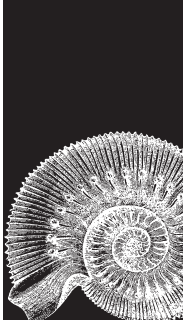

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FINANCING AND DEVELOPMENT OF INNOVATION IN COMMERCIAL SEA PORTS

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ABSTRACT

Innovation is fast becoming a major driving force in the improvement of social welfare, a crucial factor in the long-term growth and survival of companies and a key element in achieving the sustainable development of economies. In the port sector, the big changes caused by the globalization process are leading commercial sea ports to design strategies in the field of innovation allowing them to take on present and future challenges in a sector where deregulation and competition are increasingly present.

In this context, the present paper analyses innovation in the commercial sea ports. The specific objective is to determine who develops and finances innovation in the commercial sea ports. The methodology of analysis applied is the Rasch technique. Categorical variables have been used in the surveys carried out on the Port Authorities of the Spanish port system. The results obtained on innovation in Spanish ports provide answers to questions such as: Who finances the innovation? Who develops it internally or purchases it? Who acts individually? Who resorts to cooperation and which partners are chosen for the joint development of innovations?

Key words: Innovation, Ports, Rasch, Cooperation for R&D

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INTRODUCTION

In the business world in general, innovation acts not only as an engine of progress but also as a source of differentiation, a means to achieve a competitive edge that distinguishes one company from the rest. In fact, faced with the increasing international competition, innovation has become a central axis of the long-term design strategy of companies (Veugelers & Cassiman, 1999).

This importance of innovation is also reflected in the increase in expenditure on the investment which, to a greater or lesser extent, both companies and countries and international organizations dedicate to R&D+i (Research and Development and innovation).

Innovation can be defined as "the introduction of a new product, a new method of production, new markets, the discovery of new supplies of raw materials for manufactured products and even the appearance of a new sector or the redirection of a previously existing one " (Schumpeter in Solé Parellada, 2008 p.14). It is also one of the key driving forces in the improvement of social welfare and a crucial factor in the long-term growth and survival of businesses (Baumol, 2002; Schumpeter, 1939). It is also considered a key element in achieving the sustainable development of economies (OECD).

Traditionally, the literature has identified two main forms of development of innovations: "internal" and "external" (Cassiman, 2004; Cassiman & Veugelers, 2006; Veugelers & Cassiman, 1999) or, in the words of the literature, the decision to "make or buy" (the "make or buy" decision) (Cassiman & Veugelers, 2006; Chang, 2003; Perrons & Platts). More recently, a new form has been identified, that of cooperation with other agents for the development of innovations (Chen & Yuan, 2007; Hull, 2003; Navarro Arancegui, 2002), which may be considered a hybrid between the internal and external developments of innovations (Pisano, 1990). Generally, companies do not rely exclusively on one of the three alternatives proposed but rather combine internal innovation with external innovation and cooperation in order to obtain all of the capacities required to profit fully from their innovations (Hartung & MacPherson, 2000; Rigby & Zook, 2002; Teece, 1986).

The internal development of innovations has advantages such as the exclusive knowledge of all of the advances generated or the technological independence with respect to suppliers and competitors. However, it also has serious drawbacks such as a higher risk, both in economic and technological terms, or a greater need for resources to finance the development to be made. Meanwhile, in the case of external development, the situation is just the opposite.

It could be said, then, that cooperation is a hybrid solution combining the advantages of both and eliminating some of the drawbacks. Thus, the joint development of new knowledge allows riskier, more expensive and complex projects to be taken on

(Chang, 2003) and new skills to be developed through the complementarities and synergies between agents (Arora & Gambardella, 1994).

It might be asked, then, who are the agents with whom cooperation agreements can be established. According to a study by COTEC, five types or sub-systems of agents can be identified: firms, governments as providers of resources and legislation on innovation, the public R & D system, innovation support organizations (e.g. technology centers) and the environment (economic system, legal system, public and private markets, infrastructures, etc.) (Cotec, 2007 in Sacristán García, 2008).

