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Ports: definition and study of types, sizes and business models

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Abstract:

Purpose In the world today there are thousands of port facilities of different types and sizes, competing to capture some market share of freight by sea, mainly. This article aims to determine the type of port and the most common size, in order to find out which business model is applied in that segment and what is the legal status of the companies of such infrastructure.

Design/methodology/approach To achieve this goal, we develop a research on a representative sample of 800 ports worldwide, which manage 90% of the containerized port loading. Then you can find out the legal status of the companies that manage them.

Findings The results indicate a port type and a dominant size, which are mostly managed by companies subject to a concession model.

Research limitations/implications In this research, we study only those ports that handle freight (basically containerized), ignoring other activities such as fishing, military, tourism or recreational.

Originality/value This is an investigation to show that the vast majority of the studied segment port facilities are governed by a similar corporate model and subject to pressure from the markets, which increasingly demand efficiency and service. Consequently, we tend to concession terminals to private operators in a process that might be called privatization, but in the strictest sense of the term, is not entirely realistic because the ownership of the land never ceases to be public.

Keywords ports, concessions, load, management models, types of ports

1. Introduction

As emphasized by the Economic Commission for Latin America of the United Nations – CEPAL (2007) report on the Integration of Latin America in international trade, emerging economies and developing are perceiving new requirement and trends in international markets, which are evolving. According to the Port Reform Tool Kit of the World Bank, the current scenario presents new patterns in which centers of production or service are dispersed throughout the world regardless of the country origin, culture and language. As clearly expressed the United Nations Conference on Trade and Development (2005), the changes in the business model of international trade significantly affect the development of certain countries due to the composition of exports and imports.

The new scheme of market integration results in a team that does not need to converge under one roof. The result is the specialization in manufacturing, increased price competitiveness and boosting trade. From this stage, loom large synchronization of supply, distribution and marketing, spans almost the entire globe going beyond geographical boundaries. The integration process between users of different nations requires the promotion of transport, which becomes an essential tool that facilitates the flow of trade link between the states. Therefore, has a direct impact on the supply chain and the global economy, as mentioned in the International Transport Forum 2012. Transport and logistics have a management base that allows specializing the international physical distribution operations, from the use of premises known as ports.

The Ports are areas that are attached to a sea, ocean or river by connecting waterway and are essentially considered as entities. They are equipped with infrastructure and technical facilities of any kind that allow them to manage the load type for which they are specialized. Its basic function is to provide shelter to a different extent to ships, allowing the transfer of goods from one means of transport to another. They also function as node link between sea and land and are a clear example of intermodality (Tarantola, 2005).

The ports are managed under a complex legal concept and managed through an organizational model that mostly generates the need for convergence of the public and private sectors. It is therefore an organizational model whose study is by no means trivial. The management model used in Spanish territory is fairly standardized. In this model, infrastructure is publicly owned and service delivery tends to be private and regulation is carried out by a public official (Bofarull, 2010). Obviously, although this is perhaps the most widespread model, is not alone as reflected in the World Bank report (2007). For the present article we propose a study to determine the most common organizational model of this type of facility, first defining the types of ports by physical characteristics and under development activity. Furthermore we'll study the size basing on certain criteria and finally will specify the business model.

2. Methodology

For the development of this study, we take a sample of 802 ports, with different types, sizes and nationalities. Within this sample, we find the 100 port facilities at World Port Source (2013)

prominent as in the world in 2011. These port facilities handled 75% of the total annual global burden. In our case, we set a minimum percentage of ports studied by country and expanding the sample to 802 facilities we can cover a turnover close to 90% of the world market.

We will analyze management facilities for goods, so we'll leave aside the structures that focus on other areas (fishing, military, tourism or recreational). So there will be a thorough study that will identify the most common size and type of ports, in order to determine the organizational model, which should be the most optimal for this service sector, and meet market demands adapting its management to drastic changes in the economy.

This publication starts from the classification of the type of ports based on geographic location. However, given the scope of the investigation, it is necessary to generate categories whose difference is not strictly geographical but also focuses on aspects related to the type of facility (deepwater seaport, seaport, river port, harbor, pier, Jetty or Wharf terminal port, offshore terminal and channel with respect to the type), as well as its size. This size does not attend strictly to the area occupied by the port, but managed studied TEUs (TEU is the acronym of the English Twenty-foot Equivalent Unit, and is the unit of measurement of capacity of shipping containers). To define the size, we also study the number of non-containerized cargo handled during the year and the port areas of influence.

