems of operation in a container terminal consist of a set of actions that encompass the operations of the vessel, the movement of merchandise, storage, reception and delivery, entry operations, and management and information (Won et al., 2000).

– Shipping line and integral *feeder service*. The shipping lines are responsible for the transport of the merchandise by sea, although they usually provide integrated logistics packages and subcontract out the road and rail transport required for particular containers, when they do not provide these services directly themselves. As a result, their sphere of interest and action is extended inland. On occasions the shipping lines themselves, or companies of their group, are also responsible for the management of the port terminals. The *feeders* deal with the transfer of the container from the port of transhipment to the port of final destination. They operate as a service user, although on occasions they form part of a strategic alliance with the rest of the shipping companies. The *feeder* ships transport containers or merchandise to or from a major port, generally termed an ocean port, from or to the smaller ports nearby, and the ships used as feeders are of smaller dimensions.

– Forwarder or *intermediary agent*. This is a legal entity or individual who undertakes the commercial role of organising, coordinating and controlling international transport activities using any transport medium. Their principal functions are: organising transport of particular cargo using the various different modes, by land, sea and air, to the account of their customer, and being responsible to the customer for the provision of all services in respect of the issue of documentation related to the transport of the cargo. One could say that the forwarder is in charge of providing the door-to-door service, and this therefore confers an important role on the for-

warder in the decision-making on which mode of transport and which specific line to use in any particular case. These intermediaries provide integrated logistic packages to those customers who do not deal directly with the big shipping lines. They also offer their integrated services for those shipping companies that do have their own transport department, in order to provide a complete service to the customer. In Europe, it is well known that the business of the *forwarder* has a significant level of vertical integration. The *forwarders* excel in the organisation of intermodal movements that require the combination of trans-ocean cargo with various modes of land transport.[1]

– Road and rail carriers. The road transport carriers provide a container distribution service by truck from the hinterland to the port, and vice versa. The rail transport carrier (RENFE in this case) connects the container terminal via the rail network with depots inland, and vice versa. As indicated, with the expansion of intermodal transport, the combination of road and rail services has become customary practice. The services of road and rail carriers are generally subcontracted by the providers of integrated door-to-door services.

– Other complementary port activities. To the above list must be added a series of port services directly related to the process of containerisation, that are not essentially different from those provided by a traditional port organisation, but are necessary for the complete process to function correctly. (loading/unloading, tugs, moorings, fuel supply, repairs of vessels and containers, etc., in addition to official control organisms). Logically, the port authorities, as public institutions charged with the internal organisation of a port, play an essential role in the process, although perhaps they are not as deeply involved in all activities as in a traditional port organisation. The port authorities do not act as operators, they provide the port space and supervise the aspects necessary

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[1] In Spain, the role of the Forwarder is based on the Law 16/1987 of 30 July for the Regulation of Land Transport, on the Real Decreto 1211/1990 of 28 September, in which the Regulation for the Law for Land Transport was approved, and in the Order of 4 February 1993 of the Ministerio de Obras P licas y Transportes.

for the complete process to be carried out in a context of safety and legality.[2]

As we shall analyse in the following sections, the internationalisation of the maritime business and the forces of globalisation have brought about deep changes in the organisation of port activity in those ports specialized in container handling. In principle, all the activities carried out by the port operators are interrelated and need to be closely coordinated so that the process of containerisation should take place as efficiently as possible. To facilitate operations, the terminals have invested heavily in computer systems and software, and have developed extensive systems of communication. For some years now a process of vertical integration of activities has been taking place. This has been reinforced by the desire and the necessity of the shipping lines to control the integral management of the service, avoiding risks arising from dependence on the interests of independent companies. The operation (in some cases by acquisition or merger) of container terminals by shipping companies is a process in expansion. The independent forwarder also usually provides an integrated service to the customer, although it is common for a powerful customer to work without an independent forwarder and deal directly with the shipping line, which in turn provides it with a door-to-door service. Some shippers that lack the necessary infrastructure continue, in any case, to maintain business relationships with the forwarders. In respect of road and rail transport, subcontracting continues to be the normal practice, either by the more powerful companies (shipping groups and terminals), or by independent agents. In the following sections we deal with these and other recent trends and transformations.

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[2] In Spain they are regulated by the Law 27/1992 of 24 November, of Puertos del Estado y Marina Mercante, modified by the Law 62/1997 of 26 December, and by the Law 48/2003 of 26 November, in respect of the financial regime and the provision of services (currently being revised).

1.3
Evolution of the Containerisation Business: Trends and Prospects

1.3.1
Evolution of Container Traffic: Global Perspective

Figure 1.1 reflects how world container traffic has evolved. This increasing trend is expected to be maintained for at least the next twenty years. Recent estimates of the volume of merchandise containerised also point to continuing growth. It is expected that containerised trade, measured in TEUs, will grow at an average annual rate of 5.3% between 2003 and 2025 (UNCTAD, 2004).
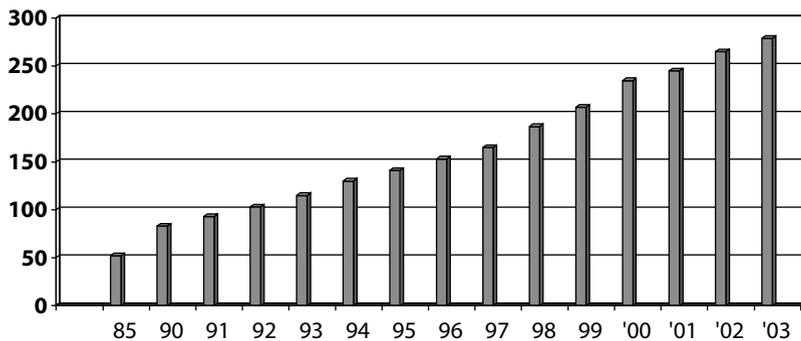
Fig. 1.1. Evolution of world container traffic (millions of TEUs). Source: C.I. (on line)

1.3.2
Concentration of the Business and Activities Related to Containerisation

The concentration of the activities related to the process of containerisation is one of the current characteristics of the business. These activities also present an increasing trend towards functional and spatial aggregation. The data and comments that follow next demonstrate this reality:

a) Concentration of traffic in fewer ports Some indicators of concentration of port traffic are given in Table 1.1. It can be observed that in 2003 almost 38% of total world traffic was concentrated in only ten ports, and the next ten ports ranked by traffic volume only accounted for another 14% of the world traffic. This characteristic, however, is not new. The data for the 1980's were already showing a strong concentration, with a slight upward trend.

By geographic zones (Table 1.2) almost 28% of total world traffic is concentrated in the ports of East Asia. China (including Hong Kong) has three of the five ports with the greatest traffic in the world, measured in TEUs. Six of the ten most important ports and twenty of the thirty with greatest traffic volume are located in Asia. The ports of the West Mediterranean, which include the PAB, accounted for 5.2% of the total world traffic in 2003.

b) Ownership of the ships Ownership of container carrier vessels is also strongly concentrated in a few shipping companies. In 2004 28.5% of total shipping capacity (in TEUs) was accounted for by only five companies (Table 1.3). The top 25 maritime container carriers controlled 79% of the total capacity in TEUs. Their capacity grew by 12% during the year 2003; in comparison, the next largest companies – between the 26th and the 50th ranking – together grew at

Table 1.1. Evolution of the concentration of container port traffic (%)

Ports with most traffic	2003	2000	1995	1990	1985	1980
Top ten	37.78	33.92	36.73	36.84	30.95	30.95
ranked from 11th–20th	14.05	12.42	13.08	16.42	16.54	16.54
ranked from 21st–50th	17.18	16.30	16.40	17.75	18.81	18.81
ranked from 51st–100th	20.42	19.86	18.32	16.23	19.57	19.57
Ports with most traffic (Cumulative)						
C10	37.78	33.92	36.73	36.84	30.95	30.95
C20	51.83	46.33	49.81	53.26	47.49	47.49
C50	69.00	62.64	66.21	71.01	66.30	66.30
C100	89.43	82.50	84.53	87.24	85.87	85.87
All ports	100	100	100	100	100	100

Notes: C10 , C20, C50, C100: Cumulative traffic in the top ten, twenty, fifty and hundred largest ports of the world.
Source: CI (2004)

Table 1.2. Distribution of traffic by geographic zones (2003)

Region	TEUs	%	Cumulative %
East Asia	76,716,166	27.66	27.66
South East Asia	34,445,940	12.42	40.08
North of Europe	32,448,693	11.70	51.78
North East Asia	24,552,710	8.85	60.64
North America, West Coast	21,034,005	7.58	68.22
West Mediterranean	15,323.724	5.53	73.75
North America, East Coast	14,448,307	5.21	78.96
Middle East	11,102,568	4.00	82.96

Source: CI (2004)

Table 1.3. Capacity of the world fleet 2004

Shipping Company	Ranking 2004	Ranking 2003	N° TEUs	Ships	Concentration (%) TEUs	Ships
Maersk Sealand	1	1	833,142	306	9.35	4.02
Mediterranean Shipping Co SA	2	2	625,082	239	7.02	3.14
P&O Nedlloyd Container Line Ltd	3	3	400,691	143	4.50	1.88
Evergreen Marine Corp (Taiwan) Ltd	4	4	346,192	124	3.89	1.63
CMA CGM SA	5	5	329,360	117	3.70	1.54
APL Ltd	6	6	296,193	92	3.32	1.21
Hanjin Shipping Co Ltd	7	7	271,644	68	3.05	0.89
Cosco Container Lines Ltd	8	8	258,979	126	2.91	1.66
NYK Line	9	10	242,179	73	2.72	0.96
China Shipping Container Lines Co Ltd	10	9	235,633	104	2.64	1.37
C10			3,839,095	1,392	43.09	18.29
C20			5,528,889	1,999	62.06	26.26
WORLD FLEET			8,909,218	7,611	100	100

Notes: C10 Capacity of the top ten shipping companies C20 Capacity of the top twenty shipping companies.
Source: Prepared from data of CI (October, 2004)

the lower rate of 9%. Table 1.3 gives the rankings of the principal shipping companies in terms of capacity, and shows the degree of concentration, in both TEUs and number of vessels.

c) Concentration of other related activities   Other data that illustrate the extent of concentration in the containerisation business are the following:

– Construction of vessels. Three Korean companies and one Japanese are the four big constructors of container carrier ships. The Korean

companies account for 62% of total orders, and if we add all the Asian shipbuilders, this rises to 86%. The participation of Europe only amounts to 13%, and North and South America together for less than 1%.

– Production of containers. Approximately 82% of all containers are now constructed in China by two leading companies: CIMC and Singamas.
– Container operators. Half of the ten main operating companies in terminals are linked to shipping companies (for example, APM belongs to the same group as Maersk-Sealand).

1.4
Current Features of the Global Process of Containerisation: Increasing Size of the Vessels, Strategic Alliances and Competition

1.4.1
Increase in the Size of Vessels

Among the various technological innovations that affect the process of containerisation, the continuous increase in the size of container ships is, without doubt, extremely important not only for policies of port infrastructure, but also for the methods of management (Steenken et al., 2004). Since specialized container ships were first adopted, vessels of increasing size and efficiency have been regularly introduced. At the start of the 1960's, the first generation of container ships carried up to 1000 TEUs. In the second generation (between 1967 and 1972), the vessels reached a capacity of up to 1500 TEUs. The third generation of container carriers, the Panamax ships, built in 1972, had a capacity of 3000 TEUs; they are capable of sailing at 26 knots. These were followed by a fourth generation of vessels constructed in 1984 with capacity of up to 4500 TEUs. The limitations of the Panama Canal made the marine engineers to extend the length of the ships rather than the beam. The advances in technology have allowed a fifth generation of Panamax vessels to be built, capable of transporting up to 4800 TEUs at a cruising speed of 25 knots and

consuming half of the energy compared with ships of the third generation. In parallel post-Panamax ships have begun to appear on the scene, the first constructed in 1988 for APL; in 1994 four companies began to operate with post-Panamax tonnage. Currently there are several vessels with a capacity of 8700 TEUs operating in the market.

The principal benefit of the increase in size for the ship operators is economies of scale. The cost per unit of TEU transported has been substantially reduced. The largest savings in transport cost are achieved with the largest ships: it is estimated that shipping in a vessel of 6000 TEUs against one of 4000 can lead to a unit cost saving of more than 20% (Loo and Hook, 2002). The latest estimates indicate that these increasingly larger vessels are being ordered to replace less efficient and slower ships. The principal motivation continues to be the reduction of unit costs. In general, it is estimated that a post-Panamax vessel of 9,500 TEUs operates at a unit cost between 30 and 35% lower than a Panamax vessel of 4,500 TEUs (Containerization International, June 2004).

Nevertheless, not all are advantages. As a counterweight there are several aspects that without doubt will have repercussions on the current policies of the port authorities:

a) Since these ships represent considerable investments, their owners and operators are even more concerned to minimise their turn-around time in port.
b) The costs of transhipment and feeder services could outweigh the operational savings accruing to the lines using these large vessels.
c) The costs may be reduced for the actual maritime transport, but may be increased in the rest of the transport chain (rail or road).
d) The largest vessels must inevitably be concentrated in specific major ports (due to limitations in draught), which can cause congestion in particular hub terminals and lead to inefficiencies.

The port characteristics and facilities required for berthing large container carrier vessels have already reduced the number of ports of call, with a considerable influence on the port geography; this has led to a classification of the container ports in three categories:

– Ports designated as *pivot*, *hub* or cargo centres, specialized in handling large container carrier ships, situated on the main trading

routes, where the containers are trans-shipped to smaller vessels for onward transport to nearby ports.
– *Feeder* ports, serving the smaller ships that transport containers to and from the *hub* ports.
– Direct ports of call where there is sufficient local trade to justify their use by large ships, but where containers are not transhipped for transport to and from other ports of the region.

The forecasts for the coming years indicate that, in the short term, container ships with capacities of between 10,000 and 12,000 TEUs are expected to break into the Far East routes. The leading ports in container traffic (Singapore, Hong Kong, Yantian, Shanghai and Yokohama) are already planning for the probable, rather than just possible, entry of these very large ships into service (World Bank, 2003). However, the great majority of new vessels that are on order for delivery in the next three years are now in the capacity range of 8000 to 9500 TEUs. Table 1.4 gives details of the orders placed for the construction of these large vessels to date: 8 ships of 9,500 TEUs capacity have been ordered from Samsung Heavy Industries for a Chinese shipping line. The delivery dates of these vessels are between 2006 and 2007, although "negotiations are apparently taking place for the possible increase of these ships' capacity to 10,200 TEUs" (CI, 2004).

We also present in Table 1.5 details of the vessels on order (at October 2004) for Maersk-Sealand, with delivery in the next four years. According to CI (2004), citing sources close to Hyundai Heavy Industries, AP Moller-Maersk has already placed an for a *K98 14-cylinder engine*, capable of generating 80,080 Kw, and propelling vessels of more than 11,000 TEUs capacity at 25 knots.

The shipping companies offer several economic reasons to justify these investments. For example, Cullinane and Khanna (2000), after surveying eight of the principal shipping companies specialising in the transport of containers, summarise the position of these companies as follows: reduction of costs per TEU transported (economies of scale provide a short term competitive advantage); the strength of the alliances between lines makes these vessels more viable; the market is expected to continue growing; finally, the operation of these large vessels is facilitated by the improvements in port infra-

Table 1.4. New constructions of ships ordered (October 2004)

Name	Owner	Operator	TEUs	Delivery
Samsung 1558	Seaspan	CSCL	9,500	August 2006
Samsung 1559	Seaspan	CSCL	9,500	October 2006
Samsung 1560	Seaspan	CSCL	9,500	December 2006
Samsung 1561	Seaspan	CSCL	9,500	January 2007
Samsung 1562	Seaspan	Unknown	9,500	August 2006
Samsung 1563	Seaspan	Unknown	9,500	December 2006
Samsung 1564	Seaspan	Unknown	9,500	March 2007
Samsung 1565	Seaspan	Unknown	9,500	June 2007
Nantong Cosco KHI NB	Cosco	Cosco	9,200	2008
Nantong Cosco KHI NB	Cosco	Cosco	9,200	2008
Nantong Cosco KHI NB	Cosco	Cosco	9,200	2008
Nantong Cosco KHI NB	Cosco	Cosco	9,200	2008
Nantong Cosco KHI NB	Cosco	Cosco	9,200	2008

Source: CI (2004)

Table 1.5. New constructions ordered by maersk sealand (October 2004)

Name	Number	TEUs	Delivery date	Shipyard
Daewoo NB	4	8,400	June 2007–August 2008	Daewoo
Hanjin 162/167	6	6,500	April 2007–June 2008	Hanjin
Hanjin NB	4	3,400	June 2007–March 2008	Hanjin
Hyundai 1630/1700	6	4,300	December 2005–February 2007	Hyundai
Hyundai 1721/1727	7	6,070	June 2006–September 2007	Hyundai
Hyundai	1	4,300	June 2007	Hyundai
Hyundai NB	2	4,300	August–October 2007	Hyundai
Odense 193/195	3	4,035	October 2004–June 2005	Odense
Odense 197/210	14	6,600	March 2006–May 2009	Odense
Volkswerft Stralsund 465	7	4,000	September 2005–March 2007	Volkswerft
Total	54			

Source: CI (2004)

structures. However, increased ship size is not the only option for unit cost reduction or greater efficiency. Another alternative that is already being implemented by some companies is to increase ship speed; smaller vessels (of between 1,400 and 2000 TEUs capacity) but capable of higher cruising speeds are being acquired, offering the additional advantage of greater agility in loading/unloading.

In the longer term, container vessels with capacity of 15,000 TEUs or even larger appear to be feasible. A new term "Malacca-Max" has been coined for such very large container carriers: vessels with

capacity for 18,000 TEUs could measure 400 metres in length, with a draught of 21 metres (the maximum for navigating the shallow water depths of the Strait of Malacca linking the Indian and Pacific Oceans). However, any prospects for ships of greater capacity than those listed in the preceding tables of orders for construction implies entering the realms of speculation.

1.4.2
Strategic Alliances and Cooperation Between Companies

One of the most significant developments in the maritime container transport business in the last decade has been the formation of strategic alliances, cartels and other strategies for cooperation, not only between shipping lines, but also between all the port operators that have adopted these defensive strategies. At least half a dozen principal mergers or acquisitions have taken place between shipping lines specialising in containers, since the mid-1990's; these have generated very significant concentration and capacity for control in fewer and fewer companies.[3]

With the object of clarifying the principal concepts, it is usual to distinguish between two types of integration: vertical and horizontal. In processes of vertical integration relationships are formed between all the various activities involved in the logistic activity of transport. The operators of a container terminal are aware of the fact that the transport chain is considered as a fully integrated system. The clients are calculating the total cost of the containerised goods, and this increases the pressure to reduce costs in all parts of the chain, in the maritime trajectory, in the port operations, and in the on-land distribution. The result is the tendency towards the integration of all these activities, in a *philosophy* of door-to-door service by one

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[3] For example, in 1999 Maersk announced the acquisition of the shipping division of SeaLand; in September 1996 P&O Container announced its merger with Nedlloyd to form one of the world's largest container lines. In February 1998 Nedlloyd acquired Blue Star Line; at the beginning of 1997 Hanjin Shipping acquired part of DSR-Senator; at the end of 1997 Neptune Orient Lines (NOL) announced the acquisition of American President Lines (APL), and so on.

provider. The shipping companies are showing increasing interest in the acquisition of container terminals and in the inland transport of containers: the logistics organisations that incorporate the complete chain of activities for the transport of the container are the result of this approach.

In parallel with the proliferation of companies integrating vertically, horizontal integration has been evolving rapidly since the mid-1990's. Horizontal integration is understood as the development of relationships of cooperation, mergers and acquisitions that take place in the same sector of activity in the containerisation business. It is horizontal integration by shipping lines that is spreading most rapidly, and that is proving the most successful. It is well known today that alliances and conferences between shipping lines are customarily employed as mechanisms for the control of prices.

The market in which the shipping lines operate has become a classic example of an oligopoly. It is notable for being dominated by a very limited number of companies. Agreements for cooperation take several forms (Notteboom, 2002): the most important are strategic alliances, in which almost all the shipping lines operating globally take part; moreover, a considerable number of agreements to form cartels (conferences) have been made in the market, mostly in response to the excess of cargo capacity existing. The objective of these processes of horizontal integration is to obtain a larger market share and to reduce operating costs.

There is no unanimous agreement on the specific factors that lead to these strategic alliances; they are a combination of attempts to reduce transaction costs and to improve management (for example, the market coverage is increased, general costs are reduced, the costs of equipment are shared, and there is no doubt that a better and multiple control of the market is achieved, Ryoo and Thanopoulou, 1999). In general, the proliferation of alliances can be attributed to the growing process of internationalisation, globalisation and to the context of increasing competition. In any case, what is increasingly evident, and not just a generalised opinion, is that the shipping companies, groups of companies and alliances have acquired greater power of direct negotiation with the port authorities, with terminal management companies, and with onland transport providers. The mergers and alliances can be attributed to the transformation of

some feeder ports into hub ports, and vice versa. Therefore, the key question is not so much to analyse a reality that began to take shape in the 1990's – the alliances and agreements of cooperation – but rather to consider how the port authorities, and the rest of operators, should deal with that trend in order to avoid losing their capacity of decision.

1.4.3
Competition Between Ports

Another of the forces and tendencies in the international context is the situation of strong competition between ports. In general, the competition between ports takes the form of developing and applying alternative strategies for attracting more customers, or customers with greater business potential, to the port. The ports are continuously analyzing strategies with the object of differentiating themselves from their competitors. As a consequence, the ports compete not only locally, but also globally, even at long distances serving the same trading zones.