In particular, the port sector also needs to develop innovations that enable it to adapt to the new world situation that it faces, characterised mainly by a high level of competitiveness (Escorsa Castells, 2008). Most international trade in goods is transported by sea, especially in transoceanic traffic, but there has also been a consolidation and development of short sea shipping, at least in Europe (Marco Polo Project).

Numerous studies reveal current problems as the low traffic or insufficient activity; or otherwise, congested marine terminals (as an example, see Kiani, M. 2010); the need for networking efficient logistics, creation of new elements in these networks, as has been the development of hub ports (see for example, Onyemechi, C. 2010); the issue of security to control traffic drugs, illegal immigration, terrorism, etc.; or pressure from environmental groups who claim improvements in environmental management, especially in port-city.

Therefore ports, if they are to be competitive, must be able to handle (process / load / unload / transfer) large quantities of merchandise quickly, to incorporate new activities and logistic services that add value and to adopt the new requirements. To do this, they will have to adapt and make investments such as building new infrastructures, acquiring new equipment, creating telematics platforms, developing ICT, improving management systems, etc. Similarly, countries must encourage and promote this type of innovative actions since, if they are to be competitive, they will need a port system that allows them to form part of the international logistics chains.

However, the innovations to be made may be substantial and may involve the investment of large amounts of resources (financial, human, time), which might mean that it is highly complex or even impossible for them to be developed by a single agent, all of which justifies resorting to cooperation.

In addition to the international competition, the ports also compete nationally, especially with the closest ports geographically. Therefore, differentiation is a key factor in ensuring survival and success, and innovation constitutes a possible means to achieve this.

The Spanish port system is not immune to the situation outlined above. It consists of 44 general purpose ports, managed by 28 Port Authorities, dependent in turn on the public entity, The State Port Authority of the Ministry of Development. In a previous era of centralised decision-making, the State Ports Authority established the tariffs, funded the infrastructures and covered the deficits of the ports. After the

change of model, when the ports were handed managerial and financial autonomy, in competition (hard and unequal) with the other ports of the Spanish system, the need arose to differentiate themselves in order to achieve long-term survival.

Moreover, given the great number of resources required and the scarcity of resources available in the ports, a number of ways to address the situation and cover the needs were implemented: private business was allowed in, mainly through government concessions; Autonomous Communities became involved, with more and more competences and freedom of management as well as increasing budget provisions, to avoid having to assume the political cost of losing their port infrastructures; partners were sought to join logistics chains, etc. In short, a great number of agents, private and public, became involved, directly or indirectly, in support of port activity. They can, therefore, be considered as potential partners when it comes to financing, developing and implementing the required innovations.

The aim of the present study is to determine who finances the innovation in the Spanish port sector and how it is developed, by applying the Rasch methodology.

METHODS

The methodology of analysis used is the Rasch technique. This tool makes it possible to use categorical variables and to order the factors or items to be analysed according to the importance assigned to these by the subjects surveyed. The software used was Winsteps (Linacre, 2010).

To obtain information on innovation in the Spanish port sector, a survey was sent by post and / or e-mail to the 28 Port Authorities in Spain (see Table 1).

Table 1. Specifications of Survey.

Universe	Spanish port authorities
Geographical scope	Ports of General interest in Spain
Sample size	28 Port Authorities (100% of the population)
Field work	July - August 2009

The questionnaire was developed in two phases. The first phase was comprised of the performance of a national and international literature review of material related to our subject, meetings between members of the research team and representatives of the State Ports and the Port Authority of Santander, and the drafting of the first version of the questionnaire. In the second phase, the content of this first version was shown to industry representatives in order to gain their opinions and suggestions for adapting the questionnaire to the specific reality of the port environment. With the incorporation of these suggestions, the final questionnaire was produced.

The distribution of the questionnaire was centralised through the Port Authority, who took responsibility for the subsequent monitoring of the respondents in

order to ensure an adequate response rate. The number of valid responses received eventually rose to 25, representing 89.28 percent of the population under study.

The original questionnaire consists of 15 questions. However, the present work focuses on the analysis of questions 4, 8 and 9 of the questionnaire, which are gathered in Appendix 1. Question 4 asks who is funding innovation, Question 8 who develops it and Question 9 asks who are on the preferred partners to cooperate with.