2.1. Ports: Classification criteria

As noted previously, the types of classification study will be based on the different features that each facility and allow them to meet their business needs. Then define the eight types of ports proposed for this study:

- "Deepwater Seaport": It is considered deepwater port, one whose draft (draft mean by the vertical distance from the water surface to the sea floor) in both the entrance channel and in the terminal area, exceeds 13.72 m.
- We are including in this classification to all ports whose foreland (offshore area of influence) are located within marine or ocean area.
- "River Port": All ports that are located in one of the banks of a river, whatever its depth, will be considered as platforms river.
- "Harbor": This classification encompasses installations which, although not strictly considered port, used for loading and unloading goods and are sheltered water outside. The overcoat is performed by means of a dam constructed for this purpose and these facilities provided are marine or oceanic.
- "Pier, jetty or wharf": in this category are those facilities that are no more than a simple dock or pier, that not always have to be sheltered from foreign waters.
- "Port Terminal": Although it is strictly a classification that should be encompassed by any of the above, the large number of such facilities in the world, makes necessary to

establish this subdivision. It is also those known as "dedicated terminals". In the strict sense, is not about ports but rather simple terminals whose material uploaded or downloaded is always the same and consequently, their facilities are accessible only to the type of goods they manage. The most common dedicated terminals are those that move soybeans, coal and other minerals. The vast majority are solid bulk, although there are also specialized in liquid bulk terminals as oils, certain types of gas, etc.

- "Off-shore terminal": They are installations which are not in the coast and its entire surface is set in the sea. Terminals are completely artificial firm whose area has been built specifically to house the equipment for the management of merchandise. Devoted exclusively to the deconsolidation of inbound cargo and shipment by short sea shipping to its hinterland and the consolidation of the projecting load coming through the same channel
- "Canal": There are certain port facilities that cannot be said to be strictly river. This is the case of those located inside marine incoming and waterways can have kilometers. In all cases, this facilities are communicating with the sea or ocean by a single point. This classification does not cover artificially constructed installations or whose activity is mere passage of ships (like the Panama Canal or the Suez Canal).

Both "River Port" as the "Channel", will fall under a category called "Waterway Systems". There are currently 25 waterway systems (5 in Asia, 8 in Europe, 10 in North America and 2 in South America) with a total of 155 ports. In the present investigation these groups are despised and we consider each port separately.

Size is another classification and groups will be formed as follows: Very small, Small, Medium, Large and Very Large. This classification of ports is not trivial and to fulfill apply multicriteria analysis that takes into account

- TEU managed throughout the year
- Tones of cargo handled during the year. There are ports like Barcelona or Rotterdam that move both containers and bulk cargo. Consequently, these ports add the two types of goods in their total load managed.
- Hinterland size and importance. Establishing a balance between the size of its inland catchment area (hinterland) and the importance of this area as business zone. It is perfectly possible for a port to have a relatively small, but very important hinterland as a center of business generation. Then, the port gets a higher score than another port with a much larger hinterland. Each of the ports is subjected to this weighting, individually.
- Foreland (offshore zone of influence). The size and area of influence are also considered when you sort.

For classification of ports by size, is important to identify whether their management entity is public or private, because this character will greatly influence how investments arise. Another

important aspect about the ownership is the scope within the influence area (hinterland) is often higher for public terminals, where most of its facilities are concessioned to private operators.

Currently, many of the ports are subject to privatization, a result of the new global trend that aims to achieve improvements in operational efficiency and requires a new investment management system (van Ham, 1998). Accordingly, the associated parameter value in analyzing its ownership may be multi fluctuating over time.