The generic criteria for the choice of a port have been considered at great length in the scientific literature, although little is known of the subjective importance that the characteristics of the transhipment ports for the shipping companies in the process of port selection. Knowledge of the relative importance of these criteria would enable the optimum characteristics for competing to be defined. In a recent study of the factors that determine the selection of transhipment ports, Lirn et al. (2004) survey the twenty shipping lines with the greatest volume of traffic and find that, among the principal criteria for the selection of ports, are the following: port costs, 38.12%; geographic location, 35.12%; physical and technical infrastructure, 16.38%; port management and administration, 10.38%. Among the principal sub-criteria, they reach the conclusion that the costs of container handling by the port has a weight of 24.27%; proximity to the principal sailing routes has a weight of 15.12%; proximity to feeder ports, 10.26%; proximity to import/export areas, 9.75%, and the basic infrastructure conditions, 8.51%. From this analysis the general conclusion of these authors is that, given that the location is

determined, on which there is no scope for action, the only means open to port operators to influence shippers is to reduce the container handling costs or to invest in infrastructure.

Another study recent carried out for a group of the principal eastern ports specialising in containers (Song and Yeo, 2004) finds that the location is still one of the most relevant factors in determining the competitivity of a port. However, other factors of great relevance emphasised by the participants in the process of containerisation are the capacity for handling more merchandise, the installations (infrastructure and superstructure, such as docks, loading equipment, storage capacity, etc.) and the level and quality of the port services. Finally, the study by Ha (2003) for the principal container ports of the world, and the review included in this study, confirm the importance of the quality of the port services for improving the competitive position of a port.

The hub ports compete in a highly competitive market, where the clients have many possibilities for switching between alternative routes and prices, and for this reason it seems generally accepted among port operators that, in addition to the factors mentioned above, those ports that combine a local import/export activity with transhipment are better placed to compete than those specialized exclusively in transhipment (Report of the World Bank). Furthermore, cooperating to compete or keeping to non-destructive competition (or win-win strategies) are the terms recently coined for confronting an environment of profound and rapid change.

Finally, other characteristics of the globalising trend in maritime transport are demonstrated in aspects such as the proliferation of information technologies, the need for international regulation due to the complexity of intermodal transport, and security (Roe, 2003). In relation to security, it should be noted that there currently exist a series of standards to follow, some developed by countries unilaterally, as in the case of United States, but that have affected all the merchandise that arrives in or leaves this country, and other emanating from international bodies, as is the case of the new International Code for the Protection of Vessels and of Port Installations or the ISPS (*International Ship and Port Facility Security Code*) drawn up by the International Maritime Organisation. The United States Customs Service has reached an agreement with the principal commercial

interlocutors on the application of two systems of security: the Container Security Initiative (CSI), whose objective is to establish criteria for identifying high risk containers, inspecting them before their shipment to the United States, utilising non-intrusive technologies, developing "intelligent" containers, and insurance; and the initiative of the Customs-Trade Association against Terrorism (C-TPAT), which establishes associations with the importers, transport operators, agents, storage operators and manufacturers to improve the security of containers along the entire supply chain. The principal challenge facing this association is to devise an intelligent electronic seal for containers that is sufficiently practical and low cost to be utilised on a large scale. With respect to standards issued by international bodies, from 9 to 13 December 2002, the Conference of Contracting Governments of the International Convention for the Safety of Human Life at Sea (SOLAS), under the sponsorship of the International Maritime Organisation, was held in London. The objective of this conference was to incorporate in the Convention a set of measures to reinforce maritime safety, and to prevent and act against terrorist attacks. As a consequence, Chapter XI was created on "Special measures to increase maritime security", within which is the ISPS Code that provides a standardised and systematic framework for the assessment of risks, with the aim of being able to adopt the appropriate measures.

1.5
Conclusions

The economic conditions in which containerisation operations are carried out are being continuously transformed. It is essential to have relevant information on current changes and future trends in containerisation for the adequate planning of port policies. From the bibliographic, documentary and statistical review conducted in this chapter (together with the impressions gained from the principal port operators) the following are the principal points to note:

☞ Growth and concentration. Evolving growth and concentration are two of the characteristics that dominate the business of containerisation. In 2003 almost 38% of the total world traffic was

concentrated in only ten ports of the world, and 52% of the total in just twenty ports. Those of East Asia account for almost 28% of all world port traffic in containers. The ports of the West Mediterranean, which include the PAB, accounted for 5.2% of the total world traffic in 2003. This concentration affects not only the traffic but practically all the activities related to the business of the containerisation, which are increasingly being undertaken by fewer companies.

☞ Increased size of container ships. Each generation of container carrier ships constructed is larger and/or faster. The current order lists published (October 2004) reveal that during the next three years eight new container carrier ships, each with capacity for more of 9,600 TEUs, will enter service. The increased size of the vessels is a very relevant fact, because it puts pressure on the ports to adapt their installations (berths, cranes, access for land transport and organisational systems), in other words, to undertake significant investments to receive these ships and thus to maintain or enhance their competitive position.

☞ Alliances and cartels. In all the activities related to containerisation a progressive process of vertical and horizontal integration is taking place. The shipping lines are intervening in both processes. The recent transformations in the shipping lines, as the principal customers of the port operators, are characterised by the concentration and rationalisation of their activities basically by means of strategic alliances and conferences (horizontal integration) and by their participation in other activities (terminals, onland transport) with the object of differentiating themselves by providing door-to-door transport as part of an integrated logistic service. Greater negotiating power with the port authorities and more effective control of the market are the two basic consequences of this integration.

☞ Competition. Location continues to be one of the most relevant factors for the choice of a port; however, it has also been confirmed that other demand factors susceptible of modification by port policies exert an important influence (capacity for handling large vessels, types of terminal installation, efficiency in container handling operations, availability or frequency of *feeder* services, attractive price rates for handling cargo, etc.). It has

been demonstrated that the quality of the services provided is increasingly more important in a context of growing competition. In parallel, in the specialized ports in container traffic, it has been shown that having a large industrial *hinterland* active in exporting and importing is critical for competing with more possibilities of success.

2 The Port of Algeciras Bay: Physical and Logistic Infrastructure in the Context of the Mediterranean Ports

2.1
Introduction

The objective of this chapter is to present a complete description of the physical and logistics structure associated with container traffic in the PAB. It is common knowledge that containerisation has been and still is a critical element in the trend towards the globalisation of markets, particularly for manufactured goods; it would seem appropriate, therefore, that the structure of the PAB should not be analysed in isolation, but that it should be considered in the context of the other ports which, for geographic reasons, may be closely competitive with or else complementary to the PAB. In order to meet this objective, we structure the chapter as follows: we begin with a brief description of the port and its antecedents; then we detail the current port infrastructure for container traffic and the investments foreseen for the next few years; in the following sections we present a comparison between the PAB and the other relevant Mediterranean ports handling container traffic, in respect of their infrastructure and logistic characteristics. The chapter is closed with a synthesis of the most relevant conclusions.

2.2
The Port of Algeciras Bay

The Port of Algeciras Bay comprises the port installations of Algeciras, La Linea de la Concepción and Tarifa, together with the private port terminals of the companies CEPSA, Acerinox, Endesa and of the Confederación Hidrográfica del Sur, located in the municipalities of Los Barrios and San Roque. Also included with the foregoing are the

port installations in the adjoining district of Campamento, which fall within the municipal areas of San Roque and La Linea de la Concepción. The Port, situated in the Bay of Algeciras, is strategically placed in the Strait of Gibraltar, the confluence between the Mediterranean Sea and the Atlantic Ocean, at a place where the continents of Europe and Africa are closest (separated by a distance of approximately 7.8 nautical miles). As has often been emphasised, this position makes the Bay of Algeciras the point of intersection of the principal East-West and North-South axes of world maritime trading routes.

The antecedents of the modern structure of the Port of Algeciras Bay begin in 1906[1] with the constitution of the Port Works Board as the regulatory body for the port activity. As A consequence of the successive increases of traffic, of both merchandise and passengers, principally with Gibraltar and Ceuta, several projects for the extension of the Port were carried out, among which were the start of the construction of the Alfonso XIII wharf, later named the La Galera wharf, in 1913 and in 1921 the works for the construction of the North Dock. At the end of the 1920's, the world economic crisis also affected the Port of Algeciras Bay, causing a serious drop in traffic. Only the transactions with Gibraltar continued at a high level (Torremocha and Humanes, 1989). This stagnation was prolonged between 1940 and 1960. In the mid-1960's two events occurred that had a very important impact on the Port of Algeciras Bay:

– One was the creation of the Regional Plan for Economic and Social Development of the Campo de Gibraltar, from the Decree of 28 October 1965.
– The second was the closing of the land border crossing with Gibraltar in June of 1969, as the culmination of a process intended to force the recognition of Spanish sovereignty over what is known in Spain as the Peñón.

These events led to the formulation of an economic policy for the Campo de Gibraltar whose principal objective was to strengthen the economy of the Region, mainly by promoting industrial and commercial activity. Among the companies created based on this policy the most notable are the metallurgical (stainless steel) manufacturing company Acerinox and the "Gibraltar" petroleum refinery of the

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[1] A recent historical review can be found in Chapter 1 of Castillo (2001).

group CEPSA. All this caused a substantial change in the port activity of the region, where passenger and fisheries traffic became less important than the handling of bulk solids and liquids, principally by the port terminals of the large companies now located in the region.

In 1975 the container traffic was consolidated with the commissioning of a terminal of the US company Sea-Land. Subsequently, in 1986, the Danish container transport company Maersk established another Terminal and invested in the construction of the containers platform known as "Terminal 2000" on the La Galera wharf (later named the Juan Carlos I wharf), which was inaugurated in March 1995. In the year 1999 these two companies were brought together by the merger between Maersk and Sea-Land (effectively the absorption of the former by the latter), which, from the point of the management of containers, resulted in the formation of a monopoly.

In this context and most recently, the Port Authority opened for competitive bidding the concession for the exploitation of a second container Terminal on the Isla Verde wharf. This Terminal is public, that is, the services provided are associated only with the loading and unloading of the merchandise, so that their clients are the shipping lines that utilise this Terminal, and not the owners of the merchandise that the lines transport. The concession to operate the Terminal was awarded to a group formed by Acciona and Container Terminals of Barcelona, who created "Container Terminal of Algeciras" (TCA) that commenced its activity in the summer of 2003.

2.3
Port Infrastructure for Container Traffic

2.3.1
Container Terminal Resources and Characteristics

The container traffic in the Port of Algeciras is handled in two docks:

a) The North Dock. This is where the Juan Carlos I Wharf is situated, with the Terminal belonging to Containers 2000 of Maersk Spain S.A. This terminal operates under the commercial name of APM TERMINALS, an independent entity within the AP Moller group. Its use is commercial, principally containers and to a less

extent *ro-ro trucks* (*roll-on/roll-off*). The total area of this wharf is 686,132 m^2; it has 2,034 metres of berths, and its depth ranges between 14 and 16 metres. Its advanced technical facilities have been improved with the installation of 3 new *super post-panamax* cranes, bringing the current total available in the terminal to 15 cranes, ten of them *post-panamax*, together with several new *trastainers* (now 46 in total). The productivity figures for this terminal are among the highest in Europe, measured both in terms of numbers handled per crane per hour (the average number of containers handled per hour is around 30 and the record is 53.8 containers), and in terms of numbers handled per vessel per hour (the record for this is 188).

b) The La Galera Dock. This dock contains the Isla Verde Wharf, with the Terminal of Contenedores de Algeciras (TCA), which forms part of a major consortium of companies comprising Acciona and Terminales Marítimas Layetanas (TCB Group-Terminals de Contenedores de Barcelona). This project will be executed in stages in function of the evolution of trade and according to the Master Plan of the Port of Algeciras Bay.

There is currently no container traffic through the ports of La Linea de la Concepción and Tarifa, nor in the port installations in the municipal districts of Los Barrios and San Roque; these zones do not have the natural conditions necessary for the construction of infrastructures for container handling.

2.3.2
Investments/Projections

In the investment plan foreseen by the Port of Algeciras Bay for the period 2004–2007, the main elements associated with container traffic are new port infrastructures for the Isla Verde Exterior Wharf (Port of Algeciras) and in Campamento (municipal districts of San Roque and of La Linea de la Concepción). When both projects are finished, the Port of Algeciras Bay will have multiplied by a factor of two and a half the port area available (Annual Report 2003, Port of Algeciras Bay, Boletín de Información Mensual de Puertos del Estado, February 2004 and Commercial Department APBA, 2004):

a) New infrastructures in Isla Verde Exterior. These civil works form part of an overall project that is considered the most important item in the Master Plan of the Port Authority. This project will be constructed in the outer zone of the current enclosed dock, without occupying any more coastline; this represents the alternative that has the least environmental impact. The first work undertaken has consisted of the construction of an inner wharf within the existing dock, the Príncipe Felipe Wharf, of 535 metres length and a depth of 16.5 metres. This wharf has been designed for operations with future generations of container cranes and container carrier ships. The Príncipe Felipe is currently being finalised and was expected to enter into service in the last quarter of 2004. Currently the second phase of the project is in hand, with a budget of Euros 99.9 million and a term of execution of 32 months. The completion of this phase will provide 1,200 metres length of berths and 50 hectares of area for handling and storage. The third phase of amplification, planned to be started in 2005, includes more in-filling, of 62 hectares to the south of the second phase. When the entire project is finished, the total new area will be 122 hectares, 2,675 metres length of wharf and 1,626 metres length of seawall. The maximum depth available will be 20 metres, which will ensure the full operativity of Isla Verde Exterior. The budget foreseen for the third phase of Isla Verde Exterior is Euros 200 million.

b) New Infrastructures in Campamento. These civil works are currently in their second phase; the objective is to recover from the sea some 45 hectares of land area and a wharf of 618 metres length. This new wharf is constructed initially as a dry dock because it is going to be used first by the company Exxon Mobil for constructing an *off-shore* terminal for liquefied gas. Once finished, this Terminal will be taken to its final destination and the dock will be free for other uses. In addition, in Campamento the construction is planned of a section of 200 metres of outer wharf, with a depth of 17.50 metres.

In aggregate these investments should increase the traffic of containers, principally that of the Port of Algeciras, and of ro-ro and general merchandise, but their eventual use will depend logically

of the future evolution of the types of traffic, both in the context of the port itself and in the international context.

c) Road and rail links between the Isla Verde and La Galera wharves, 2nd phase. With the object of not strangling the growth of container traffic in the Bay of Algeciras, the Port Authority is developing the outer part of Isla Verde. So that this development may take place in a harmonious way, it is also necessary to improve the internal connections by road and rail between the current and future areas of the docks.

2.3.3
Access to the Port and to the Land Infrastructures

The land infrastructures, road and rail links that connect the Port of Algeciras Bay with the main centres of production and distribution, play an essential role in the process of containerisation. In the following section we give details of the principal accesses to the Port and the land infrastructures of the Region of the Campo de Gibraltar.

– Access routes into the Port:
  • North Access: This provides the road connection from the N-340 and A-381 roads into the Port by means of a subterranean tunnel, with one carriageway in each direction, and a bridge that links the beach of La Concha with the Juan Carlos I wharf. The opening of this access has relieved considerably the heavy traffic congestion in the town itself, and has reduced the number of vehicles that have to pass through the town centre to reach or leave the ferries that cross the Strait. Its length is 1,850 metres.
  • South Access: This channels the vehicles entering the port from the N-340 and has a length of 2,500 metres.
  • Railway: there are two branch lines linking the Town Station to the Port: one runs to the wharves of La Galera, Fishing and Juan Carlos I (615 m in length), and the other to the Isla Verde wharf (1,763 m in length). On the South Berth and the Isla Verde Wharf there are two lines of 855 and 410 metres length, respectively. Currently new infrastructures for access to the port are under construction. These involve the creation of two new

rail terminals, one to service the new TCA terminal, and the other for the Terminal 2000 of Maersk.

– Land infrastructures of the Campo de Gibraltar.

The region of the Campo de Gibraltar has historically been considered to be generally deficient in infrastructures, and this deficiency has often been blamed for the region's limited growth and development overall, not just in respect of the Port. This situation has led various public and private bodies and institutions based in the region to call for urgent improvement of its infrastructures. From the perspective of the port such improvements would facilitate the flow of merchandise to and from the interior, building up its industrial *hinterland* and, in short, enhancing the competitivity of the port. We next give details of the current infrastructures:

– Roads:
  • N-340: this is a trunk roadway that links Cádiz with Málaga along the coast. The road is a fast dual carriageway from Cádiz as far as Chiclana and then from Algeciras to Málaga. However, along some sections and at some times of the year, the road is overloaded with traffic, and this situation is particularly serious in the summer months due to holiday traffic. Currently work is in progress to bring the sections between Chiclana and Conil and between Conil and Vejer up to dual carriageway standard, a project financed by the Spanish Goverment that is due for completion in October 2006; already some 44% of the project has been executed. As sections of this road become dual carriageway, it will be re-designated the A-48.
  • AP-7: This is a Toll Motorway linking the municipal district of San Roque, from Torreguadiaro, with Málaga.
  • A-381: By the end of December 2004, almost the entire length of the Jerez-Los Barrios dual carriageway road had been completed. The last section to be completed in 2005 is a short stretch of the approach into Jerez. This new dual carriageway road will link directly to the AP-4 Cadiz-Seville toll motorway, for the benefit of through traffic between the Campo de Gibraltar and the capital of Andalusia, Seville. It represents a new transport "backbone" for the interior of the province of Cádiz and its

benefits will extend not only to the Bays of Algeciras and Cádiz, but also to the numerous towns and villages of the La Janda district.

– Railway:

- Madrid-Bobadilla-Algeciras Line: this was constructed in 1892 and since then has only undergone minor improvements. In 2004 Algeciras was included in the future transEuropean axis that will unite the Iberian Peninsula with the centre of the continent, within the so-called TransEuropean Networks or TENs, which are part of the planned system of integrated transport infrastructure for the European Union; the Network includes the rail access to and from major maritime and river ports, among which is the Port of Algeciras Bay

– Planned projects:

- Conversion to dual carriageway of the N-340, in the section Vejer-Tarifa-Algeciras. In this projected construction, the Goverment will include an informative study of the prolongation of the outer ring road or bypass of the metropolitan area as far as San Roque, rather than only as far as Los Barrios.
- Issue of the Statement of Environmental Impact by the Central Government in respect of the engineering works to improve and electrify the Algeciras-Bobadilla railway line, since the planned route affects the Natural Park of Los Alcornocales and Grazalema. Planned term: September–October 2005.
- Improvement of the north and south access routes into the Port of Algeciras: recently the Ministry of Development has approved the performance of a study for the creation of a new lane in the northern zone of the Port that would enable the current access tunnel to this zone to be widened to two carriageways and thus create a single roadway for port entry and another for exit. In respect of the southern access, a study has been undertaken for the construction of two roundabouts for entry to the city in Los Pastores; the first of these would be at the crossroads of entry to the Cortijo Real industrial estate, and the second at the access to the Los Yankis road. The planned term for the start of the work is the end of the first quarter of 2005.

- Performance of an informative study for the construction of a dual carriageway road between Jerez Airport and Dos Hermanas, as a free alternative to the Cádiz-Seville toll motorway. The Ministry of Development has warned that any work, if approved, would not start before 2009.

2.4
Port Infrastructure for Container Traffic in the Context of the Mediterranean Ports

With the object of evaluating the evolution and current position of the Port of Algeciras Bay in relation to the principal Mediterranean ports (possible competitor/complementary ports), we present some comparative data reflecting the physical structure of these ports in relation to the PAB. To decide which other ports can be considered competitors to the Port of Algeciras Bay, several factors have been taken into account: whether the port is considered a regional *hub* in the Mediterranean; whether it could serve as a gateway for trade with Europe; whether it has a consolidated position in the world ranking of ports; and, logically, whether there is quantitative information on traffic to facilitate the analysis. With these criteria the ports chosen are the following: Gioia Tauro (Italy), Bay of Algeciras (Spain), Valencia (Spain), Barcelona (Spain), Genoa (Italy), Piraeus (Greece), Marsaxlokk (Malta), La Spezia (Italy) and Marseilles (France).[2]

Tables 2.1 and 2.2 give some of the physical characteristics of these Mediterranean ports, and the commercial systems under which they

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[2] The ports of Haifa (Israel) and Damietta (Egypt) are in intermediate positions in the ranking, in function of their volume of traffic in 2003 (between Marsaxlokk and La Spezia, and between La Spezia and Marseilles, respectively) but have not been included because they are not considered gateways to the continent of Europe. The next-ranking ports after Marseilles, the ports of Taranto and Leghorn in Italy, have not been included as they occupy very low positions in the world ranking of ports (specifically in 83rd and 88th position, respectively). Finally, the port of Cagliari has not been considered due to deficiencies in the information (the latest data available correspond to 1999).