RESULT

This section presents the results regarding the reliability and validity of the data and the measurements taken, as well as the ranking of the agents for each of the questions analysed. The "Items" refer to each of the sections of the questions (see Appendix 1) and "individuals" are the Port Authorities surveyed.

Analysis of reliability and validity of the measurements

The validity, reliability and correlation are summarised in Tables 2 and 3, associated with individuals and items, respectively. These have been compiled from information from the Winsteps results tables denominated "Summary Statistics".

Table 2. Reliability and validity of Individuals,

	INFIT[a]		OUTFIT[b]		RELIABILITY	CORRELATION
	MNSQ[c]	ZSTD[d]	MNSQ[c]	ZSTD[d]		
Question 4	1	-0,1	0,97	-0,1	0,47	0,97
Question 8	0,85	0	0,93	-0,1	0,12	0,98
Question 9	0,98	-0,1	0,99	-0,1	0,6	0,79

Table 3. Reliability and validity of "Items".

	INFIT[a]		OUTFIT[b]		RELIABILITY	CORRELATION
	MNSQ[c]	ZSTD[d]	MNSQ[c]	ZSTD[d]		
Question 4	0,99	0	0,97	0	0,46	0,05
Question 8	0,98	0,1	0,93	0,1	0,89	-1
Question 9	0,98	-0,1	1,01	0	0,34	-0,68

[a] INFIT is an information-weighted fit statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's measure level. [b] OUTFIT is an outlier-sensitive fit statistic more sensitive to unexpected behavior by persons on items far from the person's measure level. [c] MNSQ is the mean-square infit/outfit statistic. [d] ZSTD is the infit/outfit mean-square fit statistic t standardized to approximate a theoretical mean 0 and variance 1 distribution.

The overall validity of the measures can be evaluated from the INFIT and OUTFIT indices. As noted, the values obtained are consistent with those required (Linacre, 2010; Febles Acosta, 2008; Oreja, 2005), both for the case of the measures (MNSQ valid in the range (0.5 to 1.5)) as the standard of variances (ZSTD close to 0) and for all questions asked, both to individuals and items.

On analysing the reliability however, it can be observed that all the values are low (the appropriate reliability value is close to 1), especially in the case of the individuals

for Question 8, which, curiously, shows the best reliability of all the study for the case of the items.

The low reliability of the individuals may be due, among other things, to the size of the sample (Linacre, 2010). While it is true that the percentage of responses obtained is almost 90% of the population (Port Authorities), these values would seem to point to the need for the survey to be extended to other members who also participate in the daily operations of the port, such as companies, terminals, shippers, freight forwarders, agencies of the port community, etc. The question arises as to whether the results for Question 9, to mention one specific case, might not vary if it were not just the Port Authority who was asked who their most valuable partners are, but also other members of the port community, as there is a possibility that cooperation agreements might be made in which the Port Authority does not participate.

Also, the low reliability of the items may indicate that the number of items included in the question is scarce (Linacre, 2010). It would be interesting to include the private agents covered in question 4 in both Questions 8 and 9, and vice versa, to include the organisations indicated in Questions 8 and 9 in Question 4. In addition, in this last question it would be advisable to incorporate more private agents (especially firms), institutions and organisms of the region. This is likely to improve the reliability of the survey and to provide a more thorough and clearer picture of who is responsible for the innovation and the cooperation between them.

Finally, the correlation should be 1 for individuals and –1 for items when the information or data is complete (Linacre, 2010). In our application, the correlation is acceptable for all questions in the case of the individuals, but it is only acceptable for the items in question 9, not being acceptable for the items in Question 4.

The results obtained in the reliability analysis mean that the interpretation and conclusions presented below cannot be asserted categorically. It would be appropriate to extend the population in a future survey to other agents apart from the Port Authorities, especially to the private businesses that operate in the ports.

Innovation in the ports sector

In this section we discuss, for each of the questions selected for the survey, the results from the Winsteps tables, "Variable maps" and "Item: Measure".

