INTRODUCTION

In an international context where most of the international trade is carried by sea, connectivity constitutes an essential element for importing and exporting companies.

Thus, the fragmentation of global supply chains exerts pressure on ports to achieve greater integration of international transport networks with the aim of remaining competitive and to create value for companies.

Faced with this challenge, port connectivity has emerged as one of the principal factors of port connectivity. To do that, proof of the importance of this variable, port managers have been making great efforts in the design and implementation of policies that improve connectivity aimed at, among other things, incentivizing the establishment or regular maritime services and shipping companies. With this mission in mind, recent decades have seen ports embark on a process of transformation to adapt to the dynamic environment in which they operate and meet the needs of shipping companies. Measures like investment in port infrastructure and digitalization have been implemented to allow larger vessels to stop over and to improve the efficiency of operations.

As a result of this process, ports offer companies a greater range of maritime services to facilitate their access to international markets. It is important to point out that the availability of maritime services at a port is a key element in determining companies in their decision to choose a port.

So, given the importance of this variable in port competitiveness, it is important to develop a tool that allows us to systemically measure and compare port connectivity. Fundación Valenciaport and the Port Authority have jointly developed the Port Connectivity Index (or ICP, as per the Spanish). This Index measures the connectivity of SSS (SSS) traffic for container cargo from Spanish ports.

The index is particularly useful to port authorities by providing a tool that allows for self-assessment of current activity and comparison with competitors. It is also useful for companies by providing relevant information on how ports avail of greater connectivity for trade operations. Finally, shipping companies will have access to information on which ports are offering greater connectivity that can be useful in their decision in relation to stopovers.

LINEPORT DATABASE

The LinePort database, prepared by the Valenicaport Foundation, provides data on the maritime transport offering that are necessary for the development of the ICP.

This database provides standardised and detailed information on SSS service offered from Spanish ports. The wealth of data available allows us not only to enumerate the existing lines at each port under study, but it complements that information with data on the characteristics or regular lines (types of service,

frequency, rotation, transit time, number of vessels employed on service, etc.) and the characteristics of the vessels (speed, GT, maximum transport capacity for TEUs/platforms, age, consumption, engine power, etc.)

Data are obtained in minute detail, consulting the information provided by different sources, including the ports themselves, shipping agents, shipping companies, specialised press and the Automatic Identification System. After compiling the data, LinePort completes the task of validating and standardising the information from the different agents involved (shipping companies, shipping agents, ports and specialized press).

In terms of geographic coverage, adhering to the definition of the European Commission, the database encompasses any maritime transport service between Member States of the European Union and between Member States and coastal third countries on the Adriatic, Baltic, Aegean Sea, Mediterranean Sea, Black Sea and the North Sea (passenger, bulk, container, roro, vehicles, etc.) and the type of service (regular line service, feeder, interoceanic).

LinePort is an important tool for the analysis of SSS in Spain, proving standardized information quickly on SSS Services offered from Spanish ports, which is considered an essential aspect of the transport of goods.

ICP METHODOLOGY

The ICP arose from an Index developed by the United Nations Conference on Trade and Development (UNCTAD), which publishes a connectivity index called the Liner Shipping Connectivity Index (LSCI). The purpose of that index is to measure the connectivity of countries, so is calculated on an aggregated basis for each country. The variables used for the calculation of the Index, which exclusively measure connectivity for container traffic, are the number of shipping companies operating at ports; the number of regular services offered at said ports, the number of vessels they use in services to and from the ports of each country, average capacity in TEU offered by the ships operating at said ports, and the maximum size of the vessels that enter/leave the ports located in a Member State in TEUs.

Therefore, taking the methodology proposed by the UNCTAD for the connectivity index by country, the Valenicaport Foundation has calculated an index focussed on the connectivity of Spanish ports (ICP). The Index proposed by the Valenciaport Foundation measures the connectivity of Spanish ports considering exclusively their regular SSS services, using the definition of the European Shortsea Network.

That is regular services that connect Spanish ports with the ports in EU Member States or those located in non-European countries with a coastline on the seas surrounding Europe.

As a contribution in relation to the index proposed by UNCTAD, it was considered appropriate for the ICP to incorporate two key variables to define the competitiveness of a port: the frequency of maritime services and the number of connection destinations connecting Spanish ports. After incorporating these variables, the index shall tale the following form:

$$ICP_{j,i}=\left(\left(\frac{N_j}{Max(N_{j...n})}+\frac{L_j}{Max(L_{j...n})}+\frac{C_j}{Max(C_{j...n})}+\frac{B_j}{Max(B_{j...n})}+\frac{TB_j}{Max(TB_{j...n})}+\frac{F_j}{Max(F_{j...n})}+\frac{PD_j}{Max(PD_{j...n})}\right)/X\right)$$

Where:

ICP= Port Connectivity Index.

j= port under study. i= year for which the PCI is

calculated. n= total number of ports included in the PCI.

S (Shipping companies): sum of the shipping lines offering services in each port.

L (LINES): sum of SSS line offered during year analysed.

C (Capacity): sum of DWT of vessels that offer services at each port.