Table **2.1.** Physical characteristics of the principal Mediterranean ports 2004

Ports	Wharves 1[1]	Name	Operator	Wharves 21	Length (metres)	Depth (metres)
Gioia Tauro	2	Medcenter container terminal	Medcenter container terminal	1 Cont[3]	3.011	13.5–15
B. Algeciras	2	APM Terminals	APM Terminals	3 Cont[3]	2.034	9–16
	1	Algeciras container terminal	Algeciras container terminal	1 Cont[3]	375	14.5
Valencia	S/D[2]	Trans-balear				
	2	Terminals of turia	Terminals of turia-terpoval	1 Multi[4]	665	9–12
				1 Multi[4]	308	7
	3	Multipurpose terminal	Terport-combiterminal-cesa (TCV)	3 Multi[4]	1.226	9–14
	2	Valencia public container terminal	Maritima valenciana S.A.	1 Cont[3]	1.500	16
				1 Cont[3]	340	16
Barcelona	2	Catalunya terminal	Terminal catalunya S.A.	1	1.448	8.7–14
	1	Saport terminal	Unioi terminals estibadors llevant S.L.	1 GNRAL[5]	580	12
	7	Estibadora de ponent	Estibadora de ponent S.A.	2 G/CNT[6]	300	6.5
	3	Terminal port-Nou	Terminal port-nou S.A.	2 G/CNT	330	11
	S/D	Muelle príncipe de espaa	Terminal catalunya S.A.	1 Cont	160	9.5
	2	TBC Terminal	Barcelona S.L.	2 Cont	190	11
					1.362	12–16

Table 2.1. (continued)

Ports	Wharves 1[1]	Name	Operator	Wharves 21	Length (metres)	Depth (metres)
Genoa	7	Voltri terminal	Voltri terminal europa spa	4 Cont	1.200	15
	1	Southern european container hub terminal	Terminal contenitori porto di genova	1 Cont	526	14.5
	1	Genoa metal terminal	Genoa metal terminal	1 Multi	1.000	10.5
	5	Genoa port terminal	Genoa port terminal	5 Multi	1.200	–
	6	Messina terminal	Ignazio messina	6 Cont	1.215	9–12

SOURCE: Authors' own elaboration from Containerisation International 2004.

[1] "Wharves1" refers to the number of wharves that are dedicated in that port to general merchandise, containerised and non-containerised, and to ro-ro. Similarly, "Wharves2" refers to the wharves for containers, general merchandise or *multipurpose*, for each operator.

[2] S/D: no data available.

[3] CONT: Container wharves.

[4] MULTI: Multi-use or *multipurpose wharves*.

[5] GNRAL: Wharves for general merchandise.

[6] G/CNT: Wharves for general merchandise and for containers.

Table 2.2. Physical characteristics of the principal Mediterranean ports 2004 (continuation)

Ports	Wharves 1[1]	Name	Operator	Wharves 2	Length (metres)	Depth (metres)
Piraeus	9	Venizelos Container Terminal	S/D	9 Cont	3.100	11.5–16.5
	3	St. George Terminal (RO-RO)	S/D			
Marsaxlokk	2	Terminal one	Malta freeport terminal	1 Cont	1.000	15.5
				1 GNRAL	168	9.5
	3	Terminal two	Malta freeport terminal	1 Cont	480	15.5
				1 Cont	660	15.5
				1 Cont	118	15.5
La Spezia	7	Terminal Golfo	Terminal Golfo	2 Cont	310	S/D
	5	La spezia container terminal	La spezia container terminal	3 Cont	520	13
				2 Cont	467	14
Marseilles	S/D	Leon Gourret Mole	Port Autonome de Marseille			
	5	Brule-Tabac Quay	Port Autonome de Marseille	3 GNRAL	650	10.8–11.5
	6	Mourepiane Container Terminal	Port Autonome de Marseille	6G/CNT	920	11.7
	1	La Pinede Dock (RO-RO)	Port Autonome de Marseille			
	5	Fos Container Terminal	Port Autonome de Marseille	5 Cont	1.180	14

Source: Authors' own elaboration from Containerisation International 2004.
[1] "Wharves1" refers to the number of wharves that are dedicated in that port to general merchandise, containerised and non-containerised, and to ro-ro. Similarly, "Wharves2" refers to the wharves for containers, general merchandise or *multipurpose*, for each operator.
[2] S/D: no data available.
[3] Cont: Container wharves.
[4] Multi: Multi-use or *multipurpose wharves*.
[5] GNRAL: Wharves for general merchandise.
[6] G/CNT: Wharves for general merchandise and for containers

are operated. It can be observed that both Gioia-Tauro and the Bay of Algeciras are notable for having wharves with depths that permit the entry of large container carrier ships, and that are dedicated exclusively to container traffic. It is also notable that, in the case of the Bay of Algeciras, the lengths of wharf available are less in comparison with the rest of the ports indicated.

The operators of the terminals are also indicated in these tables. It can be observed that, compared with the PAB, the ports of Barcelona, Valencia and Genoa have more operators: 4, 6 and 5 respectively, and that in all the cases they operate not only with containerised merchandise but also with general merchandise utilising *multipurpose* wharves and facilities, where different types of traffic can be combined. The Port of Piraeus has only one container Terminal; the other Terminal is for ro-ro, but is equipped with nine wharves of great length. With reference to the ports of Marsaxlokk and La Spezia, both have two container terminals, with considerable length of wharves and water depth; in the Maltese port, both terminals are run by the same operator. Lastly, the Port of Marseilles possesses five container terminals (although data is not available on one of these, León Gourmet Mole, and details of its use are not known); of the remaining terminals, only one is dedicated exclusively to container traffic.

2.5
Logistics Infrastructure: Maritime Routes and Carriers

With the object of illustrating the current situation in respect of trade in containerised merchandise of the PAB in the Mediterranean context, in this part we present details of the number of routes and carriers in each of the ports listed:

– In function of the type of service provided by the maritime *carriers*.
– In function of the routes or lines (ports of origin, destination or call) of the *carriers* that operate from these ports.
– In function of the number of routes or lines of the principal world *carriers*.

a) Routes in function of the type of service provided by the maritime carrier   Table 2.3 gives the number of routes served in the ports of reference, distinguishing the type of service provided: principal lines (*mainlines*: M), secondary lines of less distance (*feeders*: F), and services to/from nearby ports (*short sea services*: SSS).

Analysis of the preceding Table 2.3 shows that the number of *carriers* (and also the number of lines), is lower in the Port of Algeciras Bay than in the other ports, which may suggest that there is less intense competition there than in the other ports; the other ports with relatively few carriers (less than 40) are: Marsaxlokk, Gioia Tauro, La Spezia and Marseilles. At the other extreme is the Port of Barcelona with 83 *carriers*, while Valencia and Genoa are also used by relatively many carriers. Another datum is that the Italian port Gioia Tauro and the Maltese port Marsaxlokk present a mix of types of service that are considerably different from the rest, with a higher proportion of *feeder* lines: the *main* lines represent approximately 65% and the *feeders* 35% of the total. In all the other ports the percentage of *feeders* is between 10% and 22% of the total.

b) Routes served by the carriers in the principal Mediterranean ports   The routes have been classified by reference to the destination most distant from each port; 15 categories of route have been obtained as

Table 2.3. Lines and carriers, according to type of service, in 2003

Ports	N° of lines	N° of carriers	N° of lines by type: main/feeder/short sea services	Type of line M, F, SSS, AS % of total
Gioia tauro	94	32	59 M/35 F	63/37 %
B. Algeciras	54	13	48 M/6 F	89/11 %
Valencia	126	70	111 M/15 F	88/12 %
Barcelona	141	83	127 M/14 F	90/10 %
Genoa	143	67	120 M/19 F/4 SSS	84/13/3 %
Piraeus	78	44	62 M/16 F	79/21 %
Marsaxlokk	86	31	58 M/28 F	67/33 %
La spezia	62	33	55 M/7 F	89/11 %
Marseilles	73	37	57 M/16 F	78/22 %
Total	857	410	697 M/156 F/4 SSS	80.8/18.9/0.3% (Average)

Source: Authors' own elaboration from Containerisation International 2004

explained in the following, making reference to the ports at which the ships call on each route (in the majority of cases, the routes include several calls at European ports of the Mediterranean, including those of Malta and Cyprus) (Table 2.4):

1. Intramed: Various Mediterranean ports, western and eastern, including some Middle East ports in Israel, Jordan, etc.
2. Europe: Northern European ports.
3. Africa S/D: North African ports, basically in countries of the Maghreb (S/D: Short distance).
4. Canaries: Some of the Canary Islands as the furthest destination.
5. Africa L/D: Ports of Central and Southern Africa (L/D: Long distance).
6. Africa L/D (Europe): Ports of Central and Southern Africa, with calls at Northern European ports.
7. North America: North American ports and, in some cases, Central American and Caribbean.
8. N. Amer (Europe): North American ports and, in some cases, Central American and Caribbean, with calls in Northern European ports.
9. N. Amer /Asia: North American ports and Asian ports.
10. S. America: South American ports and, in some cases, Central American.
11. S. Amer (Eur): South American ports and, in some cases, Central American, with calls at Northern European ports.
12. S. America /N. America: Various ports of the American continent.
13. Asia: Various Asian ports.
14. Asia (Eur): Various Asian ports, with calls at Northern European ports.
15. Oceania: Mainly Australian ports.

Table 2.5 presents the lines served by the various ports, in function of their length: short and medium distance routes that group together the lines operating along the Mediterranean (Intramed), those sailing to Northern Europe, North Africa and the Canaries; and long distance routes that includes those sailing to Central and Southern Africa, North America, South America, Asia and Oceania.

In the Port of Gioia Tauro the *Intramed* routes are important, representing 41.5% of the total, which corroborates the data of the

Table 2.4. Break-down of the principal destinations of the routes in the leading container ports of the Mediterranean

Routes	G. Tau.	B. Alg.	Valen.	Barcel.	Genoa.	Pireo	M'Lokk	Spezia	Marse
Intramed	39	3	19	26	28	44	29	6	17
Europe	3	–	6	4	1	10	1	–	1
Africa S/D	8	3	22	18	21	4	18	18	43
Canaries	–	2	–	3	–	–	–	–	–
Africa L/D	1	13	8	5	7	1	–	1	7
Afr L/D (Eur)	–	4	1	2	1	1	–	–	–
N. America	10	6	8	14	19	–	1	4	2
N. Amer (Eur)	–	–	9	4	10	–	–	–	–
N. Am./Asia	14	6	8	11	6	11	–	6	–
S. America	–	7	20	17	14	1	–	–	–
S. Amer (Eur)	–	4	1	1	–	–	–	–	–
S. Amer/N. Amer	–	–	2	1	1	1	–	–	–
Asia	8	–	17	26	23	4	9	13	–
Asia (Eur)	11	5	5	9	12	1	22	–	3
Oceania	–	1	–	–	–	–	6	14	–
Totals	94	54	126	141	143	78	86	62	73

Source: Authors' own elaboration from Containerisation International (2004)

Table 2.5. Number of lines of short/medium and long distance

Ports	Short/medium distance[1]	Long distance[1]	Total
Gioia Tauro	50 (53%)	44 (47%)	94
B. Algeciras	8 (15%)	46 (85%)	54
Valencia	47 (37%)	79 (63%)	126
Barcelona	51 (36%)	90 (64%)	141
Genoa	50 (35%)	93 (65%)	143
Piraeus	58 (74%)	20 (26%)	78
Marsaxlokk	48 (56%)	38 (44%)	86
La Spezia	24 (39%)	38 (61%)	62
Marseilles	61 (84%)	12 (16%)	73

Source: Authors' own elaboration from Containerisation International (2004).
[1] The figure in parenthesis is the percentage that each category of distance represents in the total

preceding table where the relative weight of the *feeder* lines is evident. The routes of short or medium distance, in addition to *Intramed*, such as Northern Europe and North Africa (Africa S/D), account for 53%

of the total; the routes to America and Asia account for the remaining 47%, there being no South American routes.

In the Port of Algeciras Bay only 15% of the lines are of medium or short distance, with the short distance African routes being significant, where the traffic with Morocco, with the Canaries and the Intramed routes figure strongly; the remaining 85% is distributed, in order of importance, in the routes to Central and Southern Africa (31.5%), to South America (20.4%), North America (11.1%), North America plus Asia (11%), and Asia (9.3%). In respect of the lines that include Oceania, only three of the ports analysed have routes to this continent; in order of importance, La Spezia (14), Marsaxlokk (6) and Algeciras[3] (1). These data are in consonance with those presented in function of the type of service, *main* or *feeders*, in which the *main* lines that cover the long distance routes are emphasised.

The ports of Valencia, Barcelona and Genoa present very similar patterns in the mix of short or medium distance, and the long distance routes. The short or medium routes represent 37%, 34% and 35% respectively; the most important are *Intramed* and North Africa. In respect of the long distance lines, the following destinations are presented in the same order: Asia (17%, 25% and 25%), South America (17%, 13% and 10%) and North America (13%, 13% and 20%). The lines that connect with ports of Central and Southern Africa account for a very low percentage of the total, specifically 7%, 5% and 6%.

The ports of Piraeus, Marsaxlokk and Marseilles offer more short or medium distance routes than long distance; in this respect the Port of Marseilles is notable having 84% of its total routes short and medium distance. Specifically, in Piraeus and Marsaxlokk, the main routes are the *Intramed*, while in Marseilles those with North African destinations are more important. The long distance routes served by Piraeus are principally those to Asia and North America, while from Marsaxlokk the only important routes are those to Asian

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[3] Bank Line is the *carrier* that undertakes this route (Mediterranean-Europe-Pacific-Australia-Pacific-Mediterranean); calls are made at the ports of Algeciras, Hamburg, Hull, Amberes, Dunkirk, Le Havre, Papeete, Auckland, Noumea, Santo, Honiara. The frequency is one sailing per month, without a set day (Containerisation International, December 2004).

destinations. The Port of Marseilles has very few long distance routes; the most important of these are to Central and Southern Africa.

Lastly, in the Port of La Spezia, it is the long distance routes that are more significant than those of short or medium distance, accounting specifically for 61% and 39% of the total respectively, which reflects a similar situation to that of the ports of Valencia, Barcelona and Genoa. The longest distance routes are those to Asia and Oceania, while in the short or medium distances, those to North African destinations are the most important.

It should be noted that, in relation to the relative proportions of short/medium and long distance routes served, the Port of Algeciras Bay shows the biggest difference between the two categories (15% and 85%), followed by the ports of Gioia Tauro and La Spezia. In the ports of Valencia, Barcelona and Genoa, although the long distance routes continue to be predominant, there is a more equal balance between the two categories of route. Among the ports where the opposite situation applies, with short/medium distance predominant over long distance routes, the port with the most balanced situation is that of Marsaxlokk, followed by Piraeus and Marseilles. The conclusion drawn from these data is that the ports of Algeciras Bay and Marseilles are significantly differentiated from the rest, with a very marked relative weight towards one or other of the two categories of routes, with Algeciras Bay weighted towards long distance routes, and Marseilles weighted to the short/medium distance routes.

c) Number of lines of the 10 principal world *carriers* in the Mediterranean ports   In this part we consider the involvement of the world's leading maritime container shipping companies or *carriers* in the ports studied, through the number of lines that they operate. The top 10 world carriers are the following companies[4]:

1. Maersk Sealand (Denmark)
2. Mediterranean Shipping Co SA (Switzerland)
3. P & O Nedlloyd Container Line Ltd (United Kingdom/Holland)
4. CMA CGM SA (France)
5. Evergreen Marine Corp Ltd (Taiwan)
6. APL Ltd (Singapore)

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[4] See Chap. 1 for details on TEUs and fleets.

7. Cosco Container Lines Ltd (China)
8. Hanjin Shipping Co Ltd (Korea)
9. China Shipping Container Lines Co Ltd (China)
10. NYK Line (Japan).

It can be seen from Table 2.6 that there is a high degree of concentration in the Port of Algeciras Bay in respect of the exploitation of lines by these ten principal *carriers* of the world, accounting for 56% of the total. The second port where these leading carriers are concentrated is Gioia-Tauro, with an equivalent figure of 33%, followed by Marsaxlokk, with 27%. At the other extreme, with the lowest concentration of the biggest carriers is Marseilles, where the top ten companies account for only 10% of the total lines.

   In the Port of Algeciras Bay, Maersk-SeaLand accounts for 80% of the total lines operated by the Top Ten (without including Safmarine Container Lines, belonging to the same group). However in the rest of the ports there is not so much concentration or dependence on one single operator: MSC accounts for 63% of lines in Piraeus, and Maersk-SeaLand accounts for 58% in Gioia-Tauro; in Marsaxlokk and Valencia, CMA-CGM and MSC have 43% and 41% of the lines,

Table 2.6. Number of lines operated by the 10 leading world carriers

Carriers	G. Tau.	B. Alg.	Valen.	Barcel.	Gnoa	Piraeus	M'Lokk	Spezia	Mars.
Maersk	18	24	5	4	3	2	–	–	1
MSC	1	–	11	4	2	12	–	5	1
P&O	3	1	1	3	1	1	1	4	–
CMA–CGM	–	2	3	5	6	1	10	2	5
Evergreen	–	1	1	3	3	1	3	–	–
APL	2	2	–	1	3	–	4	–	–
Cosco	1	–	2	3	3	–	–	1	–
Hanjin	3	–	3	3	3	–	–	2	–
CSCL	1	–	1	1	–	2	5	–	–
NYK Line	2	–	–	1	–	–	–	1	–
Subtotal	31	30	27	24	24	19	23	15	7
Others (*)	63	24	99	117	119	59	63	47	66
	(22)	(13)	(63)	(84)	(57)	(34)	(21)	(23)	(27)
Total	94	54	126	141	143	78	86	62	73
%Sub/Tot	33%	56%	21%	17%	17%	24%	27%	24%	10%

(*) Total number of *carriers* in parenthesis.
Source: Authors' own elaboration from Containerisation International (2004)

respectively; in the ports of Barcelona, Genoa, La Spezia and Marseilles, control of the lines is much more diversified.

Finally, it should be stated that the ports of Tangier Med and Málaga, although still not having a significant position in container traffic, are emerging as potential competitors of the Port of Algeciras Bay (in fact, it can be said that the Port of Málaga already is a competitor). In both cases it is the company Maersk-SeaLand that has decided to develop this traffic in those ports; the possibility of diversifying risks by operating from various ports of the same zone simultaneously, together with the strategic positioning in this zone of Southern Europe-North Africa, are among the common reasons for the establishment of operations in both ports. As more specific motivations, in the case of the Port of Tangier, the differences in the cost of the factors of production (principally lower labour costs) are important, while in the case of Málaga, the availability of better transport infrastructures (road, rail and air) is a factor in this development.

2.6
Conclusions

This chapter presents a concise description of the physical and logistic characteristics related to the container traffic in the PAB. With the object of evaluating its position with respect to the other principal Mediterranean ports, a comparative analysis has been carried out, from which the main results are the following:

☞ Physical infrastructure. The PAB is differentiated from most of Mediterranean ports by having some of its wharves devoted exclusively to container traffic, and by having sufficient depth to allow the entry of the largest container carrier ships.

☞ Concentration of activities. Its activity is characterised by a strong concentration in comparison with the rest of specialized ports of the Mediterranean: two terminal operators (one predominant); unlike the PAB, in the ports of Barcelona, Valencia and Genoa, there are more operators (4, 6 and 5 respectively); both the number of *carriers* and also the number of routes operated are lower in the PAB than in the principal Mediterranean ports; the ten

leading world *carriers* account for 56% of the routes, compared with 33% for Gioia-Tauro and 27% for Marsaxlokk.

☞ Distribution of lines. With respect to regular lines that call at the port, the PAB is the only one of the Mediterranean ports studied that is served by routes connecting to all five continents; the long distance routes exceed the short/medium distance ones. In Valencia, Barcelona and Genoa, the long distance routes also have more weight, although not to the same extent as in the PAB. In the contrary situation, with the short routes having greater weight, are Marseilles, Piraeus and Marsaxlokk, in order of importance, while in Gioia Tauro the mix of long and short distance routes is more equal.

3 Container Traffic in the Port of Algeciras Bay: Evolution and Relative Position

3.1 Introduction

As indicated in the introduction to this report, the studies of economic impact have a static character. This chapter is intended to complement the static picture provided by considering the effects of the principal economic variables by means of a detailed temporal analysis of the container traffic of the PAB in the context of ports that undertake containerisation activities. For this we adopt a sequential process that coincides with the sections presented next: first we place the PAB in the context of the Spanish national ports system, calculating some of the usual indicators of containerisation and specialisation; second, we describe its relative position in the context of Mediterranean ports; third, we situate the PAB in the world context. Then we present a breakdown of the figures for 2003, the latest available year, to be able to assess the volumes of maritime and terrestrial traffic, using the data available to us, with the trading zones served by the PAB. The chapter finishes with some brief conclusions that summarise the principal results.