The results presented establish: who funds innovation in the port area; whether they develop it internally or buy it; who the agents responsible for the development are; if they do it individually or rely on cooperation; and who the partners chosen for the joint development of innovations are.

This section presents the global analysis of the results grouped around 3 main ideas: financing, development and cooperation. All the concepts relate to perceptions from the field of the Port Authorities.

Table 4 in Appendix 2 gathers "variables maps" for the three questions analyzed. In general there are some missing gaps in the discrimination of the behavior, which

leads us to conclude that not all the items are identified and, therefore, that there are more agents that have not been identified or discretised sufficiently.

Moreover, in all cases there is an overlapping of two items. An overlap occurs when there are 2 or more items at the same height on the right of the map, as for example, items 4 and 5 for all the questions. This may be because both have the same significance (they are on the same level) or because the respondent does not differentiate one from another, they are unclear (they refer to the same thing).

In our case, we believe that the respondent does not clearly differentiate the concepts. In Question 4 the overlap occurs in two intermediaries. In Questions 8 and 9, the respondents do not differentiate between public and private research institutions.

Question 4 analyses who are the agents that make the greatest innovative effort in the port itself, according to the perception of the Port Authorities.

Innovation is a phenomenon which is highly valued by all concerned in the Spanish port system (Blanco, Pérez-Labajos, Sánchez, & Serrano, 2010), but the effort made by the various agents involved in the normal running of the ports is not the same. The results obtained, ordering the agents from highest to lowest effort, are (see Table 5 in Appendix 2):

1. P4-3 Shipping agents
2. P4-6 Other Administrations (Inspection Services, Harbour Master, etc.)
3. P4-2 Terminals (general y specialised)
4. P4-4 Customs Agents
5. P4-5 Forwarding Agents
6. P4-1 The Port Authorities

The least participative have been the Port Authorities and the most, private businesses, the shipping agents (who are the representatives of the shipowners in port), those who operate the terminals (often through administrative concessions) and the intermediaries (customs agents and freight forwarders). Also of importance has been the role of other Public Administrations, mainly through the incorporation of the new technologies into their systems (inspection, detection, electronic processing, etc.).

It can be seen, then, that the financing of innovation takes place mainly through private initiative, from all involved in the area of influence of the port and that the port authorities are involved to a lesser extent.

The idea expressed in the above paragraph is coherent if we consider that one of the barriers to innovation identified by the Port Authorities, though not the most important one, was the shortage of their own financial resources (Blanco et al., 2010). It is logical to expect then, that faced with the lack of financial resources available to the Port Authorities, it will be the private companies operating in the port who carry out the investment.

Question 8 focuses on which organisms have been responsible for the development of the latest innovations (listed in Question 7 of the questionnaire). In addition, this question makes it possible to establish what percentage of these innovations have been developed in a coordinated manner, that is, if the Port Authority has selected in its answer more than one agent, the corresponding innovations are assumed to have been developed through cooperation agreements.

The results show that those responsible for developing innovations have been, from most to least (see Table 6 in Appendix 2):

1. P8-1 Port Authority
2. P8-3 State Ports and/or other Port Authorities
3. P8-5 Private research entities (consulting companies, private research centres)
4. P8-4 Public research entities (universities, public research centres)
5. P8-2 Entities of the Port Community itself

As can be seen, the "entities of the same port community", which encompasses among others private participation, are those that make the greatest effort, but those who develop innovations the least. This apparent contradiction has a clear interpretation: they finance the innovation but do not develop it. The innovations are bought, but not developed internally.

The role of the Port Authorities and State Ports is a very active one in the development of innovations, but not in their funding.

In addition, 45.5% of the innovations carried out were made jointly between several agents, so that it can be stated that the Port Authorities often resort to the strategy of cooperation in developing innovative activities.

In a previous study (Blanco et al., 2010), it was shown that the third obstacle to innovation faced by the Port Authority was "Difficulty in finding partners for cooperation in innovation". Despite this, almost half of the innovations in recent years have been implemented through cooperative agreements. Thus, one asks the question who are these partners who, together with the Port Authority, have made the innovations.