3. Results

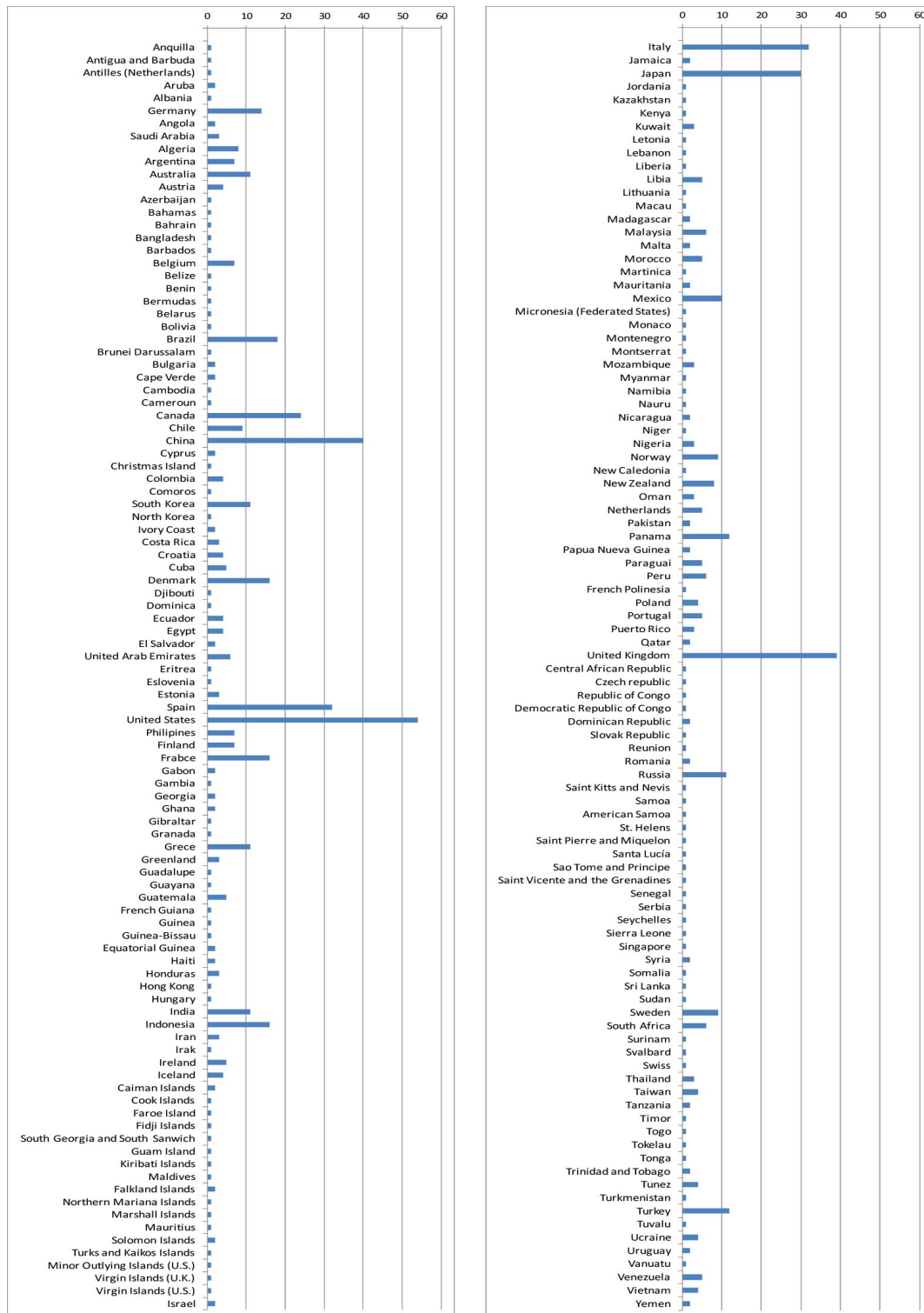


Figure 1. Ports studied in each country

The sample of the 802 port facilities mentioned above, are covering 196 countries. Figure 1 shows the ports associated with said sample. Taken together, these ports represent 16% of total infrastructure and a turnover of close to 90% of the world market.

Highlights include countries like the U.S., China, Canada and Russia, where there are plenty of port facilities. This large turnout could be related to the level of development of the countries concerned rather with its geographical spread. While other countries like Greece, whose importance is determined by its privileged historically strategic location for business and not its geographical

In Table 1 we highlight the 16 countries with the largest number of ports (regardless of their type), including those found in the top countries like Britain, Italy and Japan, with relatively lower surfaces to other countries like China, Australia and Russia.