3.2 Evolution and Specialisation of Container Traffic in the PBA, in the Context of Spanish Ports

3.2.1 Container Traffic: Evolution and Indices of Containerisation

In Fig. 3.1 the evolution of the container traffic in the PAB since 1991 is presented. It can be observed that in rather more than a decade
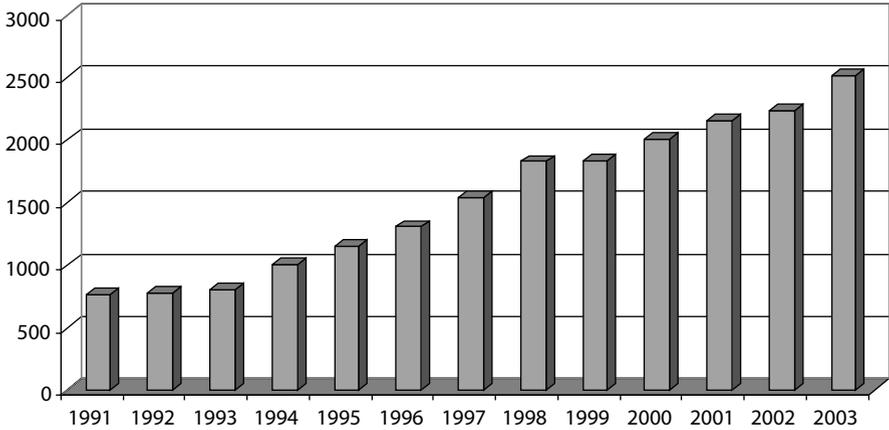
Fig. 3.1. Evolution of the container traffic in the PAB ('000 TEUs). Source: C.I. and the Port Authority, Bay of Algeciras
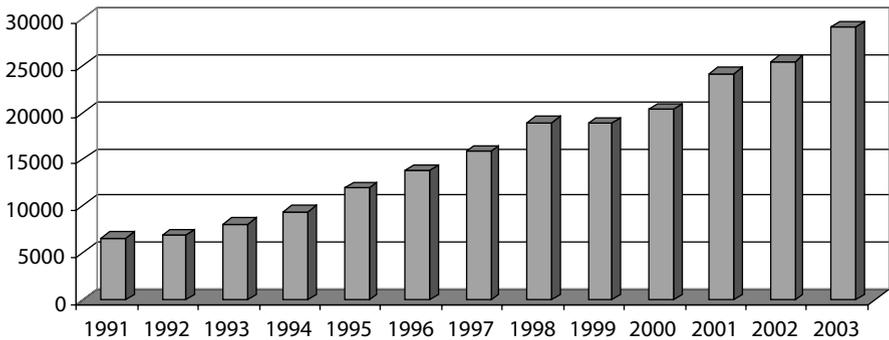
Fig. 3.2. Evolution of the container traffic in the PAB ('000 TEUs). Source: Port Authority, Bay of Algeciras

the Port has passed from managing 762,000 to more than 2.5 million TEUs. The average annual rate of growth in this period was 10.7%. Expressed in tons, the growth appears even greater (Fig. 3.2); from an annual volume of more than 6.5 million metric tons (mt) in 1991 to more than 29 million mt in 2003, with an average annual growth rate of 13.4%.

Table 3.1 gives the indices of containerisation, expressing the volume of containerised merchandise handled, against non-containerised. Two indices have been calculated, one in function of the general merchandise and other in function of the total volume in mt moved

Table 3.1. Indices of containerisation

	M.T. of merchandise (thousands)			Index of containerisation (*)	
	Containerised	M. General	Total	Index 1	Index 2
1991	6,578	9,161	29,646	0.718	0.222
1992	6,869	9,355	30,034	0.734	0.229
1993	8,100	11,272	30,002	0.719	0.270
1994	9,404	11,918	34,771	0.789	0.270
1995	11,894	14,987	36,987	0.794	0.322
1996	13,777	16,557	36,836	0.832	0.374
1997	15,821	18,634	40,052	0.849	0.395
1998	18,861	21,771	45,220	0.866	0.417
1999	18,785	22,101	45,244	0.850	0.415
2000	20,334	22,984	47,560	0.885	0.428
2001	24,153	27,344	52,747	0.883	0.458
2002	25,403	28,914	55,276	0.879	0.460
2003	29,033	32,370	60,916	0.897	0.477

(*) Index 1: M.t. of containerised merchandise/M.t. of general merchandise.
Index 2: M.t. of containerised merchandise/M.t. of total merchandise. Source: Port Authority, Port of Algeciras Bay and authors' own elaboration

in the Port. In both cases the indices of containerisation have been increasing progressively. Index 1 (containerised/general merchandise) reached a value for 2003 of 0.9, while Index 2 (containerised/total merchandise) increased from 0.22 in 1991 to almost 0.5 in 2003; that is, in 1991 one out of every five tons of merchandise moved in the Port was containerised, but by 2003 one out of every two tons of merchandise moved in the Port was containerised.

3.2.2
Container Traffic in the Context of Spanish Ports: Evolution and Specialisation

Table 3.2 shows the evolution of the container traffic (in thousands of TEUs) of the principal Spanish ports. In 2003 a total of 9 million tons was moved in these ports, with an accelerating rate of growth in the last decade. It can be seen that the PAB heads the list, followed by Valencia and Barcelona; these three ports account for 68% of all the traffic in containers passing through the Spanish ports. As can be appreciated from Fig. 3.2, the lead of the PAB over the next two

Table 3.2. Evolution of container traffic in the Spanish ports (Thousands of TEUs)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bay of Algeciras	807	1,004	1,155	1,307	1,538	1,826	1,833	2,009	2,152	2,234	2,517
Valencia	385	467	672	708	832	1,005	1,170	1,308	1,507	1,821	1,993
Barcelona	501	605	689	767	972	1,095	1,235	1,388	1,411	1,461	1,652
Las Palmas	267	313	334	354	381	491	636	621	676	759	991
Bilbao	222	268	297	301	340	368	377	434	454	455	449
Tenerife	187	215	242	262	278	325	367	393	403	400	414
Balearic Islands	107	150	170	165	188	225	272	282	265	243	264
Vigo	80	86	83	83	98	119	135	145	141	159	166
Bay of Cadiz	76	73	59	58	56	61	61	76	99	108	150
Alicante	50	58	62	72	85	89	96	113	133	136	146
Other	136	164	186	174	202	230	272	281	288	320	318
Total	2,817	3,403	3,949	4,252	4,969	5,833	6,455	7,052	7,531	8,097	9,060

Source: Ports of the State and authors' own elaboration

ports has stayed more or less constant over the past decade; however, since 2001 Valencia has overtaken Barcelona due to relatively higher growth.

In respect of the concentration of traffic, as has taken place in the rest of the world, in the Spanish ports there has been an increasing process of concentration of traffic in ever fewer ports (Table 3.3); in 1993 the top four ports accounted for 69.5% of the total traffic, while in 2003, 79% of the total container traffic, measured in TEUs, was concentrated in the same four ports. In the last decade, the PAB has held a share of around 28% (peaking in some years at 31%) of the combined traffic of all the Spanish ports; the Port of Valencia has gradually acquired relative weight in the Spanish ports system, while the Port of Barcelona, like the PAB, has maintained its share more or less constant. In respect of the rates of variation, Table 3.4 gives the annual rates of growth/decrease of all the ports that handle container traffic, and in the two last columns a simple average of all the years of the table and its standard deviation. In general, considerable fluctuations are seen in the majority of the ports. The PAB has always presented positive rates of increase and a relatively stable behaviour in comparison with the rest.

With the object of obtaining comparable information on the rest of ports of the national system on the evolution container traffic as a proportion of the total merchandise handled, the two coefficients of containerisation previously defined have been calculated: the first index CI1 that measures the containerised merchandise in relation to the general merchandise, and the second, CI2, that measures the containerised merchandise in relation to the total merchandise handled in the port (loaded and unloaded). In relation to the first index, in Table 3.5 and Fig. 3.3 it can be appreciated that the highest value corresponds to the PAB, where 90% of the general merchandise is moved in container. The second highest value corresponds to Valencia, where around 80% of the general merchandise is containerised.

With respect to the second index (Table 3.6 and Fig. 3.4) in 2003 one out of every two tons handled in the PAB were containerised, while that for the group of ports as a whole this ratio is only one out of every four tons. The Port of Valencia presents the highest value, with 63% of the total merchandise containerised, followed by the PAB with 48%. If we consider the evolution of the process of containerisation,

Table 3.3. Concentration of container traffic in Spanish ports (%) (*)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bay of Algeciras	28.63	29.49	29.24	30.74	30.95	31.30	28.39	28.49	28.57	27.59	27.78
Valencia	13.68	13.72	17.01	16.66	16.73	17.24	18.13	18.55	20.01	22.49	22.00
Barcelona	17.79	17.79	17.45	18.04	19.56	18.77	19.13	19.68	18.74	18.05	18.24
Las Palmas	9.48	9.20	8.45	8.33	7.66	8.41	9.85	8.81	8.97	9.37	10.94
Top four	69.58	70.2	72.15	73.77	74.9	75.72	75.5	75.53	76.29	77.5	78.96
Bilbao	7.89	7.87	7.51	7.07	6.84	6.31	5.85	6.16	6.03	5.62	4.95
Tenerife	6.64	6.32	6.13	6.17	5.59	5.57	5.68	5.58	5.35	4.94	4.57
Balearic Islands	3.80	4.42	4.32	3.87	3.78	3.86	4.22	4.01	3.53	3.00	2.91
Vigo	2.82	2.53	2.10	1.95	1.97	2.03	2.09	2.06	1.88	1.97	1.83
Bay of Cadiz	2.69	2.13	1.50	1.37	1.13	1.05	0.95	1.08	1.32	1.34	1.66
Alicante	1.76	1.72	1.58	1.69	1.72	1.53	1.49	1.60	1.77	1.67	1.62
Other	4.81	4.81	4.71	4.10	4.07	3.94	4.22	3.98	3.83	3.95	3.50
Total	100	100	100	100	100	100	100	100	100	100	100

(*) Calculations made in function of TEUs.
Source: Ports of the State and authors' own elaboration

Table 3.4. Rates of variation of container traffic in Spanish ports – % (*)

	93–94	94–95	95–96	96–97	97–98	98–99	99–00	00–01	01–02	02–03	Mean	STD
Bay of Algeciras	24.42	15.07	13.17	17.66	18.73	0.38	9.63	7.10	3.83	12.67	12.27	7.25
Valencia	21.16	43.90	5.43	17.39	20.91	16.39	11.78	15.20	20.85	9.44	18.25	10.42
Barcelona	20.79	13.87	11.30	26.68	12.68	12.77	12.36	1.69	3.56	13.08	12.88	7.22
Las Palmas	17.28	6.53	6.14	7.49	28.88	29.62	-2.32	8.79	12.31	30.58	14.53	11.57
Bilbao	20.41	10.83	1.35	13.12	8.24	2.51	15.12	4.61	0.14	-1.42	7.49	7.25
Tenerife	14.92	12.54	8.29	5.93	16.92	12.98	7.24	2.42	-0.63	3.50	8.41	5.79
Balearic Islands	40.36	13.39	-3.41	14.05	19.82	21.03	3.69	-6.00	-8.55	8.69	10.31	14.86
Vigo	8.13	-3.46	0.08	17.63	21.25	13.92	7.73	-2.84	12.73	4.17	7.93	8.51
Bay of Cadiz	-4.23	-18.22	-1.51	-4.17	9.09	0.18	24.76	30.20	8.79	38.78	8.37	17.82
Alicante	17.84	6.79	15.42	18.73	4.34	7.78	17.66	17.95	1.58	8.08	11.62	6.54
Other	20.74	13.62	-6.29	16.05	13.51	18.47	3.23	2.71	10.96	-0.81	9.22	8.98
Total	20.79	16.07	7.66	16.86	17.39	10.66	9.25	6.79	7.51	11.90	12.49	4.94

(*) Calculations made in function of TEUs.

Source: Ports of the State and authors' own elaboration

Table 3.5. Indices of containerisation (CI1) of the principal Spanish ports in container traffic (*)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bay of Algeciras	0.718	0.789	0.793	0.832	0.849	0.858	0.850	0.885	0.883	0.883	0.897
Valencia	0.633	0.640	0.686	0.702	0.714	0.732	0.754	0.750	0.754	0.778	0.791
Barcelona	0.744	0.714	0.743	0.756	0.771	0.765	0.753	0.739	0.741	0.717	0.734
Las Palmas	0.561	0.555	0.568	0.594	0.576	0.656	0.595	0.533	0.690	0.704	0.758
Bilbao	0.494	0.504	0.467	0.483	0.503	0.504	0.535	0.526	0.580	0.592	0.581
Tenerife	0.451	0.452	0.492	0.458	0.445	0.511	0.534	0.537	0.524	0.503	0.492
Balearic Islands	0.269	0.286	0.295	0.298	0.310	0.313	0.331	0.319	0.287	0.265	0.255
Vigo	0.416	0.392	0.389	0.386	0.433	0.441	0.458	0.460	0.474	0.521	0.521
Bay of Cadiz	0.335	0.288	0.298	0.277	0.252	0.235	0.238	0.275	0.321	0.388	0.372
Alicante	0.759	0.725	0.686	0.769	0.741	0.656	0.654	0.655	0.646	0.630	0.665
Total	0.505	0.519	0.549	0.574	0.589	0.610	0.615	0.614	0.638	0.651	0.667

(*) CI1 = M.t. containerised/M.t. general merchandise
Source: Ports of the State and authors' own elaboration
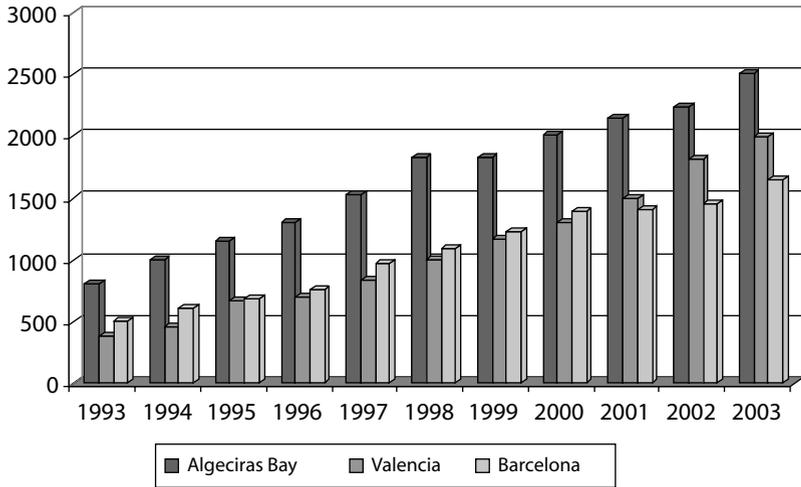
Fig. 3.3. Evolution of the container traffic in the three principal Spanish ports ('000 TEUs). Source: Ports of the State and authors' own elaboration
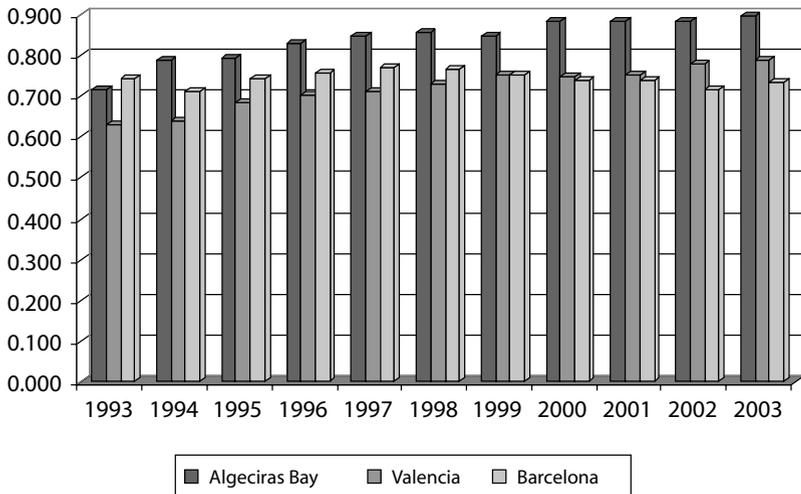
Fig. 3.4. Indices of containerisation CI1 of the three principal Spanish ports. Source: Ports of the State and authors' own elaboration

the containerised merchandise handled in the majority of ports is increasing.

Complementary to the indices of containerisation, the calculation of other indicators of specialisation allows the descriptive analysis

Table 3.6. Indices of containerisation (CI2) of the principal Spanish ports in container traffic (*)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bay of Algeciras	0.270	0.270	0.322	0.374	0.395	0.413	0.414	0.428	0.458	0.460	0.477
Valencia	0.401	0.395	0.456	0.484	0.511	0.536	0.538	0.557	0.563	0.598	0.626
Barcelona	0.284	0.292	0.300	0.316	0.356	0.395	0.405	0.431	0.421	0.419	0.432
Las Palmas	0.258	0.262	0.267	0.272	0.268	0.324	0.320	0.279	0.358	0.390	0.453
Bilbao	0.078	0.094	0.110	0.134	0.148	0.136	0.145	0.153	0.170	0.178	0.164
Tenerife	0.135	0.139	0.157	0.159	0.157	0.169	0.184	0.185	0.186	0.178	0.178
Balearic Islands	0.158	0.176	0.118	0.094	0.104	0.195	0.209	0.203	0.181	0.167	0.161
Vigo	0.218	0.223	0.220	0.254	0.315	0.327	0.347	0.352	0.340	0.375	0.369
Bay of Cadiz	0.199	0.166	0.117	0.146	0.146	0.138	0.139	0.148	0.176	0.210	0.216
Alicante	0.193	0.204	0.235	0.257	0.318	0.268	0.244	0.281	0.301	0.326	0.325
Total	0.114	0.125	0.135	0.150	0.167	0.186	0.194	0.198	0.215	0.224	0.243

(*) CI2 = M.t. containerised/M.t. of total traffic
Source: Ports of the State and authors' own elaboration
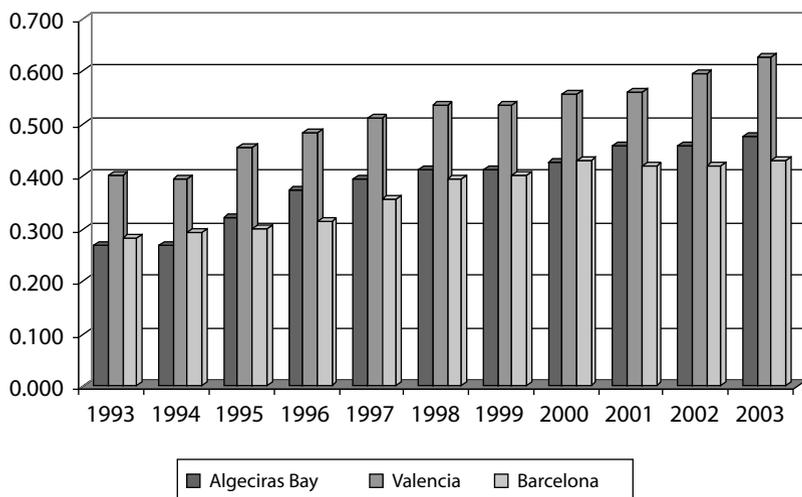
Fig. 3.5. Indices of containerisation CI2 of the three principal Spanish ports. Source: Ports of the State and authors' own elaboration

to be improved. These coefficients evaluate the importance of the container traffic (measured in tons) with respect to total volume of traffic of a port, in relation to the container traffic of the Spanish port system ads a whole, and to the total traffic of the port system. A value close to one indicates that the container traffic as a proportion of the total traffic in that port is similar to the national figure; a value above one indicates a certain degree of specialisation in containers, which is greater the higher the coefficient; lastly, a value of less than one indicates that the container traffic has relatively little importance in the total tonnage handled in the port in relation to the national average, and this weight is less the lower the coefficient. Table 3.7 gives the coefficients for each of the Spanish ports; over the decade analysed, the PAB presents values higher than or around two, which is clear evidence of the specialisation of the PAB in container traffic in relation to the Spanish port system as a whole.

Table 3.7. Coefficients of specialisation in container traffic in relation to all Spanish ports (*)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bay of Algeciras	2.362	2.169	2.375	2.490	2.362	2.215	2.138	2.164	2.128	2.054	1.965
Valencia	3.512	3.163	3.369	3.224	3.055	2.876	2.779	2.818	2.615	2.672	2.582
Barcelona	2.484	2.344	2.213	2.103	2.128	2.117	2.089	2.180	1.958	1.874	1.781
Las Palmas	2.255	2.105	1.970	1.811	1.600	1.735	1.652	1.410	1.664	1.744	1.868
Bilbao	0.682	0.755	0.809	0.894	0.882	0.729	0.748	0.772	0.788	0.793	0.677
Tenerife	1.181	1.113	1.156	1.061	0.936	0.904	0.948	0.938	0.864	0.797	0.733
Balearic Islands	1.379	1.412	0.871	0.628	0.621	1.048	1.079	1.026	0.843	0.744	0.665
Vigo	1.904	1.790	1.628	1.688	1.883	1.754	1.791	1.780	1.579	1.675	1.520
Bay of Cadiz	1.742	1.328	0.866	0.975	0.872	0.741	0.716	0.747	0.819	0.940	0.892
Alicante	1.684	1.636	1.735	1.709	1.901	1.435	1.261	1.420	1.398	1.458	1.341

(*) CE = (M.t. Container traffic/total traffic in that port)/(Container traffic/Total traffic in all ports).
Source: Ports of the State and authors' own elaboration

3.3
Evolution and Relative Position, in Relation to the Principal Mediterranean Ports

With the object of evaluating the evolution and current position of the Port of Algeciras Bay in relation to its principal competitors in the Mediterranean, we next present data reflecting the trends in traffic in recent years (in determining the competitor ports, the factors indicated in the preceding chapter have been taken into account).

Table 3.8 gives the data on traffic for the years 2002 and 2003. All these ports are located in the continent of Europe, with the exception of Marsaxlokk situated on the island of Malta. Three of them are Spanish, including the PAB, three are Italian, one French and one Greek. From a brief descriptive analysis it can be appreciated that the Italian Port of Gioia-Tauro, in the Strait of Messina, has the largest volume, although it has dropped three positions with respect to 2002 and its annual rate of growth has been 6.5%, two points less than the average for these ports as a whole, at 8.5%. The next three ports in the ranking by volume are Spanish: The ports of Algeciras Bay, Valencia and Barcelona. The Port of Algeciras Bay is the only one that has held its position with respect to the previous year; Valencia and Barcelona have dropped one and two positions respectively.