Question 9 asks which entities, of those enumerated in the previous question, are most valuable when it comes to finding a partner for cooperation in innovation. The results obtained for the ranking of agents, establishing who is or are considered as potential partners for future developments are as follows, from highest to lowest preference (see Table 7 in Appendix 2):

1. P9-1 Entities of the Port Community itself
2. P9-5 Private research entities (consulting companies, private research centres)
3. P9-4 Public research entities (universities, public research centres)
4. P9-3 Other port Authorities
5. P9-2 State Ports

As can be appreciated from the above classification, the preference is to cooperate with those who are within the area of influence of the port, rather than with other Port Authorities, who are normally seen as competitors, and also rather than the State Ports, which is the umbrella-group for all, but not a dynamic agent of differentiation, at least in theory.

The need for differentiation in order to survive leads us to prefer potential partners who may have common interests and do not represent competition.

From the classification outlined in the previous paragraphs, it can be deduced that the preference is for partners with similar characteristics, those whose scope and influence largely coincides with that of the Port Authority itself. Thus, first are the entities of the port community itself. Second are the research entities whose scope may be broader, covering several provinces, communities or even the whole country. Then come the other Port Authorities, who, obviously, are located in another geographical area but can share common interests in some cases and be rivals in others. And finally are the State Ports who, since this is an organism on which all of the Port Authorities depend, is not the first candidate to act as a partner for one main reason: the search for differentiation on the part of the Port Authorities.

DISCUSSION

Ports have to be competitive in order to be integrated, as links, in the international supply chains. In addition they also have to face internal competition in the country where they are located. To improve efficiency, innovation is needed, considered as a source of competitive advantage and differentiation.

The investments required share some characteristics:

a. They are usually quite substantial, making it difficult for them to be financed exclusively by the Port Authority.
b They are usually highly specific investments that do not always have alternati ve uses. Although they may have a degree of flexibility, they are not easily adaptable. This point means that agreements must be reached with the users (clients become logistical partners).
c. The problem of scale. The investments cannot normally be dimensioned (increased or decreased) gradually as the activity varies. Thus, problems of underuse or saturation may arise. In general, the facilities are over-dimensioned in anticipation of a growth in the activity.

However, since the resources of the ports to be assigned to innovation are scarce and since these are not conceived as independent entities, but rather as members or as a part of the logistics chain, it might be considered that the innovation strategy will affect the whole chain and thus that the development and financing will be shared among all those who form part of the port community.

CONCLUSIONS

1. The Rasch method is a suitable tool for undertaking studies on port innovation with categorical variables. We consider that, in comparison with other techniques, it provides a greater wealth of information. It enables more detailed analyses that allow us to find explanations, especially in rare cases. Its findings may guide decision-making by those responsible for port policy and, by establishing areas for improvement, guide future research.
2. Private enterprise in the port community assumes most of the financing of innovation, along with other authorities (Inspection Services, Harbour Master, etc.). However, they do not develop it. Most innovation is developed externally (it is bought).
3. The Port Authorities, given their limited resources, participate little in financing. However, together with the State Ports, they are the main driving force behind the development of innovations.
4. Cooperation is often recurred to for the joint development of innovations. This strategic approach is often aimed at entities of the port community itself. The preferred potential partners are those that enable us to achieve a greater differentiation and do not represent competition.

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APPENDIX 1: Questions and associated items

Question 4
In your view, assess the level of innovative effort made within the operation of the port by:

P4-1 The Port Authorities
P4-2 Terminals (general y specialised)
P4-3 Shipping agents
P4-4 Customs Agents
P4-5 Forwarding Agents
P4-6 Other Administrations (Inspection Services, Harbour Master, etc.)

Question 8
Indicate the main entity responsible for undertaking the main innovations carried out during the period 2004-2008 (you can mark several options, if the innovation has been developed in cooperation with other entities):

P8-1 Port Authority
P8-2 Entities of the Port Community itself
P8-3 State Ports and/or other Port Authorities
P8-4 Public research entities (universities, public research centres)
P8-5 Private research entities (consulting companies, prívate research centres)

Question 9
In your view, evaluate from 1 (not at all) to 5 (a lot) what type of partner you consider of most value for the innovation activities of your organisation:

P9-1 Entities of the Port Community itself
P9-2 State Ports
P9-3 Other port Authorities
P9-4 Public research entities (universities, public research centres)
P9-5 Private research entities (consulting companies, prívate research centres)

APPENDIX 2: Tables of Results

Table 4. Variable Maps.