Country	Ports studied	Ports in the country	Surface	Length of coastline
			(km ²)	(km)
United States	54	531	9.158.960	19.924
United Kingdom	39	389	241.590	12.429
Italy	32	311	294.020	7.600
Japan	30	292	374.744	29.751
Canada	24	239	9.220.970	202.080
China	40	172	9.326.410	14.500
Denmark	16	159	42.394	7.314
France	16	159	545.630	3.427
Indonesia	16	154	1.826.440	54.716
Australia	11	105	7.617.930	25.760
Spain	32	105	499.542	4.964
Russia	11	105	16.995.800	37.653
Grece	11	103	130.800	14.880
Germany	14	98	349.223	2.389
Sweden	9	82	410.934	3.218
Brazil	18	81	8.456.510	7.367

Table 1. Geographical data of the countries with the highest number of ports

Clearly, therefore, exist as in the case of Greece conditioning commercial, or merely geopolitical, as in the case of Japan. In view of Table 1, it is easy to see that there are countries where, due to the large number of ports, port management becomes a matter of state and collect a vital importance in the development of national economic policy.

Table 2 lists the pooled data for the type in rows and columns for its size (according to the selection criteria listed above).

In view of Table 2, we can see that the vast majority of ports studied are of the type "Seaport" (marine) and taking into account the size of them, belong to the "Medium". It makes sense, moreover, because there are much more global waterfront banks than navigable rivers.

According to the criterion of space, we can only find 34 ports classified as very large among the 800 studied. Of these 34 ports, 20 are in the top 100 world's largest ports. It is surprising that, being classified as "very large", 14 of which do not appear in the list above. This reaffirms the view that the size is not always the most important parameter, and yes it is the geostrategic position of the port in a framework of global trade.

	Very large	Large	Medium	Small	Very small	TOTAL	%
Deepwater Seaport	18	10	4	0	0	32	4,0%
Seaport	15	81	333	70	0	499	62,2%
River Port	1	6	36	29	5	77	9,6%
Harbor	0	1	24	98	1	124	15,5%
Pier, Jetty or Wharf	0	0	3	31	28	62	7,7%
Port terminal	0	2	1	0	0	3	0,4%
Off-Shore Terminal	0	0	1	1	1	3	0,4%
Canal	0	1	1	0	0	2	0,2%
TOTAL	34	101	403	229	35	802	
%	4,2%	12,6%	50,2%	28,6%	4,4%		

Table 2. Overall study results

In a similar way, ports classified as "large" (37 of 101), are in the same list. Viewing the test result, we can detect that within the group of size "medium", 39 of the 403 ports in the sample studied, appear in the list of the 100 most important ports in the world. Among others we can see the port of Guangzhou (China), which is ranked No. 6, the Port of Jebel Ali (UAE) is ranked No. 7, the Port of Kaohsiung (Taiwan) is ranked No. 12 and the Port of Tanjung Pelepas (Malaysia), ranking No. 17 in the list. From these data, it is again reasonable to ask if the port size is directly related to its importance in international trade or other factors are more important than the size and therefore seems obvious that the geostrategic factor generates a transcendent effect.

As can be seen in Table 3, according to the IUEM (Institute of Maritime Studies of La Coruña) (2007), the fleet of container ships is increasing the size of ships every year.

Generations of containership					
Vessel	Name	Years	Length	Draft	TEU's
First generation	n/a	1956-1970	135-200	<9	500-800
Second generation		1970-1980	215	10	1.200-2.500
Third generation		1980-1988	250-280	11-12	
Fourth generation	Panamax	1988-2000	275-305	11-12	3.000-4.000
Fifth generation	Post Panamax	2000-2005	320-380	13-16	6.000-12.000
Sixth generation	Suez Max	2005-2008	380-400	16-19	2.000-14.000
Seventh generation	Post Suez Max o Super Post Panamax	Desde 2009	>400	>19	>14.000

Table 3. Increase of size of the ship container fleet

Consequently, since the fifth generation container ships appeared, it is absolutely necessary that the ports are of type "Deepwater Seaport", as the necessary draft exceeds 13.72 m. This type of vessel is constructed from start of 2000. Consequently, until then it was not necessary to use so deep port facilities. All ports built to date, are at most of type "Seaport". However, as can be seen in Table 4, according to Alphaliner (2012), the trend to 2014 represents a substantial increase over 10,500 vessels TEUs, a fact that makes it likely that in the near future, the new port facilities should tend to be designed based on the requirements of this segment.