Table 3.8. Container traffic in the principal Mediterranean ports

World rankings (*)	Port	Zone	TEUs 2002	TEUs 2003	% CTO 2002-03
20 (17)	Gioia-Tauro	Western Mediterranean	2,954,571	3,148,662	6.57
26 (26)	B. Algeciras	Western Mediterranean	2,234,248	2,517,318	12.67
33 (32)	Valencia	Western Mediterranean	1,821,005	1,992,903	9.44
44 (42)	Barcelona	Western Mediterranean	1,461,232	1,652,366	13.08
47 (39)	Genoa	Western Mediterranean	1,531,254	1,605,942	4.88
48 (48)	Piraeus	Eastern Med./Black Sea	1,404,939	1,605,135	14.25
56 (55)	Marsaxlokk	Western Mediterranean	1,244,232	1,300,000	4.48
70 (68)	La Spezia	Western Mediterranean	975,005	1,006,641	3.24
73 (74)	Marseilles	Western Mediterranean	809,153	831,000	2.70
Total			14,435,639	15,659,967	8.51

(*) In parenthesis is the ranking in 2002
Source: C.I. and authors' own elaboration

The rates of inter-annual growth have, in the three cases, been significant and above of the average, particularly the growth of the ports of Barcelona and Algeciras Bay, which were around 13%, the second and third highest rates of growth of all the ports. The Italian ports of Genoa and La Spezia have declined in their position in the world ranking, with rates of growth of 4.88% and 3.24% respectively, as has also occurred for the Maltese Port of Marsaxlokk, with a growth rate of 4.48%. The Port of Piraeus (Greece) has seen the highest rate of growth, 14.25%, which has enabled it to maintain its ranking. Lastly, Marseilles has managed to rise by one position in the ranking, from 74th to 73rd, despite having recorded a reduced rate of growth (2.7%).

Table 3.9 shows the evolution of the ports' market shares. Corresponding to the position that they occupy in the ranking, Gioia Tauro currently has the highest share, 20%, followed by the PAB with a share of 16%. The historical evolution of market shares indicates, broadly, two well-differentiated periods, separated by the entry of Gioia Tauro in the container market. Coinciding with the entry of Gioia Tauro into full operation, Algeciras loses several points in its market share, as do Barcelona and Genoa; however, the hardest-hit port is La Spezia, whose volume of traffic falls to less than half its previous level. Marsaxlokk continues with approximately the same share, while Valencia and Piraeus even increase their market share.

To evaluate the trends in traffic in the PAB in comparison with the other ports that can be considered competitors, some simple coefficients of correlation between the market shares have been calculated (Table 3.10). It can be observed that the correlation coefficients of the PAB with G. Tauro and Marsaxlokk are negative and with values close to one, that is, when these ports have increased their market share, the PAB has seen its share reduced. Genoa and Piraeus show coefficients close to zero, suggesting independence in their competitive position with respect to the PAB. The rest of ports with positive coefficients would indicate behaviour in a similar direction to the PAB. A similar analysis can be drawn for the rest of ports.

Table 3.9. Evolution of market shares of the principal Mediterranean ports (%) (*)

	Algeciras	Barcelona	Genoa	Gioia Tauro	La Spezia	Marsaxlokk	Marseilles	Valencia	Piraeus
1990	22.23	18.02	12.48		18.11		7.04	15.58	6.54
1991	24.89	15.97	11.25		15.14		5.73	11.91	15.12
1992	15.65	11.08	6.77		11.95	5.20	7.03	7.43	34.89
1993	19.88	12.35	8.44		18.86	7.10	10.64	9.50	13.24
1994	21.08	12.72	10.76		17.54	8.05	9.18	9.81	10.86
1995	20.22	12.07	10.78		16.91	9.02	8.72	11.77	10.51
1996	19.32	11.34	12.21	8.46	12.88	8.77	8.05	10.47	8.50
1997	17.98	11.36	13.80	16.94	7.20	7.75	7.27	9.72	8.00
1998	17.11	10.24	11.86	19.92	6.86	10.04	6.13	9.10	8.74
1999	16.30	10.98	10.97	20.04	7.50	9.29	5.93	10.41	8.58
2000	15.83	10.94	11.83	20.91	7.17	8.14	5.72	10.31	9.15
2001	16.39	10.75	11.62	18.95	7.42	8.87	5.65	11.47	8.88
2002	15.48	10.12	10.61	20.47	6.75	8.62	5.61	12.61	9.73
2003	16.07	10.55	10.26	20.11	6.43	8.30	5.31	12.73	10.25

(*) Total of all the ports listed in each year = 100
Source: C.I. and authors' own elaboration

Table 3.10. Correlations between market shares of the principal ports of the Mediterranean 1990–2003 (*)

	Algeciras	Barcelona	Genoa	G. Tauro	La Spezia	Marsaxlokk	Marseilles	Valencia	Piraeus
Algeciras	1.00	0.85	0.19	−0.91	0.79	−0.69	0.40	0.34	−0.13
Barcelona		1.00	0.17	−0.62	0.69	−0.90	0.17	0.56	−0.07
Genoa			1.00	−0.43	−0.25	0.03	−0.26	0.41	−0.81
G. Tauro				1.00	−0.96	0.08	−0.90	0.21	0.44
La Spezia					1.00	−0.51	0.77	0.14	0.14
Marsaxlokk						1.00	0.05	−0.43	−0.24
Marseilles							1.00	−0.27	0.08
Valencia								1.00	−0.54
Piraeus									1.00

(*) Except Gioia Tauro, which has been calculated for 1996–2003
Source: Authors' own compilation

3.4
Container Traffic of the PBA, in the Global Context

Table 3.11 shows the evolution of the world ranking of the PAB. Two decades ago the PAB occupied 44th position in the ranking of world ports; since then it has progressively climbed higher in the ranking and, after some oscillations, has now managed to hold the 26th place. It can be observed that, in the second half of the 1990's, the PAB lost some three percentage points in its market share of the Western Mediterranean, possibly due to the entry of Gioia Tauro onto the scene; however, the PAB continues to maintain and even increase its share of world traffic in containers.

Table 3.12 gives the traffic figures of the 20 most significant container ports of the world in terms of traffic volume. Of these 20, 11 are in developing countries and territories, and in socialist countries of Asia, while the other 9 are in the developed countries with market economies. Of these there are six in Europe, three in the United States

Table 3.11. Container traffic in the port of algeciras bay

Years	Ranking			Market Share, World (%)	
		Medit (*)	Medit (*)	Top hundred	of the world
1985	44	4	13.04	0.78	0.67
1990	33	1	18.14	0.76	0.66
1991	29	1	23.22	0.94	0.82
1992	30	1	20.67	0.88	0.76
1993	31	1	19.42	0.83	0.70
1994	28	1	20.64	0.91	0.77
1995	27	1	19.87	0.97	0.82
1996	28	1	18.87	1.01	0.85
1997	24	1	18.37	1.10	0.93
1998	21	2	17.70	1.17	0.97
1999	23	2	17.07	1.06	0.88
2000	26	2	16.70	1.03	0.85
2001	25	2	17.22	1.07	0.88
2002	26	2	16.46	1.00	0.84
2003	26	2	17.19	1.01	0.90

(*) Includes all the Western Mediterranean ports that in any of the years listed have had container traffic activity.
Source: Annual Reports of the PAB, Containerisation International and authors' own elaboration

Table 3.12. World traffic of the principal container ports

Ranking	Port	Zone	TEUs		% incr. 2003/2	Share of "Top 20" (%)	
			2002	2003		2002	2003
1 (1)	Hong Kong	East Asia	19,144,000	20,449,000	6.82	7.23	7.32
2 (2)	Singapore	Southeast Asia	16,800,000	18,100,000	7.74	6.35	6.48
3 (4)	Shanghai	East Asia	8,610,000	11,280,000	31.01	3.25	4.04
4 (6)	Shenzhen	East Asia	7,613,754	10,614,900	39.42	2.88	3.80
5 (3)	Busan	Northeast Asia	9,453,356	10,407,809	10.10	3.57	3.73
6 (5)	Kaohsiung	East Asia	8,493,000	8,840,000	4.09	3.21	3.16
7 (8)	Los Angeles	W Coast, N. Amer.	6,105,863	7,178,940	17.57	2.31	2.57
8 (7)	Rotterdam	North Europe	6,515,449	7,106,778	9.08	2.46	2.54
9 (9)	Hamburg	North Europe	5,373,999	6,138,000	14.22	2.03	2.20
10 (10)	Antwerp	North Europe	4,777,152	5,445,436	13.99	1.80	1.95
11 (13)	Dubai	Middle East	4,194,264	5,151,958	22.83	1.58	1.84
12 (11)	Port Klang	Southeast Asia	4,533,212	4,840,000	6.77	1.71	1.73
13 (12)	Long Beach	East Coast. N. Amer.	4,526,365	4,658,124	2.91	1.71	1.67
14 (15)	Qingdao	East Asia	3,410,000	4,239,000	24.31	1.29	1.52
15 (14)	N.York/N.Jersey	East Coast, N. Amer.	3,749,014	4,067,812	8.50	1.42	1.46
16 (21)	Tanjung Pelepas	Southeast Asia	2,660,000	3,487,320	31.10	1.00	1.25
17 (19)	Tokyo	Northeast Asia	2,712,348	3,280,000	20.93	1.02	1.17
18 (16)	Bremen	North Europe	3,031,587	3,190,707	5.25	1.15	1.14
19 (22)	Laem Chabang	Southeast Asia	2,656,651	3,180,130	19.70	1.00	1.14
20 (17)	Gioia Tauro	Western Mediterranean	2,954,571	3,148,662	6.57	1.12	1.13
	TOTAL "TOP 20"		127,314,585	144,804,576	13.74	48.10	51.83
26 (26)	B. Algeciras	Western Mediterranean	2,234,248	2,517,318	12.67	0.84	0.90
	WORLD TOTAL		264,710,873	279,386,980	5.54	100	100

Source: C.I. and authors' own elaboration

and one in Japan. The Port of Algeciras is included in the table so that its relative position can be appreciated.

It can be observed that the twenty most important ports account for almost 52% of the world's container traffic. In only the top five ports, all in Asia, 23% of the total traffic is concentrated. The biggest shares of the world market correspond to Hong-Kong and Singapore. On average the growth in the latest year of the top twenty ports is 13.7%, while the volume of world traffic has grown by 5.5%. It is therefore foreseen that the degree of concentration will continue to increase. The Port of Hong Kong (China) has stayed at the head of the world ranking, with an increase of 6.82%, followed by Singapore, which recorded a growth of 7.74%. However, the two main ports of continental China have recorded an extremely rapid growth: Shanghai has had a notable increase of 31.01%, and has risen by one position in the ranking; Shenzhen has managed an extraordinary increase of 39.42%, jumping two positions with respect to the year 2002. Among the US ports, Los Angeles has risen one place, with a growth of 17.57%, while Long Beach and New York/New Jersey have both dropped one place. Changes have also taken place in the positions of European ports, like the case of Rotterdam and Gioia Tauro which have dropped one and three places respectively. in the ranking. Other ports such as Hamburg and Amberes have maintained the same position.

In this context, the Port of Algeciras Bay continues to hold the 26th position in the world ranking in 2003, the same position as it held in 2002. Its growth in terms of traffic in 2003 with respect to 2002 was 12.7%, a rate of growth similar to the average of the top twenty, and double the average growth rate for the world as a whole. In respect of its market share in the world traffic, in 2003 this was 0.90%, an increase over its share of 0.84% in 2002.

3.5
Container Traffic in 2003 and the Land and Maritime Zones of Commercial Exchange

In the previous parts of this Report, it has been shown that, in the Port of Algeciras Bay more than two and a half million TEUs were

Table 3.13. Container traffic in 2003

	TEUs	%
Transit	2,369,033	94.11
Import/export	148,285	5.89
Total	2,517,318	100

Source: APBA

handled in 2003. Table 3.13 shows the distribution of this volume between transhipment and export/import activities. As can be seen from the table, in the PAB the greater part of the volume of containers handled corresponds to transhipment.

The analysis of the *import/export* activities provides us with an approximate idea of the economic *hinterland* of the Port. The *hinterland*, as the inland zone of influence of a port where services are provided and there is interaction with clients, is an intuitively simple concept. This geographic space of influence extends to the area of commercial exchanges from the port by means of road and rail communications (in some cases this extends also to the zones with which the port has commercial relationships via maritime or fluvial *feeder* services). Even in this broad interpretation, various levels usually appear in the zone of influence: a primary level at which the port exerts an absolute or predominant influence or principal *hinterland*, and a secondary level or margin of competition at which the port competes in the same geographic space with others ports. Sometimes, it would even be possible to define a third level or potential *hinterland*, where the port has no current influence but could act commercially and economically. Although it is customary to attribute the extent of the *hinterland* to the communications network of the Port, another series of factors are also very relevant (specialisation, efficacy and physical conditions; the lines of navigation, commercial organisation of the shipping agencies and forwarders, etc.).

This is not the place to determine the *hinterland* of the PAB, since it would require a deeper study to identify and analyse it, but it is appropriate at least to offer some relevant data that might give an approximate idea of the nature and extent of the terrestrial area of influence of the Port. In this line, analysis of the traffic reveals, for the transport by road and from a survey conducted of the seven most important companies in the transport of containers (one of them

comprises more than 40 transport operators of the Bay of Algeciras), that between 85% and 90% of the origins and destinations of the merchandise are within Andalusia (and of these between 40% and 45% are within the Province of Cadiz). The rest (between 10% and 15%) are merchandise with origin or destination outside Andalusia, particularly Madrid, Badajoz and Cáceres. A very small proportion (around 1%) has its origin or destination outside Spain (mostly Portugal).

The information provided by RENFE for the transport of containers by rail is more detailed. Table 3.14 gives the origins and destinations of containers, ranked by volume in TEUs. It can be observed that, for containers transported by rail, Madrid accounts for around 75% of the destinations and more than 50% of the origins.

Concerning the PAB's *foreland* (ports of origin or destination for maritime transport), the country of origin with most specific weight in the total weight of containerised merchandise handled is Spain, with 11.4%; this is followed by Brazil and China, with 9.25% and 7 %

Table 3.14. Transport by rail of containerised merchandise in 2003

Origin	Destination	TEUs	%
PAB.	Madrid	10,337	75.93
	Linares	1,438	10.56
	Leon	476	3.50
	Barcelona	395	2.90
	Campo de Gibraltar.	295	2.17
	Others	674	4.95
	Total	13,614	100
Origin	Destination	TEUs	%
Madrid	PAB.	4,994	52.01
Linares		1,528	15.91
Bilbao		768	7.99
Barcelona		619	6.44
Campo de Gibraltar.		557	5.80
Leon		494	5.14
Zaragoza		248	2.58
Others		397	4.13
Total		9,603	100
Total TEUs		23,217	

Source: R.E.N.F.E.

respectively. Other countries of origin accounting for more than one million tons handled per year are Italy, India and United States, each accounting for around 5% of the total. In the case of the countries of destination of containerised merchandise, Spain occupies second place with 8.4%, after the leading country Nigeria with 10%; these are followed by the United States and Morocco, accounting for 7.2% and 3.7% respectively, and reaching volumes in excess of one million tons per year.

By zones, in the case of the ports of origin (Fig. 3.6), merchandise from the countries of the European Union (the 15 countries including Spain that formed the EU in 2003) is notable and accounts for 30.7% of the total; the EU is followed in importance by Asia (20.6%) and America (19.6%). In the latter case, this can be subdivided between that from South America (14%), that for North America (5.3%), and that from Central America (0.3%). Merchandise from countries of the African continent accounts for 16%; this is distributed between Central and Southern Africa (12%), and North Africa (4%). The merchandise from the Middle East accounts for 6% of the total, from Oceania for 2%, and from the European countries that were not at that time members of the EU for 1.5%.

As regards the countries of destination of the merchandise passing through the port (Fig. 3.7), the first point to note is the relative impor-
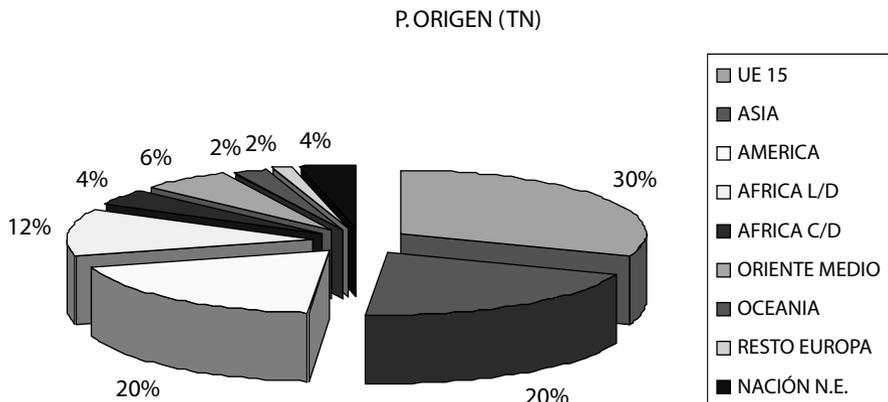
Fig. 3.6. Distribution of containerised merchandise in function of the region of origin in 2003 (tons). Source: Authors' own elaboration from data of the Port Authority of the Bay of Algeciras, 2004

P. DESTINO (TN)
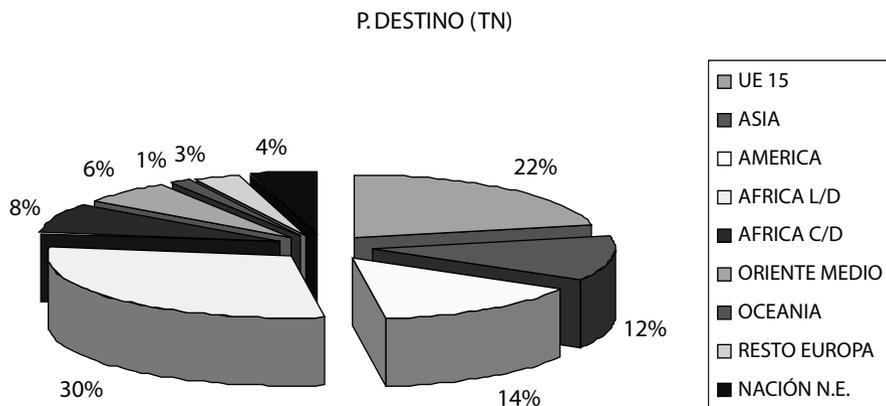
Fig. 3.7. Distribution of merchandise in function of the region of destination in 2003 (tons). Source: Authors' own elaboration from data of the Port Authority of the Bay of Algeciras, 2004

tance of Africa, accounting for 37% of the total; of this, 29.4% went to countries of Central and Southern Africa, and 7.6% to countries of North Africa. Next in importance as destinations are the countries members of the EU, including Spain, accounting for 21.6%, then countries in America for 14.2% and Asian countries for 12.1%. In the case of America, this can be subdivided among North America (9.1%), South of America (3.8%) and Central America (1.3%). Lastly, the countries of the Middle East accounted for 6.3%, the non-EU countries of Europe for 3.2%, and those of Oceania for 1.2%.

In conclusion, the preceding analysis demonstrates the broad scope of the *foreland* of the PAB, which extends to the five continents. The importance of intra-EU trade is also emphasised, in respect of both the origins and the destinations of the merchandise handled; this trade occupies the first place in origin and second place in destination. The trade with the African continent occupies first place in destination and fourth place in origin. In both cases the movements of merchandise to and from the countries of Central and North Africa are significant, the principal countries being Nigeria, Ghana, Ivory Coast, Benin and Angola. With respect to the countries of North Africa, Morocco is the most important country for both the origin and the destination of merchandise. The continent of America occupies third place in importance as both origin and destination

of merchandise; in the case of origin, Brazil and other countries of South America are important, and in destination, the United States is most significant. With respect to Asia, this continent occupies second place as origin of merchandise, and fourth place as destination; the countries that have the greatest weight in this continent are China and India. Of least weight in terms of the movements of merchandise are the countries of the Middle East, then the rest of the European countries and Australia and New Zealand.

3.6
Conclusions

In 2003 container traffic in the PAB reached a volume of 2.52 million TEUs, having grown by 12.6% over the previous year. The PAB holds first place in the ranking of Spanish container ports, second place in the Mediterranean container ports ranking, and 26th in the world ports ranking. In this chapter we break down these figures to give an idea of the comparative evolution in terms of volume of container traffic handled in the PAB. The principal conclusions are the following:

☞ Evolution and growth. In little more than a decade, the PAB has grown from handling 762,000 to more than 2,500,000 TEUs, an average annual growth rate of 10.7%. This growth in absolute terms has been accompanied by a process of increasing containerisation of the merchandise handled, very much in line with the global trend, the index of containerisation (containerised merchandise in proportion to general merchandise) rose from 0.7 in 1991 to 0.9 in 2003. The containerised merchandise as a proportion of the total handled rose from 0.22 in 1991 to almost 0.5 in 2003; that is, in 1991, one out of every five tons of merchandise moved in the Port was containerised, but by 2003 one out of every two tons of merchandise moved was containerised.

☞ The PAB in the context of Spanish ports. In the last decade, the PAB has held a share of around 28% (with some peaks that reached 31%) of the total traffic of all Spanish ports; the Port of Valencia has been acquiring more relative weight in the context of the Spanish ports system, while the Port of Barcelona, like

the PAB, has maintained a fairly constant share. In respect of the rates of annual variation, considerable fluctuations are seen in the majority of Spanish ports. The PAB has always presented positive rates of increase and a relatively stable pattern of growth in comparison with the rest.