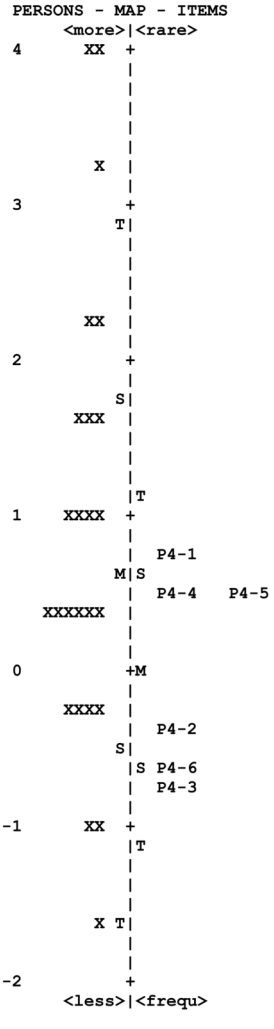
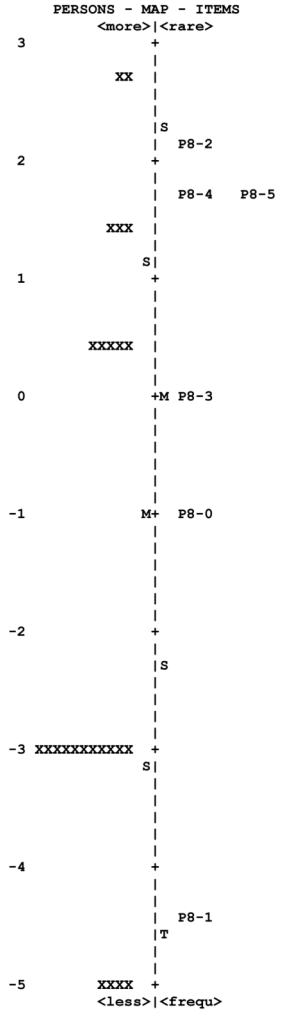
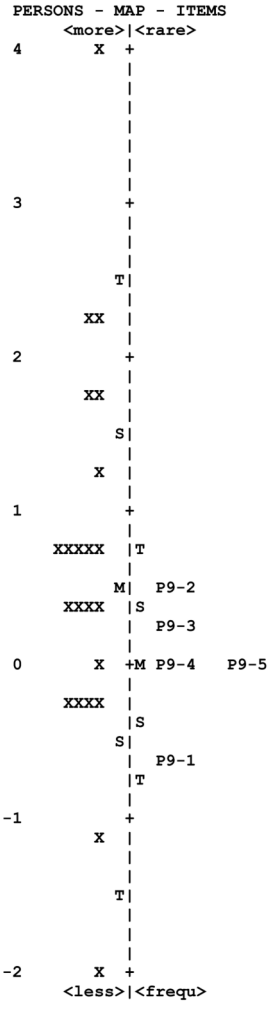
Question 4	Question 8	Question 9
		

Table 5. Question 4. Item statistics: Measure order.

ENTRY NUMBER[a]	TOTAL SCORE[b]	COUNT[c]	MEASURE[d]	MODEL S.E.[e]	INFIT[f]		OUTFIT[g]		PT-MEASURE		EXACT MATCH		ITEM[n]
					MNSQ[h]	ZSTD[i]	MNSQ[h]	ZSTD[i]	CORR.[j]	EXP.[k]	OBS%[l]	EXP%[m]	
1	76	25	0,74	0,36	1,33	1,3	1,34	1,3	0,49	0,64	52,2	60,1	P4-1
5	64	25	0,5	0,47	0,92	-0,4	0,83	-0,6	0,55	0,5	65,2	68,7	P4-5
4	54	25	0,44	0,43	0,81	-0,5	0,81	-0,5	0,68	0,56	69,6	71,3	P4-4
2	85	25	-0,4	0,39	0,88	-0,4	0,89	-0,3	0,6	0,54	60,9	63,7	P4-2
6	60	25	-0,59	0,45	1,19	0,7	1,17	0,6	0,32	0,47	60,9	71	P4-6
3	59	25	-0,69	0,43	0,83	-0,6	0,81	-0,6	0,66	0,56	78,3	69,5	P4-3
MEAN	66,3	25	0	0,42	0,99	0	0,97	0			64,5	67,4	
S.D.	10,7	0	0,58	0,04	0,2	0,7	0,21	0,7			8,1	4,1	