V (Vessels): total number of vessels per line that are used in the rotation.

VS (Vessel size): maximum size of vessel operating at the port in question, expressed in DWT.

F (Frequency): number of departures per week offered by each port

DP (Destination ports): number of foreign destinations ports connected by Spanish port.

X: total number of ports included in the ICP.

As a result, the ICP generates a value of 100 for the port with the highest average index in the first half of 2016. For the upcoming semesters, the maximum value obtained for each variable in the first half of 2016. This way, in the following semesters the evolution of connectivity at each Spanish port can be analysed, assessing whether the policies implements to improve connectivity are effective.

RESULTS

The results of the Port Connectivity Index (PCI) for the second half of 2024 reveal significant changes in the connectivity of several Spanish ports compared to the previous semester.

PORT OF ORIGIN	ICP 1st Semester 2016	ICP 2nd Half 2016	ICP 1st Semester 2017	ICP 2nd Half 2017	ICP 1st Semester 2018	ICP 2nd Half 2018	ICP 1st Semester 2019	ICP 2nd Half 2019	ICP 1st Semester 2020	ICP 2nd Half 2020	ICP 1st Semester 2021	ICP 2nd Half 2021	ICP 1st Semester 2022	ICP 2nd Half 2022	ICP 1st Semester 2023	ICP 2nd Semester 2023	ICP 1st Semester 2024	ICP 2ndo Semester 2024
VALENCIAPORT	100.00	95.47	98.89	102.19	102.12	97.31	100.76	102.47	102.36	101.09	99.26	105.32	101.97	102.81	102.36	105.20	107.49	111.69
ALGECIRAS	75.26	78.44	87.64	88.75	85.86	83.85	92.14	93.2	96.33	94.46	92.57	94.92	85.53	84.02	82.53	88.81	80.61	77.10
BARCELONA	76.91	73.20	84.03	84.94	89.42	83.57	84.88	83.99	78.94	78.57	81.57	85.42	82.07	90.60	85.01	87.76	76.05	76.37
CASTELLÓN	26.63	24.10	31.88	28.37	29.55	29.45	31.42	31.88	29.57	28.35	23.60	22.55	21.45	18.64	18.69	17.56	19.37	17.44
LAS PALMAS DE GRAN CANARIA	26.42	26.89	26.94	27.98	29.54	29.55	27.75	28.8	27.18	29.11	28.50	25.03	26.42	28.31	27.82	37.35	28.07	29.58
VIGO	18.74	16.70	15.78	18.43	19.65	20.48	20.36	17.44	18.28	19.11	18.57	15.45	13.96	16.82	17.73	21.44	28.24	28.75
BILBAO	23.67	16.86	18.44	18.75	20.15	18.96	18.99	18.94	18.16	15.03	15.00	15.71	16.04	17.06	20.51	24.28	20.54	23.76
MALAGA	-	-	-	2.04	8.22	17.81	15.23	15.15	14.60	8.81	8.94	8.02	8.31	5.35	5.38	7.39	6.75	18.92
GIJÓN	12.82	6.15	9.15	9.24	11.91	12.87	10.89	11.31	11.45	10.10	9.55	9.98	10.37	9.54	10.19	12.93	12.80	13.35
TARRAGONA	12.38	13.40	15.71	14.95	11.33	11.58	14.54	11.19	10.74	10.84	8.81	7.83	7.83	7.86	7.51	4.43	-	-

Since the inception of the historical index series, Valenciaport has solidified its position as the port with the highest maritime connectivity in Spain for short-sea traffic. In the second half of 2024, Valenciaport recorded a further increase in its score, reaching a PCI of 111.69, continuing its upward trend. This growth reflects the strength of its network of scheduled services, which seamlessly integrates inter-oceanic connections with feeder and short-haul traffic. Its ability to adapt to changes in global shipping routes has further strengthened its position as a key strategic node in international maritime connectivity.

Following Valenciaport, the ports of Algeciras (77.10) and Barcelona (76.37) continue to compete for the second and third positions. Both ports have very similar values, with comparable services, frequencies, and the presence of similar shipping companies. However, Algeciras stands out in terms of operational capacity, while Barcelona maintains a strong presence in regular services. In this semester, both have shown slight variations in their connectivity, reflecting adjustments in routes and the operations of shipping lines.

The group of ports rounding out the top 10 in connectivity demonstrates significantly lower levels compared to the top three. Within this range, Las Palmas de Gran Canaria (29.58), Vigo (28.75), Bilbao (23.76), and Castellón (17.44) stand out. Vigo and Castellón have seen increases in their scores, while Bilbao and Las Palmas have experienced a more stable evolution. Malaga (18.92) and Gijon (13.35) have also strengthened their connectivity, advancing in their positions in the index. Tarragona, on the other hand, has not registered a score this semester and has been excluded from the ranking.

The overall analysis of the index reflects the key trends that have shaped the industry in recent years: the consolidation of operators, route optimisation, and the progressive increase in vessel size and the capacity managed by the ports. In this context, Valenciaport continues to reinforce its leadership, while other ports are adjusting their strategies to keep pace with the changes in the sector.