☞ The PAB in the context of Mediterranean ports. Among the principal Mediterranean container ports, the highest share of total traffic, 20%, corresponds to Gioia Tauro, and the second highest to the PAB with 16%. The historical evolution of market shares indicates, broadly, two well-differentiated periods, separated by the entry of Gioia Tauro in the container market. Coinciding with the entry of Gioia Tauro into full operation, the PAB lost several percentage points in its market share, as did Barcelona and Genoa; however, the hardest-hit port was La Spezia, whose volume of traffic fell to less than half its previous level. Marsaxlokk continued with approximately the same share, while Valencia and Piraeus even increased their market share. From an analysis of correlations it can be appreciated that the Spanish ports of Barcelona and Valencia (to a less degree) have moved in a similar direction to the PAB in terms of traffic volumes.

☞ The PAB in the world context. Two decades ago the PAB occupied 40th position in the ranking of world ports; since then it has progressively climbed higher in the ranking and, after some oscillations, has now managed to reach 26th place. Although in the second half of the 1990's the PAB lost around three percentage points in its market share of the West Mediterranean (possibly due to the entry into operation of Gioia Tauro), the PAB managed to hold and even increase its share of the world container traffic.

☞ Zones of commercial exchange. The analysis of the origins and destinations of the containerised merchandise handled gives us an idea, albeit superficial, of the economic *hinterland* and *foreland* of the PAB. With respect to the hinterland, analysis of the road traffic in containers to and from the port indicates that between 85% and 90% of the origins and destinations of the merchandise are in Andalusia (of these between 40% and 45% are in the Province of Cadiz). The rest (between 10% and 15%) are merchandise with origin and destination beyond Andalusia, particularly Madrid, Badajoz and Cáceres. The principal commercial

focus of rail transport is Madrid, in respect of both origin and destination. With respect to the *foreland,* the distribution of containerised merchandise demonstrates that the PAB serves a very extensive *foreland* that encompasses the five continents. In the study of the origins and destinations of containerised merchandise by maritime transport, the importance of intra-EU trade is very evident; this occupies first place in origin and second place in destination.

4 The Economic Impact of Container Traffic

4.1
Introduction

A sequential process of interviews and surveys has been undertaken in order to analyse the economic effects of the Port's container traffic, to identify the associated economic activities and their degrees of dependency on this traffic. Firstly, the interviews have been arranged to determine all the companies in the immediate area of the Port (essentially the Campo de Gibraltar) that have a direct relationship with the process of containerisation; secondly, the questionnaire was designed to provide the quantitative information necessary for measuring the direct, indirect and induced impacts. The process was started by selecting an initial sample of companies in coordination with the Port Authority of the PAB; that first list of companies was then revised and completed from initial interviews with executives of Maersk España S.A. and Terminal de Contenedores de Algeciras S.A. The list has then been progressively amplified to identify all the companies involved and their degrees of relationship with the process of containerisation.

Two types of activity will be differentiated within the operations of the port: transhipment and import/export (I/E). As is known, the transhipment operation involves the entry of the containers by maritime transport and their later departure by the same means, by sea; the port is neither the point of origin nor point of destination of the merchandise, only a point of exchange of the cargo for redistribution, in function of the maritime routes that the shipping company may operate. In the case of the I/E activities the container for export is generally transported by road or rail and is subject to the customs and para-customs controls before entering the port terminal for loading, or in the opposite direction for imports. In many

instances the companies surveyed have differentiated perfectly the part of their services related to containerisation that corresponds to I/E from that corresponding to transhipment. When the characteristics of the company's activity makes it impossible to differentiate (the repair of containers, for example) the average ratio for the container terminal has been applied; the implicit assumption is that certain complementary activities, like repairs, are undertaken in the same proportion as the overall distribution of operations between I/E and transhipment.

4.2
The Containerisation Process in the Port of Algeciras Bay: Companies and Economic Activities

As stated in Chap. 1, the organisation of the port system – or what we understand as the port community – is different in the ports specialising in container traffic compared with traditional ports, and the organisation of the PAB is no exception. In the Port of Algeciras Bay, however, both forms of managing the container traffic coexist: the predominant form of organisation is the vertically integrated provision of logistic services developed fundamentally by MAERSK Spain S.A., whereas the other form, which is less significant than the former, is the more traditional framework involving a wide variety of companies with different objectives and strategies. Whether from a traditional or integrated perspective, the agents involved in the process are essentially the shipping companies and container terminal operators, the intermediary agents, and the road and rail transport operators. Additional to these are various port services intended to make the process function efficiently (stevedores, tugs, mooring services, public institutions, etc.). We refer in the following section to the list of companies involved in both types of management and to their functional aspects.

4.2.1
Container Terminals and Vertically-integrated Companies

We include in this part the two container terminals of the PAB: "Terminal 2000" of Maersk España and TCA. The Terminal of the Maersk España Group in the PAB is only one link in a chain of companies that provide integral services; in consequence, within the companies of the Maersk Group, the Terminal and the rest of the companies with some activity in the PAB will be considered. On the other hand, TCA is a terminal that is not vertically integrated with other activities related to containerisation. We therefore divide this part in two subsections, one with the companies of the Maersk group, and the other with TCA.

4.2.1.1
Companies and Activities of the Maersk España S.A.Group

In the ports specialising in containers, as is the case of the PAB, the process of containerisation is usually vertically integrated. One organisation with a single management controls all the operations in a unified way, from when the customer contracts the shipment of the containerised merchandise, until it reaches its destination after being transported by whatever means may be required. Many of the activities in the container transport chain are carried out by persons of the same company or group of companies of the terminal; on other occasions activities are simply sub-contracted. The key argument that has resulted in changes to the traditional system of port organisation for the transfer of merchandise is improved efficiency in terms of rapidity, cost and convenience for the customer.

This type of integral management, which is the system mainly used in the PAB, has been developed by the Maersk España, S.A. Group of companies, formed by a network of entities that cover practically all the activities related to the process of containerisation. Those activities that are not specifically incorporated in the Group are generally sub-contracted out to provide an integral service to the customer.

The following companies within Maersk España S.A. are active in the PAB: a) the shipping companies (MAERSK-SEA LAND, SAF

Marine); b) logistics and intermediary functions (MAERSK Logistics); and c) the Port Terminal (APM Terminals). Two other subsidiaries must be added (Containers del Mediterráneo SA-COMESA and Reparaciones Mar ítimas Españolas SA-REMESA).

The activities carried out by Maersk España in the PAB therefore go beyond the operations of the Terminal of Algeciras (APM Terminal), which is one link within the Maersk España S.A. chain of companies set up to provide an integrated service. The MAERSK management spans the globe, with all operations coordinated by one single management team. As well as giving the owner of the cargo an integral door to door service, the objective of this integration is to eliminate other intermediaries, minimise costs and plan the optimisation of the space required by the cargo on the ship and in the terminals. The Group can act as shipping line or ship owner, ship's agent and consignee of the merchandise, stevedores company (cranes), forwarder and customs agents. The activities subcontracted comprise road and rail transport (outside the Terminal) and all the other complementary activities related to the vessel (stowage, supplies/repairs, berthing services, tugs, pilots). The following details are given on each company and activity involved to clarify their functions.

a) Maersk Sealand (M-SL) is the container shipping division of the Danish industrial group AP MOLLER-MAERSK, which was created in 1999 after the integration of the previous Maersk line and Sealand (following its acquisition) by AP Moller. The container shipping line of Maersk Sealand spans the world and has a very important presence in the rest of the cargo transport business; it operates with its own terminals, even its own trucks and trains, in more than 100 countries of all the continents. Through partners which it owns (Safmarine), its domination is also growing in the African market. The customer can contact M-SL directly to request its integral service of merchandise delivery; this service encompasses all the activities of the process of containerisation for door to door delivery; the shipping, agents' and customs services, etc. will all be provided therefore by M-SL.

b) The intermediary activities are provided by MAERSK Logistics; this company acts as *forwarder*, which in this case is also part of

the Group. The customer therefore has a variety of possible ways to request containerisation services; as explained in the preceding paragraph, it can go directly to the Shipping Line, or it can request the services of MAERSK Logistics, acting as *forwarder*, which will then make contact with the Shipping Line of the Group, although where cost restrictions imposed by the customer mean that it may not be advantageous to contract the Group Line, Maersk Logistics has the possibility of using other shipping lines.

c) The port terminal of the MAERSK Group in Algeciras is the property of Maersk España, S.A., which in turn belongs to APM TERMINALS, an independent entity within of the A P Moller group. The activities of the Terminal comprise the physical operations related to the process of containerisation in the area contracted by the Terminal from the Port Authority. The Terminal, utilising its own resources and installations, controls all the activities related to the handling of the container, from its arrival by sea until it is either transhipped or transferred for onward land transport (which requires various complementary and coordinated systems: ship operation system, location and relocation of the container in its correct place on board in the most efficient way, planning of the loading and unloading, description of the position of the containers in the Port, handling of the containers in the terminal, etc.). Most of the operations undertaken in the PAB, to date, have been those of transhipment, although a smaller number of containers arrive by land for export, and in this case the Terminal takes charge similarly of their handling, loading and placement for maritime shipment.

d) Together with the three previous entities, there are another two subsidiary companies of the Group included in the PAB, with significant levels of economic activity, one engaged in the repair of containers (Containers del Mediterráneo-COMESA) and another, Reparaciones Marítimas Españolas (REMESA), engaged in the repair of ships while afloat.

The subcontracted activities are also involved in all the integral management operations; these are of great importance in terms of economic activity for the whole Bay of Algeciras and will be dealt with in the following sections.

4.2.1.2
Terminal de Contenedores de Algeciras (TCA)

A minor proportion of the container traffic in the PAB is managed in a more traditional way, with the intervention of independent agents, companies that have little or no interconnection.[1] Within this organisation, parallel to that of the Maersk España S.A. Group, the existence of a public terminal is notable: this is the Terminal de Contenedores de Algeciras (TCA), which still has only a minority presence in terms of container traffic (it should be borne in mind that this terminal is of very recent creation). Its activities commenced in 2003 and are still limited. Its functioning is characterised by being a link within a more traditional structure, in which a number of companies intervene, whose management is external and independent of that undertaken by TCA. The presence of two container terminals in the Port of Algeciras Bay – APM Terminals of the MAERSK Group, and TCA – therefore represents the coexistence of two organisational forms: one characterised by the integral management of services, and the other independent with a more traditional organisational structure.

4.2.2
Port Services

The full complement of port services described in the following are necessary for the process to function efficiently. In some cases (the offer of integral door to door services), these activities are subcontracted to independent operators, particularly by Maersk España

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[1] By traditional management we mean an organisational model in which the members that form the port community act independently, with the relationships between them only existing to the extent necessary for them to carry out their mercantile activities, and with each business frequently being unaware of the objectives of the rest of the companies. This is very different from the current predominant management model which is highly integrated, where there is very close coordination due to most of the activities being undertaken by companies of the same group (a detailed description of both forms of management is given in Martin and Thomas, 2001).

S.A.; in other cases, they are provided through independent ship's agents.

4.2.2.1
Stowage/Unstowage

Within the overall process of containerisation, the activities of stowage and unstowage represent a critical role in the PAB. These activities are undertaken by SESTIBALSA, a company that is practically 100% dependent on the container traffic. The operations of this company cover the handling of the container from the vessel until it is placed on a road or rail vehicle or in the transit compound of the wharf, and the reverse operations for departing containers. In addition to the activities encompassed within the "public service" (loading, unloading and stacking in the Terminal), SESTIBALSA also carries out other complementary tasks. The company also performs training activities and provides its clients with a series of additional services related to the detailed and accurate reporting of all the activities they undertake in the container terminals.

4.2.2.2
Pilots

The pilot provides an advisory service to the captain of the ship to facilitate its entry and departure from the port, and any nautical manoeuvres of the ship within the port, under the conditions of safety laid down, in the case of Spain, in the Law of Ports of the State and of Merchant Shipping (and all other regulations on safety). In the Spanish territory, the pilots are organised as a corporation under public law that depends functionally on the Port Authority. This activity is undertaken by the CORPORATION OF PILOTS of the PAB.

4.2.2.3
Auxiliary and Bunkering Services

Included in this part are the activities of towing, together with other auxiliary services. Towing is an auxiliary activity that is indispensable

for the manoeuvring of vessels in port, and basic for the safety of the vessels themselves and that of the port structure and installations. It is a nautical operation to assist with the movements of a towed vessel, by means of its coupling to another specialized vessel, a tug, which provides its motive power. The number and power of the tugs in each service is related by regulation to the characteristics of the container carrier vessels to be towed. We include in this part the three companies that provide this service (CIRESA, SERTOSA and SERMAR).

The services involving the supply of fuel to vessels or *bunkering* are undertaken in the PAB by CIRESA BUNKER S.A., CLH S.A., CEPSA and SHELL Marine Lubricants (Hermo Ibérica). The activity carried out by Gabarras y Servicios S.A. (Boluda Group) can also be incorporated in this group of activities. The degrees of dependence on the container of all these activities have been obtained taking the proportion of the total invoicing of these companies imputable to container carrier ships that operate in the PAB; the figure ranges between 7% and 100%.

4.2.2.4
Mooring Services

Operatives and equipment are provided to assist vessels manoeuvring within the port, particularly for executing its mooring alongside the wharf, to the standards of safety determined by the vessel's captain. In the PAB, this activity is undertaken by the company MARÍTIMA ALGECIREÑA S.L.

4.2.2.5
Marine Workshops, Repairs of Containers, and Supplies

We include in this part the rest of the companies that, to a greater or less degree, perform some repair, service or supply activity related to containers or to container carrier ships. The degree of dependence in each case is variables (between 10% and 100%), and again the data were obtained by separating their invoicing for activities related to containers or container carrier ships from the rest. The companies

included in this group are REINMAR S.L., TALLERES MAJO S.A., PE-DRO GARCÍA LEÓN and the COMPAÑIA DE SUMINISTROS MARITIMOS DEL ESTRECHO S.A. To present a congruent structure by activities, we also include in this grouping COMESA and REMESA, both part of the Maersk Group, which are described at the beginning of the section.

4.2.3
Customs Agents, Forwarders and Ships' Agents

The activity of the intermediary agents (*forwarders*, Customs agents and ships' agents) in the process of containerisation of the PAB is undertaken by a large number of companies, although the bulk of this work is done by Maersk España S.A. as part of its integral services. Within MAERSK's overall container operations, the independent agents – *forwarders* – have a lot of influence, because the many customers who are generally not accustomed to ordering transfers of containerised merchandise resort to using *forwarders* who are independent of Maersk España S.A. but who then contract the provision an integral service from MAERSK. However, the work of customs agencies and ship's agencies is mostly carried out by the MAERSK Group itself; although a smaller part of the total cargo continues to be consigned, by express agreement, with companies situated in the surroundings of the Bay of Algeciras. In addition, there are the companies that operate with the other terminal, TCA. The list of forwarders and Customs agents that, with varying degrees of dependence, are related to the TCA container traffic comprises: AGENCIA PAUBLETE S.L., ABAD Y ORTEGA S.L., INTER-CARGO ANDALUCÍA, S.A., NAYPEMAR S.L., ALGECIRAS PUERTO IMPORT/EXPORT S.L., UNIVERSAL FORWARDING S.L and PAR-TIDA ADUANAS. In respect of MAERSK's share of the total activities of consignation, this Group consigns 97.5% of the total merchandise (in TEUs), and 93.7% of the total vessels (in GT). If MARÍTIMA DEL MEDITERRÁNEO S.A., NAVIERA DEL ODIEL, ROMEU Y CÍA., MERTRAMAR ALGECIRAS S.L. and GONZÁLEZ GAGGERO S.L. are added to Maersk, together they account for 99.6% of the total merchandise consigned (in TEUs) and 99% of the total ships (in GT).

Concerning Naviera del Odiel S.A., this company has its head office in Madrid, and is active in several ports; therefore it was decided to impute the part of its total activity that is related to the container traffic in the PAB from the unit average (by TEU) of the variables of the rest of the consigner companies (except Maersk) multiplied by the number of TEUs consigned by this company. The same rule was applied to Romeu y Cía S.A.

4.2.4
Land Transport (by Road and Rail)

Road and rail transport play an essential role in the structure of intermodal transport. The transport of containers by road is undertaken by a number of independent companies associated in ALTRANSA, together with the other important companies listed below: TRANSPORTES Y ARRASTRES ANDALUCES S.L., S.A. DE TRANSPORTES ANDALUCES (SATRANSA), ALGECIREÑA DE TRANSPORTES Y MAQUINARIA, TRANSMAGSA, AUXILIAR DE TRANSPORTE S.A. (AUTRANSA), CONTENEDORES DEL ESTRECHO S.A., EMATRA and COTRANSA ANDALUCÍA S.A. All these companies are based in the Campo de Gibraltar, but there are other companies, such as TRANSMETA, with head offices outside Andalusia, that have not been included.

The rail transport is undertaken exclusively by RENFE; the variables corresponding to RENFE are not included in this study because its managers state that it is very difficult to impute the part corresponding to the PAB. In any case, transport by rail is less than 1% of the total container traffic of the PAB; hence in principle this omission will not alter the overall result.

4.2.5
Port Authority

The function of the Port Authority in the process of containerisation is basically that of ensuring that all the activities described are carried out under correct conditions of safety, legality and normality; it

provides the port space and is the collecting agent for the charges levied on vessels and merchandise.

The economic and financial imputation of the set of activities performed by the PAB in respect of the process of containerisation has been done by means of a break-down of the sales by the Department of Administration and Finance, in which the PAB's income from the activities related to containers have been separated from the rest of income for port services. This break-down includes the separation between the costs invoiced to each of the two container terminals, to the intermediaries and to other operators related to the process of containerisation (by the concepts of T-0 Maritime signalling, T-1 Vessels and T-3 Merchandise, concessions for the utilisation of infrastructure and others). These data have been cross-referenced with the data supplied by the above-listed companies. The resulting figure for the PAB's degree of dependence on containerisation is 35.55% of the total income of the PAB for all services and activities.

4.2.6
Public Institutions and Official Services. Customs and Para-Customs Authorities

As is known, the Customs is the official body established generally on the coasts or borders, for recording the merchandise that is imported or exported in international traffic, and for collecting the corresponding tariffs or customs duties. The required information imputable to the container traffic was facilitated by the Spanish "Agencia Tributaria". The Para-Customs Authorities are control bodies charged with issuing certain certificates authorising that a particular class of merchandise may be dealt with by the Customs on entry to or departure from the European Union. In the PAB the following are the areas covered:

– Animal Health: These Authorities are responsible for the inspection and control of live animals and of certain products of animal and vegetal origin that are imported into the European Union from third party countries, in application of the Community Directives for veterinary control.

- Vegetal Health: These Authorities are responsible for the inspection and control of vegetables and vegetable products that are imported into the European Union from third party countries, and for the control of those that are exported, re exported or are in transit through the European Union.
- Exterior Health: the mission of this Authority is the vigilance and control of possible risks for health derived from the import, export or transit of merchandise or passengers.
- SOIVRE (Official Service of Inspection, Vigilance and Regulation of Exports): This is a body responsible for the inspection and control of the commercial quality of the products that the EU exports to or imports from third party countries.

Together with the above bodies, the part corresponding to the "Capitanía Marítima" of Algeciras-La Linea has also been considered. After carrying out the corresponding surveys of these bodies, information on the number of employees and personnel costs imputable to the container traffic has been collected. When it has not been possible to specify the degree of imputation or dependence, an estimate has been made in function of the volume of containerised merchandise as a proportion of the total merchandise moved in the Port (i.e. a coefficient 0.47 has been applied to the data supplied).

4.3
Economic Activities in the PAB
and Their Degrees of Dependency

Table 4.1 gives the average degree of dependence on containerisation and its distribution between transhipment and import/export traffic, for the activities classified as directly related to this process. The coefficients given in the Table have been obtained by applying a weighted average of the percentages specified by each of the companies referred to in the preceding section.

Table 4.1. Average degree of relationship/dependence on container traffic (%)

Groupings	Companies Nº	Dependence			Tranship or IMP-EXP	
		Average	Max	Min	T	I/E
Terminals	2	100.00	100.00	100.00	93.31	6.69
Port operators	15	47.50	100.00	7.00	90.91	9.09
Intermediaries	12	75.61	100.00	10.00	35.42	64.58
Transport operators	9	100.00	100.00	100.00	0.00	100.00
Port authority	1	35.55	35.55	35.55	94.10	5.90
Other official bodies	6	45.00	51.00	2.00	78.46	22.53
Total	45	56.94	100.00	2.00	85.24	14.76

Source: Authors' own elaboration from the information provided in the questionnaires by the companies and other bodies

4.4
Quantification of the Direct Economic Impact

The results of the surveys and, where applicable, those derived from the data provided by the Mercantile Register, are that the direct effects derived from the containerisation activities of the PAB include: 2,294 jobs, income from employment (salaries etc) of 90.9 million euros and a GVA of the 155.4 millions of euros (Table 4.2).

Table 4.2. Direct economic impacts of container traffic in the PAB. (*) total (transhipment plus import/export)

	Jobs	Wages and Salaries	G.O.M.	G.V.A.	Taxes	Sales
Terminals	680	22,025,489	19,751,037	47,151,026	116,313	134,461,637
Port operators	1,042	57,486,407	10,153,793	79,498,915	242,842	96,594,179
Intermediaries	111	3,085,355	423,631	4,234,824	41,680	9,852,111
Transport operators	265	4,183,601	3,149,208	8,909,442	49,345	16,467,228
Port authority	119	2,831,077	11,537,127	15,602,018	763	19,649,993
Other official bodies	77	1,254,160			97,500,000	
Total direct impact	2,294	90,866,088	45,014,796	155,396,224	97,950,942	277,025,148

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to the IAE and other local taxes, with the exception of those of the Official Bodies which correspond to the income imputed to the Customs Administration of Algeciras in respect of the container traffic.