Table 6. Question 8. Item statistics: Measure order.

ENTRY NUMBER[a]	TOTAL SCORE[b]	COUNT[c]	MEASURE[d]	MODEL S.E.[e]	INFIT[f]		OUTFIT[g]		PT-MEASURE		EXACT MATCH		ITEM[n]
					MNSQ[h]	ZSTD[i]	MNSQ[h]	ZSTD[i]	CORR.[j]	EXP.[k]	OBS%[l]	EXP%[m]	
3	3	23	2,17	0,74	0,89	-0,2	0,36	-0,1	0,52	0,5	85,7	87,8	P8-2
5	4	23	1,66	0,69	0,79	-0,6	0,4	-0,1	0,61	0,6	90,5	85,2	P8-4
6	4	23	1,66	0,69	1,05	0,3	0,53	0,1	0,55	0,6	81	85,2	P8-5
4	8	23	-0,07	0,66	1,45	1,2	1,55	0,9	0,63	0,7	81	85	P8-3
1	10	25	-0,95	0,67	0,17	-2,6	0,15	-2,1	0,92	0,8	100	87,6	P8-0
2	19	23	-4,46	0,77	1,17	0,5	6,5	2,3	0,37	0,5	90,5	90,1	P8-1
MEAN	8	23,3	0	0,7	0,92	-0,2	1,58	0,2			88,1	86,8	
S.D.	5,5	0,7	2,27	0,04	0,39	1,2	2,24	1,3			6,6	1,9	

Table 7. Question 9. Item statistics: Measure order.

ENTRY NUMBER[a]	TOTAL SCORE[b]	COUNT[c]	MEASURE[d]	MODEL S.E.[e]	INFIT[f]		OUTFIT[g]		PT-MEASURE		EXACT MATCH		ITEM[n]
					MNSQ[h]	ZSTD[i]	MNSQ[h]	ZSTD[i]	CORR.[j]	EXP.[k]	OBS%[l]	EXP%[m]	
2	80	22	0,46	0,3	0,84	-0,5	0,85	-0,4	0,67	0,62	47,6	49,9	P9-2
3	70	21	0,24	0,3	0,92	-0,2	0,93	-0,1	0,66	0,65	40	49,5	P9-3
5	77	22	0,01	0,31	0,81	-0,5	0,84	-0,4	0,69	0,65	42,9	52	P9-5
4	79	22	-0,05	0,31	0,5	-1,6	0,55	-1,5	0,79	0,64	61,9	53,6	P9-4
1	87	21	-0,66	0,31	1,83	2,4	1,87	2,3	0,27	0,54	45	48,1	P9-1
MEAN	78,6	21,6	0	0,3	0,98	-0,1	1,01	0			47,5	50,6	
S.D.	5,5	0,5	0,37	0,01	0,45	1,3	0,45	1,2			7,6	1,9	