Containership fleet			
Size in TEU's	Number of ships 2010	Number of ships 2014	Variation
100-499	268	265	-1,1%
500-999	806	826	2,5%
1.000-1.499	705	762	8,1%
1.500-1.999	583	608	4,3%
2.000-2.999	718	760	5,8%
3.000-3.999	322	367	14,0%
4.000-5.099	680	702	3,2%
5.100-7.499	432	408	-5,6%
7.500-10.499	264	366	38,6%
>10.500	71	233	228,2%
TOTAL	4.849	5.297	

Table 4. Containership fleet development

However, what really becomes important and is found from the data presented in this study, is that a larger port will not have greater potential for management of goods, but a number of influencing factors that minimize the importance of purely geographical extension of the port itself, such as the volume of cargo handled (containerized or not), the size of the hinterland and foreland.

4. Business model

For the business model, this study will focus on a range of ports from different countries but with a common denominator, it is medium sized seaports. All ports of its kind in Spain are managed by publicly owned Port Authorities (Malaga, Alicante, Algeciras, Bilbao, Cadiz, Las Palmas, Ferrol, La Coruña, Huelva, Marin, Palma de Mallorca, Santander, Tarragona, Vigo and Valencia). Notably, Valencia occupies position 26 in the ranking of ports above 2011

In the case of French neighbor, 8 ports are including in this segment (Fos-Sur-Mer, Pallice, Ballone, Boulogne-Sur-Mer, Cherbourg, Calais, Nantes and Sete). The business model is identical to the Spanish one, since ownership is public and concession certain areas to private operators. Something similar happens with Italy, which positions 10 ports in this segment, and Mexico with 8 or Morocco with 4.

Studying only this portion of the port market, it can be seen that the most common business model is a combination of public ownership with private concession (Rúa, 2006). In countries like India, for example, dry ports are managed by a state company that owns the land, called

Concor, that dealer spaces to private operators or sometimes, provides certain services in exchange for a fee activity (Gujar & Yan, 2010)

No wonder that this business model be the most common, since port infrastructures require a high level of investment in the early stages of project development, a fact that makes it difficult for private investors in these early stages to go into business (Saurí & Robusté, 2011).

More often in these ports is that infrastructures are planned and executed by the states themselves, becoming National Interest Project development thereof. Then, they offer selected area to private operators (terminals, campas, deposits, etc.) in administrative concession, and are allowed to develop superstructures or facilities of their activity.

Thus, it is achieved that the state recovers some of their investment by charging the appropriate fees to private operators. The current trend towards privatization (van Ham, 1998), it turns out, then, necessary. If in the embryonic stages, the public presence is more, it seems that the presence gradually diminishes until the state capital eventually disappears completely.

Consequently, privatization is only complete transfers control to a port operator or operators that, in the background, paid an initial investment undertaken by the state (or most of it).

Far from trying to enter the debate on what kind of management is more appropriate for this segment, the truth is that in countries like the Netherlands, some reports recommend privatizing ports as dynamic system for port activity improvement (van Ham, 1998). In fact, some reports have been published that attempt to show that the port privatization is an effective tool for improving the competitiveness of ports (Tongzon & Heng, 2005).

5. Conclusions

it has been confirmed by the present investigation, the most common type of port is the seaport, where stands out the size "medium". the projection of the global freight market makes predict that the fleet of container ships will be increased in number and volume in the coming years. therefore, although the study focuses on what is currently the standard port size and scope, it is foreseeable that the ports will now be designed to become more of type "deepwater seaport". this change will allow housing the operations of larger vessels and draft and port concerned "large" or "very large" because the specializations of the terminals will gradually diluting the competition, becoming more pronounced differences between large and load managers and the other ports.

The vast majority of port facilities meets the criteria of differentiation, as well as proves to be managed by public entities whose business model is more widespread granting terminals spaces or private entities.

It is a widespread practice that allows public ownership of the port is not an obstacle to development, to the extent that it allows the entry of private operators to streamline the infrastructure behavior and partially reduce the weight of the investments made by the states.

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