Tables 4.3 and 4.4 are the result of separating out the effects generated by the transhipment of containers and by the export and import of merchandise by container, respectively.

Table 4.3. Direct economic impacts of container traffic in the pab. (*) Transhipment

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	633	20,587,344	18,385,042	43,997,752	106,721	125,393,768
Port operators	948	52,038,135	9,459,557	72,274,804	226,172	88,182,143
Intermediaries	37	1,163,934	66,824	1,500,037	6,805	3,245,554
Transport operators	0	0	0	0	0	0
Port authority	112	2,664,044	10,856,437	14,681,499	718	18,490,643
Other official bodies	62	984,061			92,625,000	
Total direct impact	1,792	77,437,519	38,767,860	132,454,091	92,965,416	235,312,109

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to the IAE and other local taxes, with the exception of those of the Official Bodies which correspond to the income imputed to the Customs Administration of Algeciras in respect of the container traffic

Table 4.4. Direct economic impacts of container traffic in the PAB. (*) Import/Export

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	47	1,438,145	1,365,995	3,153,274	9,592	9,067,869
Port operators	94	5,448,272	694,236	7,224,111	16,670	8,412,036
Intermediaries	74	1,921,420	356,807	2,734,787	34,874	6,606,556
Transport operators	265	4,183,601	3,149,208	8,909,442	49,345	16,467,228
Port authority	7	167,034	680,691	920,519	45	1,159,350
Other official bodies	15	270,098			4,875,000	
Total direct impact	502	13,428,570	6,246,936	22,942,134	4,985,527	41,713,039

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to the IAE and other local taxes, with the exception of those of the Official Bodies which correspond to the income imputed to the Customs Administration of Algeciras in respect of the container traffic.

From the data it is clear that the effects are heavily weighted towards the transhipment of containers (congruent with the physical volume that transhipment represents as a proportion of the total); although this activity does not involve the transport companies, it generates 1,179 jobs, against the 502 jobs generated by the activities of import and export (of which 265 are imputable to transport operators).

4.5
Quantification of the Indirect and Induced Economic Effects

4.5.1
Indirect Economic Effects

The relationship between the agents that intervene in the container traffic and the rest of the economy is manifested in the goods and services they purchase in the local and regional environment. This relationship generates a volume of activity that translates into jobs, wages and salaries, profits (gross operating margins), added value, taxes and sales.[2]

The indirect effects are calculated from the information obtained directly by surveying the companies linked economically with the container traffic and indirectly from the review of the documentary sources of the "Registro Mercantil".

To compute this economic impact, it is necessary to have a breakdown by sector of these purchases; in some cases this has been provided directly by the company surveyed and in other cases it has been obtained from the accounting information also provided by these companies. In both cases the geographic destination of the expenditure has been included together with the numerical datum, such that the purchases can be divided between those made in the Campo de Gibraltar, those made in the rest of Andalusia, and those

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[2] In other versions of the methodology for measuring these effects, the investments made by these same companies over the year analysed are added to the purchases. But given the erratic character of such investments, it has been decided to adopt a criterion of prudence and utilise only the purchases.

made outside the Region. The results from this process of estimation are that the greater proportion of the purchases made by the "containers sector" takes place in the District of the Campo de Gibraltar (83.8%), and only 7.7% are made in the rest of Andalusia, and 8.5% outside the Region.

By applying the Input-Output Tables, as stated in the Annex on Methodology, we obtain the indirect effects of the container traffic for the whole of Andalusia. The process does not allow us to discriminate between effects generated in the Campo de Gibraltar and in the rest of the Region (however, from the percentage distribution of purchases, it is clear that more than three quarters of the indirect effects can be imputed to the Bay of Algeciras).

The indirect economic impacts are shown by the same economic groupings as the direct effects (Table 4.5), and broken down by sector of activity (Table 4.6).

Table 4.5. Indirect economic impacts of container traffic in the PAB. (*) Total (Transhipment plus Import/Export)

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	554	4,931,298	11,025,811	17,363,776	866,771	28,238,136
Port operators	276	2,459,899	5,088,876	8,250,468	408,525	13,603,051
Intermediaries	26	276,849	536,493	892,314	53,932	1,591,419
Transport operators	153	1,355,620	2,949,004	4,691,319	238,935	7,665,575
Port authority	33	332,122	655,152	1,082,012	57,330	2,035,470
Other official bodies	–	–	–	–	–	–
Total indirect impact	1,043	9,355,787	20,255,336	32,279,888	1,625,493	53,133,650

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

The results indicate that, among other indirect effects, there are 1,043 jobs and a value added of 32.3 million euros. The greater part of the indirect effects are generated by the terminals (mainly that of Maersk), which account for 53% of the jobs of the total of companies. By sectors, the economic impact is concentrated in that of *Recovery, repairs and commercial services* (which includes all the wholesale

Table 4.6. Indirect economic impacts of the container traffic in the pab, by sectors (*)

	Employment.	Wages and Salaries	G.O.M.	G.V.A.	Taxes.	Sales
1. Agriculture and silviculture	1	8,158	20,394	30,879	−723	47,086
2. Fishing	0	215	534	810	119	1,366
3. Energy and water.	8	189,366	498,142	741,525	48,748	1,969,988
4. Minerals, metals and non-metallic products	9	136,680	271,205	446,873	99,213	1,922,279
5. Chemical products	0	7,503	19,022	28,665	1,687	84,540
6. Metal products and machinery	3	26,491	36,178	70,225	1,078	177,060
7. Transport material and equipment	1	15,753	12,262	32,508	−192	62,169
8. Food products, drinks and tobacco	1	18,886	30,220	54,493	−8,996	216,588
9. Textiles, leather and shoes	2	15,849	17,255	37,626	−638	109,184
10. Paper, paper articles and printing.	7	54,913	99,277	169,854	3,204	556,701
11. Wood, cork and furniture	3	21,283	13,232	40,585	718	118,520
12. Rubber, plastic and other manufactures	4	30,581	34,580	73,884	474	247,671
13. Construction and engineering	8	111,858	83,587	227,353	14,507	570,175
14. Recovery, repair and commercial services.	693	5,330,264	12,022,466	18,873,208	904,998	27,906,066
15. Hotels and restaurants	5	27,113	75,082	109,929	10,732	233,852
16. Transport and communications	64	751,325	1,273,266	2,238,909	164,129	3,841,885
17. Credit and insurance, property rental	63	1,322,088	3,951,875	5,651,094	237,579	9,827,108
18. Others services for sales	168	1,247,387	1,785,519	3,388,728	153,147	5,158,150
19. Public services	0	6,836	3,370	12,156	413	16,661
20. Education and health	2	33,234	7,871	50,585	3,364	66,603

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

and retail sector); next in order of importance is the sector of Other *services for sales*, which includes business services like computer services, property and equipment rental, lawyers, etc.

As in the preceding section, the indirect effects have been broken down by the type of containerisation activity that generates them (Tables 4.7 and 4.8). Again as in the case of direct effects, for this

Table 4.7. Indirect economic impacts of container traffic in the PAB. (*) transhipment

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	517	4,601,513	10,288,448	16,202,555	808,805	26,349,681
Port operators	251	2,236,366	4,626,447	7,500,743	371,402	12,366,934
Intermediaries	9	98,064	190,034	316,071	19,104	563,704
Transport operators	0	0	0	0	0	0
Port authority	31	312,526	616,498	1,018,174	53,947	1,915,377
Other official bodies	–	–	–	–	–	–
Total indirect impact	809	7,248,469	15,721,427	25,037,543	1,253,258	41,195,696

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

Table 4.8. Indirect economic impacts of container traffic in the PAB. (*) Import/Export

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	37	329,786	737,363	1,161,221	57,966	1,888,455
Port operators	25	223,532	462,429	749,725	37,123	1,236,117
Intermediaries	17	178,785	346,459	576,243	34,829	1,027,715
Transport operators	153	1,355,620	2,949,004	4,691,319	238,935	7,665,575
Port authority	2	19,595	38,654	63,839	3,382	120,093
Other official bodies	–	–	–	–	–	–
Total indirect impact	235	2,107,318	4,533,909	7,242,346	372,235	11,937,955

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

set of indicators, the proportion accounted for by the transhipment activities is much greater than that of import/export.

4.5.2
Induced Economic Effects

The induced economic impact, as detailed in the Annex on Methodology, concerns the effects derived from the private consumption generated by the wages and salaries of the workers of those companies active in the sector of containers, and by the wages and salaries of the workers that indirectly depend on these, already calculated in the preceding section.

The process is similar to that for deriving the indirect effects, and again is presented using the customary economic indicators. As in the previous case, the methodology for calculating this effect prevents us from identifying the induced effects generated on a geographic scale smaller than the Region of Andalusia as a whole; however, practically all the direct jobs, and their corresponding wages and salaries, together with rather more than three quarters of the indirect jobs, with their wages and salaries, are generated in the Bay of Algeciras.

Table 4.9. Induced economic impacts of the container traffic in the PAB. (*) total (transhipment plus Import/Export)

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	408	3,962,352	7,398,389	12,491,013	501,741	23,336,938
Port operators	906	8,811,380	16,452,353	27,777,205	1,115,759	51,896,105
Intermediaries	51	494,204	922,764	1,557,941	62,580	2,910,699
Transport operators	84	814,208	1,520,265	2,566,727	103,101	4,795,412
Port authority	48	464,954	868,148	1,465,731	58,876	2,738,422
Other official bodies	19	184,346	344,205	581,136	23,343	1,085,736
Total induced impact	1,515	14,731,444	27,506,123	46,439,753	1,865,399	86,763,312

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

Table 4.10. Induced economic impacts of container traffic in the PAB, by sectors

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
1. Agriculture and silviculture	65	360,219	900,546	1,363,519	−31,914	2,079,196
2. Fishing	12	58,941	146,293	222,047	32,637	374,479
3. Energy and water.	13	314,862	828,271	1,232,949	81,054	3,275,540
4. Minerals, metals and non-metal products	20	305,972	607,122	1,000,374	222,099	4,303,230
5. Chemical products	3	58,494	148,285	223,465	13,150	659,041
6. Metal products and machinery	8	71,847	98,121	190,463	2,925	480,216
7. Transport material and equipment	2	28,148	21,911	58,088	−342	111,088
8. Food products, drinks and tobacco	56	746,956	1,195,235	2,155,263	−355,783	8,566,303
9. Textiles, leather and shoes	18	121,082	131,825	287,446	−4,872	834,123
10. Paper, paper articles and printing.	11	82,673	149,465	255,721	4,823	838,133
11. Wood, cork and furniture	17	109,784	68,254	209,355	3,701	611,375
12. Rubber, plastic and other manufactures	8	61,785	69,864	149,274	958	500,385
13. Construction and engineering	22	323,064	241,413	656,632	41,900	1,646,759
14. Recovery, repair and commercial services.	527	4,053,920	9,143,660	14,353,977	688,294	21,223,898
15. Hotels and restaurants	230	1,136,738	3,147,864	4,608,861	449,945	9,804,429
16. Transport and communications	98	1,149,288	1,947,693	3,424,820	251,066	5,876,866
17. Credit and insurance, property rental	95	2,005,680	5,995,210	8,573,019	360,421	14,908,261
18. Others services for sales	197	1,465,767	2,098,111	3,981,994	179,958	6,061,189
19. Public services	8	108,805	53,641	193,482	6,569	265,192
20. Education and health	105	2,167,406	513,339	3,299,006	219,391	4,343,610

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

From these calculations, it is concluded that the induced effects include 1,515 jobs and a gross value added of 46.4 million euros (Table 4.9). In general, the indicators of direct impact are always higher than those of the indirect impact, which largely reflects the effect of the remuneration of the employees of the port operators, especially

Table 4.11. Induced economic impacts of container traffic in the PAB. (*) transhipment

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	380	3,697,366	6,903,614	11,655,663	468,186	21,776,256
Port operators	824	8,010,685	14,957,319	25,253,075	1,014,369	47,180,277
Intermediaries	18	175,054	326,856	551,846	22,167	1,031,012
Transport operators	0	0	0	0	0	0
Port authority	45	437,521	816,927	1,379,253	55,402	2,576,855
Other official bodies	15	144,645	270,076	455,981	18,316	851,910
Total induced impact	1,282	12,465,272	23,274,792	39,295,818	1,578,440	73,416,310

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The taxes collected refers to all taxes on production, on income and on companies

Table 4.12. Induced economic impacts of container traffic in the PAB. (*) Import/Export

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Terminals	27	264,986	494,775	835,350	33,554	1,560,682
Port operators	82	800,695	1,495,035	2,524,130	101,390	4,715,828
Intermediaries	33	319,150	595,907	1,006,095	40,413	1,879,687
Transport operators	84	814,208	1,520,265	2,566,727	103,101	4,795,412
Port authority	3	27,432	51,221	86,478	3,474	161,567
Other official bodies	4	39,701	74,129	125,155	5,027	233,826
Total indirect impact	233	2,266,172	4,231,331	7,143,935	286,959	13,347,002

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The GVA is computed as personnel costs (including social charges) plus gross operating margins. The taxes collected refers to all taxes on production, on income and on companies

of SESTIBALSA, with a rate of "compensation per employee" much higher than the average.

The induced effects by economic sector (Table 4.10) again reflect the greater impact in the sector of *Recovery, repairs and commercial services*, followed by *Hotels and restaurants* and by *Others services*. The distribution by sector differs form that obtained for the indirect impacts because now the effects are conditioned by the distribution of costs of family units and not of companies.

The separation of these effects between the transhipment traffic and the import/export traffic shows that jobs are mainly generated by transhipment (1282 in total), especially in the operators and terminals, whereas the import/export traffic only accounts for 233 induced jobs, generated by port operators and transport companies.

4.6
Total Economic Impact of the Container Traffic

Table 4.13 summarises the total effect of the container traffic in the Port of Algeciras Bay. The employment generated directly (2,294 jobs) represents 2.98% of the total in active employment in the municipalities of the Bay (Algeciras, Los Barrios, Castellar de la Frontera, Jimena de la Frontera, La Linea de la Concepción, San Roque and Tarifa) and 0.65% of the total in the Province of Cadiz. In terms of Gross Value Added, the direct effects represent 1.14% of the provincial total.

Taking the combined direct, indirect, and induced effects, the 4,852 jobs generated by the container traffic represent 6.5% of the total employment in the Campo de Gibraltar, and 1.4% of the provincial total. In respect of Gross Value Added, the containerisation activities in the Port of Algeciras Bay contributed 234 million euros in 2003, 1.72% of the total GVA of the Province.

When we differentiate between total effects derived from the transhipment of containers and those from the import and export of containerised merchandise, the results show a balance inclined towards transhipment (Tables 4.14 and 4.15). The total jobs generated are 3,883 from transhipment, against 970 from import/export activities; these jobs are mainly in the road transport companies and, to a less extent, in the terminals and operators.

Table 4.13. Total economic impacts of container traffic in the PAB. (*) transhipment plus Import/Export

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Direct	2,294	90,866,088	45,014,796	155,396,224	97,950,942	277,025,148
Indirect	1,043	9,355,787	20,255,336	32,279,888	1,625,493	53,133,650
Induced	1,515	14,731,444	27,506,123	46,439,753	1,865,399	86,763,312
Total indirect impact	4,852	114,953,319	92,776,255	234,115,865	101,441,834	416,922,110

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The GVA is computed as personnel costs (including social charges) plus gross operating margins

Table 4.14. Total economic impacts of container traffic in the PAB. (*) transhipment

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Direct	1,792	77,437,519	38,767,860	132,454,091	92,965,416	235,312,109
Indirect	809	7,248,469	15,721,427	25,037,543	1,253,258	41,195,696
Induced	1,282	12,465,272	23,274,792	39,295,818	1,578,440	73,416,310
Total	3,883	97,151,260	77,764,079	196,787,452	95,797,114	349,924,115

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The GVA is computed as personnel costs (including social charges) plus gross operating margins

Table 4.15. Total economic impacts of container traffic in the PAB. (*) Import/Export

	Jobs	Wages and Salaries	G.O.M	G.V.A.	Taxes	Sales
Direct	502	13,428,570	6,246,936	22,942,134	4,985,527	41,713,039
Indirect	235	2,107,318	4,533,909	7,242,346	372,235	11,937,955
Induced	233	2,266,172	4,231,331	7,143,935	286,959	13,347,002
Total	970	17,802,060	15,012,176	37,328,415	5,644,721	66,997,996

(*) Notes: Figures in euros, except for the number of jobs. The wages and salaries are the gross receipts of the employees under all categories. The GVA is computed as personnel costs (including social charges) plus gross operating margins

However, analysis of these figures reveals that in fact that the activities of import/export by container are more intensive in the generation of employment than those of transhipment: the ratio of import/export to transhipment for employment is 0.25. But tran-

shipment generates a greater proportion of the rest of indicators: the average ratio is 0.19.

4.7
Conclusions

☞ A total of 6 economic activities related to containerisation have been considered (Terminals, Port Operators, Intermediaries, Transport operators, the Port Authority and Other official bodies). These are undertaken by a total of 45 companies and institutions located in the District of the Campo de Gibraltar that, with varying degrees of commercial dependence, are directly related to the processes of containerisation in the PAB.

☞ The dependence on containerisation activities varies considerably between these companies; the percentage found ranges between only 2% for some of the Official Bodies and 100% for the two Terminals. For its importance in the calculation of the economic effects, the 100% dependence of the road transport companies identified is notable.

☞ When the total container traffic is divided between transhipment and import/export operations, there is also a big difference in the degree of dependence. The average dependence on the activities of transhipment is 93.31% for the Terminals, due to the predominance of Maersk over TCA, 94.1% for the Port Authority and 90.91% for the Port Operators. In contrast, for the Transport sector, 100% of its containerisation activities involve import/export operations, while the various intermediaries attribute 64.58% of their activities to import/export.

☞ The container traffic of the Port of Algeciras Bay generates 4,852 direct, indirect and induced jobs; in 2003 these represented 6.5% of the District's total employment and 1.4% of the total provincial employment. The GVA (234 million euros) represents 1.72% of the total GVA of the province of Cádiz.

☞ In direct employment, the port generates 2,294 jobs, most of them in the Port Operators and Terminals (particularly Maersk). The Gross Value Added generated amounts to 155.4 million euros and sales to 277.0 million euros.

☞ Separating the two main areas of container handling activity, transhipment generates 1,792 jobs, and import/export 502 jobs. In the case of transhipment activities, these jobs are mostly with the Port Operators and the Terminals, whereas for the activities of import/export, the employment is mainly in the road transport companies and, to a less degree, in the Port Operators.

☞ The indirect effects generated by the purchases of these companies account for 1,043 jobs and expenditure of 32.3 million euros. These impacts are mainly concentrated in those sectors in which the purchases are directly made, that is, in commercial activities and business services. In respect of the type of traffic, the effect of job generation in the Bay of Algeciras is stronger in the import/export activities, due particularly to the interactions of the transport operators and intermediaries with the local economy; despite this, the greater total physical volume of the transhipment activities means that, overall, this activity generates most of the indirect effects.

☞ The induced effects, those generated by consumption financed by the direct and indirect jobs generated, account for a total of 1,515 jobs, most of them in the commercial sector, hotels and restaurants, other services and in education and health provision. Although one would expect that, per unit of activity, the import/export activities would generate more employment than transhipment, from its greater involvement in the economy of the District, in reality, because the transhipment activities generate jobs of higher remuneration, the situation is evidently the reverse.

☞ From the comparison of the 6 indicators selected (employment, wages and salaries, profits, value added, taxes and sales) by type of traffic (transhipment versus import/export), it is observed that the activities of import/export have, in relative terms, a greater propensity to generate employment, whereas the transhipment activities generate proportionally more wealth in terms of wages and salaries, value added and profits.

Methodology

A.1
Studies of the Economic Impact of Ports

National and regional governments, the Port Authorities themselves, and a substantial body of researchers have frequently emphasised the significance of ports for regional and local economic development and growth. It is a known fact, therefore, that the port infrastructure creates and supports a cluster of economic activities that extend along the entire economic chain, with notable repercussions in terms of employment and value added in the port environment.

From a theoretical point of view, and in relation to public investment, from the end of the 1980's to the present day, many researchers studied the cause-effect relationship between the allocation of productive public capital and productivity in the private sector of the economy. A high degree of elasticity has been observed in productive output with respect to public capital investment. The work of Aschauer (1989) in this field has had particularly significant repercussion. Other authors like Bielh (1988) have estimated the regional expenditures on infrastructures and their influence on regional development, and have found evidence of a positive correlation between the two variables. Button (1983) reports three contradictory points of view on the relationship between transport infrastructures and economic growth. The first of these considers that transport infrastructures almost automatically lead to an expansion of commercial and industrial activities. The second identifies in these infrastructures a necessary but not sufficient condition for economic growth to take place. The third believes that, with transport infrastructures the criterion of equity is rewarded against that of economic efficiency or maximisation of welfare. In any case, there is a broad consensus in the economic literature on the important role that these infrastruc-

tures play in productivity and economic development. On the basis of this theoretical framework, many studies of the impact of ports on the economy of their region have been carried out, and in all of them the effects of the port activity on the principal socioeconomic variables have been estimated.