a ENTRY NUMBER is the sequence number of the person, or item, in your data, and is the reference number used for deletion or anchoring.
b TOTAL SCORE is the raw score corresponding to the parameter, i.e., the raw score by a person on the test, or the sum of the scored responses to an item by the persons.
c COUNT is the number of data points used to construct measures
d MEASURE is the estimate (or calibration) for the parameter, i.e., person ability or the item difficulty. Values are reported in logits with two decimal places.
e MODEL S.E. is the standard error of the estimate.
f INFIT is a t standardized information-weighted mean square statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's measure level.
g OUTFIT is a t standardized outlier-sensitive mean square statistic, which is more sensitive to unexpected behavior by persons on items far from the person's measure level.
h MNSQ is the mean-square infit or outfit statistic with expectation 1.
i ZSTD is the infit or outfit mean-square fit statistic t standardized to approximate a theoretical "unit normal", mean 0 and variance 1, distribution.
j PT-MEASURE CORR is the point measure correlation between the observations on an item and the corresponding person measures, or vice-versa. The point-measure correlation has a range of -1 to +1.
k PT-MEASURE EXP is the expected value of the correlation when the data fit the Rasch model with the estimated measures.
l EXACT MATCH OBS%: observed % is the percent of data points which are within 0,5 score points of their expected values.
m EXACT MATCH EXP%: Expected % is the percent of data points that are predicted to be within 0,5 points of their expected values.
n ITEM is the name of the list of persons (data rows) or items (data columns) reported her.

FINANCIACIÓN Y DESARROLLO DE LA INNOVACIÓN EN PUERTOS MARÍTIMOS COMERCIALES

ESUMEN

La innovación se está convirtiendo en un motor fundamental en la mejora del bienestar social, un factor crucial para el crecimiento y la supervivencia de las empresas a largo plazo y un elemento clave para conseguir un desarrollo sostenible de las economías.

En el sector portuario, las profundas transformaciones originadas por el proceso de globalización, están llevando a los puertos marítimos comerciales a diseñar estrategias en el ámbito de la innovación, que permitan asumir retos presentes y futuros, en un sector en el que la desregulación y la competencia son elementos de presencia creciente.

En dicho contexto, en el presente trabajo se analiza la innovación en los puertos marítimos comerciales. El objetivo específico es determinar quién desarrolla y financia la innovación en los puertos marítimos comerciales. La metodología de análisis aplicada es la técnica de Rasch. Se han utilizado variables categóricas en las encuestas pasadas a las Autoridades Portuarias del sistema portuario Español. Los resultados obtenidos en torno a la innovación en el ámbito portuario español, permiten responder a cuestiones tales como: ¿quiénes la financian? ¿quiénes la desarrollan internamente o la compran? ¿quiénes actúan individualmente? ¿quiénes recurren a la cooperación y qué socios eligen para el desarrollo conjunto de las innovaciones?

METODOLOGÍA

Para obtener información sobre la innovación en el ámbito del sector portuario español se realizó una encuesta por correo postal y/o electrónico a las 28 Autoridades Portuarias existentes en España. El número de contestaciones válidas ascendió a 25.

El cuestionario original consta de 15 preguntas. El presente trabajo se centra en el análisis de las preguntas 4, 8 y 9 del citado cuestionario que se recogen en el anexo 1. La 4 sobre quién financia la innovación, la 8 sobre quién la desarrolla y la 9 sobre los socios preferidos para cooperar.

La metodología de análisis utilizada es la técnica de Rasch, y el software empleado ha sido el Winsteps (Linacre, 2010).

CONCLUSIONES

1. El método Rasch es una herramienta adecuada para realizar estudios sobre innovación portuaria con variables categóricas. En comparación con otras técni-

cas, creemos que aporta una mayor riqueza informativa. Permite análisis más detallados que nos ayudan a encontrar explicaciones, especialmente en los casos raros. Sus resultados pueden orientar la toma de decisiones de los responsables de la política portuaria y, al establecer aspectos a mejorar, orientan la investigación futura.

2. La iniciativa privada de la comunidad portuaria es la que asume la mayor parte de la financiación de la innovación, junto con otras Administraciones (Servicios de Inspección, Capitanía, etc.). Sin embargo, no la desarrollan. La mayoría de la innovación es desarrollada externamente (se compra).
3. Las Autoridades Portuarias, dada su escasez de recursos, participan poco en la financiación pero, junto con Puertos del Estado, son los principales agentes dinamizadores del desarrollo de las innovaciones.
4. Frecuentemente se recurre a la cooperación para el desarrollo conjunto de innovaciones. La apuesta estratégica se dirige a entidades de la propia comunidad portuaria. Como socios potenciales se prefiere a los que nos permitan alcanzar una mayor diferenciación y que no representen competencia.