A variety of methods have been proposed for estimating the economic impact of ports, but the most frequently used method is the Port Economic Impact Kit (developed under the auspices of the North American Maritime Administration – MARAD); this is based in the application and analysis of input-output tables. The application of a similar methodology to a variety of ports around the world has demonstrated the suitability – or at least the general acceptability – of the procedure for identifying and quantifying the magnitude of the effects of a port on the principal economic variables. The assessments made at the end of the 1980's and during the 1990's of the ports of Rouen, Dunkerque and Nantes in France; Anvers, Ghent and Bruges-Zeebrugge in Belgium; Rotterdam in Holland; Genoa in Italy; London, Southampton, Liverpool, and Plymouth in the United Kingdom, New York and Hampton Roads in the United States, constitute good examples of the efficacy of the methodology. From the year 2000 the same methodology with slight modifications has continued to be used, for example, in Port Esperanza, Gladstone and Mackay in Australia, several ports of the NE coast of the US, and others.

For the Spanish ports the methodology for studying impact was adapted in the mid-1990's by the TEMA consultancy firm (Consultant Group for the Public Entity "Ports of the State"); this methodology has been utilised as the basis for our study reported in this paper. One of the first applications was in respect of the Galician Ports of General Interest, to evaluate their influence on the economy of Galicia and, later, on the rest of Spain. The direct, indirect and induced effects of the Port Industry and of the industries dependent on it were determined. In both studies the high degree of dependence of the port activity on the national economy and on the economy of Galicia in particular was revealed (De la Lastra, 1996). Two studies of this nature have been carried out for the Port of Bilbao. The first of these evaluated its economic impact on the Basque Country in 1993, and the second, more recent (2000), in addition to estimating the economic impact in terms of added value or wealth, also calculated

the investments in the period 1991–2004 and the strategic impact of the port as a generator of economic activity. This study conducted by KPMG Consulting for the Port Authority of Bilbao utilised a model of measurement where only the activity generated by each unit of merchandise was taken into account, and not the total earnings of each agent. The results obtained show that the Port of Bilbao has a strategic function for the economy of the Basque Country and for all its hinterland (Puertos del Estado, 2001).

Another known adaptation to the Spanish case of the methodology of impact study based on input-output tables is the study conducted for the Port of Santander by Villaverde and Coto (1996) for the year 1993. These authors had already carried out a previous study (Villaverde and Coto, 1995) for the same port in the year 1992, but combining two methodologies for the study of port impact: surveys and input-output tables. There were considerable differences in the results between the two studies. In the first, the contribution of the Port of Santander to employment, salaries, gross profits and gross value added in the region was found to range between 6% and 8%, but in the second study between 16% and 17%. The explanation for this divergence, according to the authors, is that these latter figures are due to the greater magnitude of foreign trade of Cantabria in the second year, to the consideration of the total movement of goods, and not only of the exports, and to the subjective component of the methodology employed.

In the report "Analysis of the economic impact of the Ports of Barcelona and Tarragona" by Consultrans and the Tomillo Foundation and commissioned by "Ports of the State", this methodology utilised, but with some important differences with respect to other studies. The principal difference is that the port is treated in an endogenous way, that is, in the input-output table for Catalonia a row and a column were inserted for each of the two ports studied; the port activity was defined with the standard form of the tables. Another difference is the performance of a prospective exercise utilising a dynamic model that allows study of the sensitivity of the ports to the evolution of the local economy to which they belong.

In our region, the input-output methodology has been applied to quantify the economic impacts of the ports of Huelva, Cadiz, Seville and Ceuta. The effects of the economic activity of the Port of Algeciras

have also been assessed using a version of the input-output model following the methodology devised by TEMA (Castillo, 2001). In the results of this study, the authors calculated the direct, indirect, and induced impacts of the port activity for 1996, and demonstrate the importance of the port for the economy of the District and of the Region. This previous study also included an extensive review of all the earlier studies made that have concerned, directly or indirectly, the Port of Algeciras Bay.

In summary, from the accumulated experience from these studies that apply a methodology based on input-output tables to determine the impact of the activity of a port on the economy of its region, we can conclude that, while the Spanish Port System as a whole is of great relevance in the national economy, the particular cases of the ports analysed also show an important contribution to the value added and employment levels of the region.

A.2
General Approach

It is well known that there are different methodologies for quantifying the economic effects of a particular infrastructure. Cost benefit analysis, economic models of simulation and input-output analysis are valid instrumental techniques usually employed for the successful evaluation of the economic activity of a port. To evaluate the container traffic in the Port of Algeciras Bay we have selected a methodology of economic impact based on the use of input-output tables. This choice was made for two fundamental reasons: one, the experience in the application of the technique to various Spanish and foreign ports has demonstrated that this is a good instrument for accurately obtaining the effects generated by the port on the regional economy; and two, the results that it provides and the characteristics – advantages and disadvantages – of this type of analysis are well understood by the port managers of the Bay of Algeciras, where – as indicated in the preceding section – the global impact of the Port has previously been evaluated using a similar methodology.[3]

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[3] See Castillo (2001).

The application of the procedure requires the adaptation of some of the concepts of generic analysis of port impact to the characteristics of the specific activity to be evaluated: container traffic. The first stage consists of identifying all the containerisation activities undertaken in the Port and all the activities related in some way to containerisation. In other words, on the one hand, there are the economic activities necessary for the loading, unloading, transport, etc. of containers and, on the other hand, those other activities that utilise these services in the normal course of commercial activity. The first group, therefore, is formed by those activities that we can call the port containerisation industry, that is, companies mostly located within the bounds of the port proper; the second group is constituted by the industry dependent on the services of containerisation that are carried out in the Port, and formed by companies that undertake import/export activities through the Port of Algeciras Bay. It should also be taken into account that, with the development of intermodality and the provision of integral door to door services, overland transport fulfils an essential role in the process of containerisation. Having identified the agents that operate in both fields (maritime and land), there are three different types of impact to evaluate (Davis, 1983):

– *Direct effects or primary impacts*, which are those generated by the economic activity of the companies that provide services related to containers, and the others that depend on the container traffic for their commercial activity.
– *Indirect effects*, which comprise the economic activity generated in consequence of the commercial relationships between the companies of the Region and those defined as generating direct effects. In consequence, the indirect effects take place in the wider area of the Bay of Algeciras, the province of Cadiz and the region of Andalusia.
– *Induced effects*, which take place as a consequence of the expenditure or consumption generated by the disposable income obtained by the employees engaged directly or indirectly in activities related to the container traffic.

These effects can analysed from diverse perspectives (sales volume, gross value added, value of output, stock of capital, salaries, jobs, etc). Ii is necessary formulate various questions based on these definitions:

the variables to be used, the period of study, the geographic area in which the impact is to be evaluated, etc.

A.3
Variables of Impact

The variables considered are of economic character and perfectly quantifiable:

– *Employment*: the number of persons occupied.
– *Wages and salaries*: the remuneration of the employees, quantified as the amounts received (excluding the contributions for which the employer company is responsible).
– *Gross operating margins*: the sum of the company's profits or losses before taxes (losses shown with negative sign), amortizations, payments of interest, less any subsidies and transfers received. In the case that they constitute a cost or expenditure, these amounts will have to be added and not subtracted.
– *Taxes*: the amount of the taxes or fiscal charges imposed by the State (linked to production, to importation, etc).
– *Gross value added* (GVA): the aggregate of personnel costs and gross operating margins.

These are magnitudes related to production and, particularly, to the value added. As can be appreciated, this methodology is based on perfectly quantifiable variables that, taken together, adequately reflect the volume of economic activity. The calculation of the gross value added and employment is particularly useful, in so far as they allow the economic impact of the port to be evaluated in wider spatial fields such as the District of the Campo de Gibraltar or the Region of Andalusia.

A.4
Period of Study and Geographic Area

In respect of the choice of the study period, the methodology proposed is static rather than dynamic in character: the evaluation is

made for one particular year. It is essential, therefore, to select the most appropriate year. It must be taken into account that, if input-output methodology is applied, the choice of the period will be conditioned by the availability of these Tables for the region. In Andalusia the most recent tables are for the year 1995 (published in 1999). Further, a year must be chosen that is sufficiently recent to make the study as up-to-date as possible, and for which it is feasible to find sufficient information when the surveys are conducted. In our case we have chosen 2003, a year for which the companies studied have already finalised their accounts definitively.

In respect of the geographic scope, it is also essential to delimit spatially the study area. Most previous studies of port impacts estimate their effects on the scale of the Region. To narrow the focus of the analysis of port effects down to a smaller territorial scale brings the disadvantage of the lack of macroeconomic data for making comparisons and determining effects. The analysis of impact of the Port of Algeciras Bay has been undertaken for Andalusia and for the local administrative District ("Comarca") of the Campo de Gibraltar.

A.5
Stages

Having defined the basic elemental concepts, the study involved the following stages of work:

1. Identifying the companies that are directly or indirectly related to the container traffic in the Port.
2. Estimating the magnitude of the direct effects for these operators.
3. Adapting the available Input-Output tables to the requirements of the study.
4. Calculating the vectors of indirect and induced impacts.
5. Obtaining the indirect and induced effects with the vectors of impact and Input-Output Tables.
6. Calculating the total effect or global impact by summing the direct, indirect and induced effects.

Table A.1. Phases in the execution of the project "Assessment of the economic impact of the container traffic in the port of algeciras bay" (Summary)

Phases	Objectives	Activities		Result
			Organisational Techniques	
1. Preparatory	– Development of the methodology	– Drafting of a synthesis of the Report for the agreement of the Contract. – Delimitation and drafting of the general and specific objectives – Bibliographic review – Identification of statistical sources – Search and review of documents in the national and international fields (other similar experiences) – Drafting of the complete "Technical Project Specification" – Production of an initial classification of economic activities related to containerisation – Identification of the companies involved in containerisation activities (first proposal)	– First contacts with relevant personnel of the Port Authority – Identification and contacts with institutional agents, in search for relevant information – Detailed schedule of work (interviews, meetings…)	– Technical Project Specification
2. Collection of information	– Collection of the primary data of the economic activities associated with the container industry.	– Compilation and classification of relevant statistical information. – Design of surveys – Design of interviews	– Plan of interviews and meetings with the most relevant agents involved in the containerisation process – Requests for statistical information from official Bodies – Distribution of survey questionnaires – Compilation of data of the "Registro Mercantil" (Companies Register)	– Primary statistical information, quantitative and qualitative

Table A.1. (continued)

Phases	Objectives	Activities		Result
			Organisational Techniques	
3. Data processing	– Obtaining the direct, indirect, and induced effects	– Grouping the data from the surveys and resolving anomalies – Completing the data with that obtained from the Registro Mercantil – Obtaining the direct effects – Calculation of the vectors of impact – Grouping of the MIOAN 95 Tables in the required sectors (twenty) – Obtaining the sectoral deflators – Application of the adapted MIOAN Tables to the twenty sectors. Indirect and induced effects	– Drafting provisional reports – Analysis and presentation of initial results	– Provisional Report
4. Report writing phase	– Availability of a global assessment of the effects of the economic activity of the Port of Algeciras Bay	– Writing and development of objectives, methodology and rest of chapters – Drawing conclusions	– Presentation of results to the PAB Authority	– Final Report

A.6
Study Execution Phases

The development of the methodology can be appreciated in detail in Table A.1. The operative activities carried out are shown grouped in four phases (preparation, gathering of information, data processing, and writing), each with its objectives, activities and results.

In the phase of information collection, it should be stated that the primary data has been obtained principally by laborious field work. Various types of survey were designed, especially adapted to the requirements of this particular study. Additionally, the following statistical and documentary sources were accessed:

– Port Authority of Algeciras Bay: (Reports, listings of companies, quantitative information on traffic, and other relevant documentation).
– University of Cádiz (specialized data bases)
– Registro Mercantil: relevant information from the official accounts of companies, when not facilitated directly by a company.
– Ports of the State: levels and evolution of the principal port variables (container traffic of the principal Spanish ports).
– Instituto Nacional de Estadística: macroeconomic data of National and Regional Accounts.
– Instituto de Estadística de Andalucía: Input-Output Framework (MIOAN 95), Regional Accounts.
– Agencia Tributaria: relevant information on customs tariffs.
– International sources specialized in containerisation.

A.7
Input-Output Tables of Andalusia and Deflators

Input-output tables are a statistical-accounting instrument in which the totality of the production and distribution operations that take place in an economy are represented. They constitute a reliable method for presenting data of transactions between sectors. Input-output tables have a double entry format that shows, for a given territory and in a particular year, economic interrelationships in the form of flows of goods and services. The tables are structured in rows and columns, the first corresponding to the jobs and the second to the resources. The information in an input-output table is not limited to the transactions between sectors. In addition it incorporates the sales to the final demand (by rows) and the employment of the primary inputs (by columns).

   Input-output tables have the following characteristics: First, the table of relationships between sectors (or of intermediate inputs, also denominated inter-industry relationships) presents the same number of rows as columns; the rows express the sales that a productive sector makes to the rest of the sectors of activity; the columns represent the purchases that a sector makes from the rest of the sectors. Second, the table of final demand presents the productive sectors by rows, and the components of the final demand (private consumption, public consumption, gross capital formation, and exports) by columns; by rows, the total output is obtained as the sum of sales of intermediate outputs plus net final demand; by columns, total output is obtained as the sum of purchases of intermediate inputs consumed plus primary inputs or value added. Third, the table of primary inputs includes, by rows, the components of the inputs (wages and salaries, taxes linked to output, value added, etc.) and, by columns, the productive sectors. The formalisation of the input-output tables requires the representation of a system of linear equations, each of which describes how the output of a branch or sector is distributed among the parts of the whole economy. From these equations the technical coefficients are obtained; these are the quotients between the amount consumed of an input and the value of the output of a sector or branch; it is a measure of the amount of output of the branch "i" that is needed by another branch "j" for the production

of a unit of its own output. The calculation of the inverse matrix of
Leontief from the tables allows diverse types of economic analysis
to be applied; in our case, the obtaining of the indirect and induced
effects of the port containerisation activity.[4]

In Andalusia the Tables are produced periodically (four to date:
1975, 1980, 1990 and 1995), but it must be taken into account that the
availability and publication takes place at least four years after the
period to which the data refers. The latest for Andalusia (MIOAN-95),
which are utilised in this study, refer to the year 1995. The application
of a regional input-output table to estimate economic impacts of the
port activity requires the resolution of two fundamental problems:
First, as a prior step, the selection of the sectors of economic activity
that are to be considered; second, the application of sectoral deflators
to the data of 2003 (the year of the study) in order to apply the Tables
for 1995.

In relation to the first question, the original table for Andalusia
includes 89 branches of activity and outputs. The need to maintain
a degree of homogeneity to provide points of reference between the
results of the impacts and the existing accounting information at
the provincial or regional level requires a reduction of the number
of sectors in the input-output Tables so that it coincides with the
number of sectors covered by the provincial and regional accounts.
In this respect, the TEMA (1994) methodology suggests a break-
down into 16 defined sectors. In our case we have decided on 20
sectors since the basic macroeconomic information at the provincial
and regional levels that we intend to utilise as point of reference for
the data utilises a similar break-down. The sectoral break-down is
given in Table A.2.

The second question to resolve concerns the application of de-
flators. It is an unavoidable problem that the economic impact is
evaluated for the year 2003, while the tables needed for this refer to

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[4] In order to avoid making this explanation over-complicated, the mathemat-
ical formulation of the input-output model is not reproduced in this Report.
For a simple presentation, readers are referred to TEMA (1994, pp. 36–50)
and for greater detail, to Pulido and Fontela (1993). The operative aspects
can be consulted in chapter 9, "The input-output framework" of the SEC-
95, published in the Regulation (EC) No 2273/96 relating to the System of
National and Regional Accounts of the EU.

Table A.2. Break-down chosen for the impact study of the economic activity of the port of algeciras bay, and its correspondence with the Mioan-95

Branches of activity	MIOAN-95
1. Agriculture and silviculture	1 to 5
2. Fishing	6
3. Energy and water.	47 to 49
4. Minerals, metals and non-metal products	7 to 11, 27, 31 to 34
5. Chemical products	28, 29
6. Metal products and machinery	35 to 40
7. Transport material and equipment	41 to 43
8. Food products, drinks and tobacco	12 to 20
9. Textiles, leather and shoes	21 to 23
10. Paper, paper articles and printing.	25, 26
11. Wood, cork and furniture	24, 44
12. Rubber, plastic and other manufactures	30, 45
13. Construction and engineering	50, 51
14. Recovery and repairs, and commercial services	46, 52 to 55
15. Hotels and restaurants	56, 57
16. Transport and communications	58 to 63
17. Credit and insurance, property rental	64 to 67
18. Others services for sale, domestic service	68 to 76, 84, 86 to 89
19. Public services	77, 82, 83, 85
20. Education and health	78 to 81

the year 1995. It is therefore necessary to apply indices of the inflation that has occurred over this intervening period of eight years, to "correct" the magnitudes valued in 2003 monetary terms obtained from our data sources, the surveys, the Registro Mercantil, etc. As is known, the evolution of prices is different according to the geographic frame of reference, to the good or service sold, to the market in which the transactions take place, etc.

Taking into account the sectoral break-down chosen (the 20 activity sectors evaluated), it was decided, in the case of the first two sectors covering activities of the primary sector, to utilise the indices of observed prices published annually by the Instituto Nacional de Estadistica (INE). For the industrial sectors (from Nº 3 to Nº 12), the Index of Industrial Prices (IPRI) was chosen. Since these 10 sectors include all the groupings of the National Classification of Economic Activities (CNAE-93), when more than one grouping coincided in one sector, the weightings of the IPRI requested from the Publication Department of the INE were utilised. The use of these weights avoids

over- or under-valuing the importance of some subsectors. In the sector of Construction and Engineering, the National Index of Labour in the Construction sector has been employed. For the rest of the sectors (№ 14 to № 20) the Index of Consumer Prices (IPC) has been used. In this case, the "basket" of products and activities included in the IPC do not have a direct correspondence with our seven sectors of services; it has therefore been necessary to assign each group and subgroup to each sector and, as with the industrial sectors, resort to the weightings of the IPC to avoid over-valuing some outputs. The methodological changes have been saved by making use of the link indices provided by the INE. Table A.3 shows the corrective indices for the conversion backwards and forwards.

Table A.3. Sectoral inflation corrector indices

Branches of activity	2003/95	1995/03
1. Agriculture and silviculture	0.956	1.046
2. Fishing	0.956	1.046
3. Energy and water.	1.024	0.976
4. Minerals, metals and non-metal products	0.799	1.307
5. Chemical products	0.929	1.076
6. Metal products and machinery	0.900	1.119
7. Transport material and equipment	0.893	1.122
8. Food products, drinks and tobacco	0.788	1.276
9. Textiles, leather and shoes	0.898	1.116
10. Paper, paper articles and printing.	0.907	1.109
11. Wood, cork and furniture	0.874	1.145
12. Rubber, plastic and other manufactures	0.891	1.128
13. Construction and engineering	0.827	1.209
14. Recovery and repairs, and commercial services	0.814	1.229
15. Hotels and restaurants	0.727	1.376
16. Transport and communications	0.857	1.179
17. Credit and insurance, property rental	0.779	1.285
18. Others services for sale, domestic service	0.824	1.213
19. Public services	0.689	1.452
20. Education and health	0.770	1.308

A.8
Limitations

Before closing these methodological notes, a warning must be given of the limitations of any study of impact conducted using input-output methodology. In addition to the static character of the method, there are references in the literature to some criticisms originally made by Waters (1977) and Davis (1983), and more recently by Verbeke and Debisschop (1996) and Weisbrod and Weisbrod (1997). These reservations have also been emphasised in various studies on Spanish and foreign ports. The restrictions or basic disadvantages of the methodology concern three specific aspects related to the possible inflation or exaggeration of the effects: the first is associated with the designation of the economic activities that should be included as affected by the presence of the port; the second refers to the form in which the indirect impacts are determined; the third is related to the use of the results for evaluating the changes in the volume of economic activity of the port. In our case, it is the two first restrictions that are relevant; the third is linked to the viability of particular port infrastructures and is marginal to this study. With the object of dealing with these criticisms in a reasonable way, the modifications made in the following paragraphs are introduced.

In relation to the first question, we have limited our analysis by selecting those companies related exclusively with the container traffic and, on the other hand, we have made a clear separation between the three types of effects, a separation that is not only methodological but also practical. The direct effects are perfectly quantified, and do not give rise to any doubt or reservation. The identification of the industry dependent on the port is, however, controversial, and having evaluated whether or not it should be included in successive interviews with several of the large companies of the Bay of the Algeciras and with the quantitative information from the surveys in our possession, it was decided not to incorporate it in this analysis.

In relation to the second matter, the calculation of the indirect impacts is obtained after the application of the Input-Output Tables and this could give rise to two difficulties: one, the gap in time between the year for which the Tables were produced and the year for which our impact assessment is made. It should be taken into account

that the magnitudes compiled from the campaign of surveys have to be deflated to equivalent prices for the year of the tables, in order to calculate indirect effects. It has been necessary to apply various indices to correct for inflation (i.e. sectoral deflators) for converting the data for 2003 (the year of the surveys) to 1995 prices (the year of the tables). And two, the disaggregation of the input-output Tables in general is very detailed (there are 95 sectors). It is much more operative to reduce the number of those tables to a smaller number of sectors so that the presentation of results may be clearer without loss of rigour. Further, the regional accounting data refers to a smaller number of sectors and it is of interest that the sectoral breakdown of the study should be comparable with the regional accounting data to be able to compare the effects found with the regional magnitudes. Finally, the need to compare the estimations with the district and provincial figures has forced us to make estimations of the number of persons in employment and the gross value added in 2003.

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