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Analysis of port sustainability using the PPSC methodology (PESTEL, Porter, SWOT, CAME)

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ABSTRACT

Modern societies are demanding sustainable activities within all processes, industrial, commercial, etc. This is not unrelated to transport or ports, as they are one of the most decisive links in the transport chain for promoting sustainable operations. To this end, a PPSC (PESTEL, Porter, SWOT, CAME) methodology has been developed to analyse port sustainability in the Spanish Port System. This will make it possible to determine the areas where a good route is being followed and where the greatest deficiencies and problems exist. Finally, it proposes a series of lines of action that will make sustainability a reality. The main conclusion drawn is that it is necessary to pay close attention to the main driver of innovation: human capital. In this way, the opportunities offered by new technologies will be better exploited.

Keywords: PESTEL, Porter, SWOT, CAME, port sustainability

1. INTRODUCTION

In 2015, more than 150 heads of State and Government met at the Summit on Sustainable Development, which adopted the Agenda 2030 on Sustainable Development, which aims to

enable countries to improve the lives of all, with 17 goals of universal application that came into force in 2016 [1].

These goals are heirs to the Millennium Development Goals, although, in addition to expanding them, they seek to achieve the goals that were not achieved then [2]. Therefore, they encourage all countries, regardless of their economic level, to adopt measures that protect the planet and promote prosperity [3]. In addition, they recognise that efforts to end poverty must go hand in hand with strategies that promote economic growth and address a range of social needs [4].

As in other areas, sustainable development also applies to ports, both at national and international level [5]. This is because such effects as global warming produce consequences, such as rising sea levels, which greatly affect maritime transport and thus port infrastructure.

At present, one of the main achievements to be made in ports is sustainable development, which is becoming increasingly important and is being taken more into account when carrying out various actions and planning. However, there is no clear methodology that allows the concept to be applied more widely.

In the Revised Text of the Law on State Ports and the Merchant Navy (RDL.2/2011), the term sustainability is introduced as one of the pillars on which ports should be planned and managed with two objectives:

- 1) To achieve a port development committed with the environment and according to the available resources, in a way that contributes to a harmonious and balanced growth that does not put in between the desirable quality standards of our future generations.
- 2) To contribute to an integrated transport system, which favours the achievement of sustainable mobility, in which, in addition to road transport, there is room for maritime and rail transport, in line with the European policy guidelines in force today.

This is the basis of port sustainability policies [6].

With the 2011 Ports Act, the Port Authorities are obliged to draw up the draft Business Plan on an annual basis, in accordance with the defined objectives. Thus, among other aspects, it must contain the objectives and indicators of environmental sustainability of the port, as well as a sustainability report [7]. Meeting these objectives can lead to a reduction in port charges, which aims to increase the competitiveness and sustainability of port activity and the transport system, both economically and environmentally.

In Spain, Port Sustainability Reports have been drafted since 2011 [8]. These reports have the aim of measuring, disseminating and rendering accounts to internal and external stakeholders in relation to the organisation's behaviour with respect to the objective of sustainable development.

Thanks to port sustainability and the reports prepared on it, the State Ports and Port Authorities are able to materialise their commitment to transparency in their management, providing a broad vision of their achievements and challenges in aspects such as competitiveness, quality in the provision of services, efficiency in the use of resources and their impact on their environment, whether economic, social or natural [7].

The aim of this article is to carry out an analysis of port sustainability using the PPSC methodology, i.e. a PESTEL, Porter, SWOT and CAME analysis.

The sustainability situation will be analysed by means of four types of analysis, ranging from the study of the environment to the study of the real situation in which the ports find themselves, as well as risks and opportunities.

Thanks to them and their subsequent analysis of results, it will be possible to locate the areas where a good route is being followed and where the greatest deficiencies and problems exist. Finally, it will be possible to propose a series of lines of action that will make sustainability a reality, thus reducing the possible damage caused in the different areas of application of the concept in ports, while generating a benefit at the social, economic, environmental and institutional levels.

2. KNOWLEDGE STATUS

Due to the great importance that the term sustainability in ports is acquiring, research has begun to be developed in order to measure port sustainability, although it is true that there is still some way to go.

The article by González et. al. in 2010 [9] aims to develop a series of indicators with which to measure the state of Spanish ports in relation to the concept of sustainability. In addition, the aim is for the index to allow comparisons between them and thus generate a ranking.

To this end, a so-called "Synthetic Index of Sustainability of Ports (ISSP)" is defined, which is structured in a pyramidal structure, comprising four components divided into various indicators. Finally, a total of 73 variables are selected, grouped into 33 sub-indicators, concentrated into 13 indicators, to be distributed in the four dimensions of sustainability, that is, the institutional dimension, the economic dimension, the social dimension and the environmental dimension.

The article by Molina et al. [10] makes use of Bayesian networks to find out the relations between variables in the exploitation and management of infrastructures, such as ports. A methodology is created in which a database with port variables of the four dimensions of sustainability and a network through an acyclical degree directed to know the relations between the variables have been developed. It is observed that the most decisive variables for port sustainability with the institutional ones, so that the economic, social and environmental dimensions are effects of these variables. For this reason, the Port Authorities must incorporate the tools for the regulation of port services and the management of the public domain that the Ports Act provides for in the area of sustainability.

The Doctoral Thesis of Orive A.C. [11], deals with the selection and application of environmental sustainability indicators to study Spanish ports based on the concept of "green port", which are those ports that bet on sustainability in the environment, by becoming aware of the impact that ports and maritime transport have on the marine, atmospheric and land environment. For the study, the 28 Port Authorities of national interest that exist in Spain were consulted. The main conclusion was that the use of the cluster methodology in the port environment, based on the definition of indicators, is effective. In the proposed case study it is demonstrated that the clusters correctly reflect the Spanish port reality.

In order to know the state of port sustainability in Spain, the sustainability reports carried out in the Spanish port system are used. These reports are divided into the four dimensions of sustainability:

- 1) Institutional: the main aspects related to port infrastructure, target markets, financial viability, institutional communication, operational efficiency and service quality appear in relation to the sustainability challenges established by the port authorities.

- 2) Economic: describes the main economic and financial results of the port system, as well as the structure of investments and the main challenges and achievements in relation to productivity.
- 3) Social: it is mainly based on human resources policy. It includes the training actions developed under the competence management scheme, the equality plan and the efforts made in the area of health and safety.
- 4) Environmental: environmental impacts are evaluated, both on the aquatic environment and on land and air. In addition to evaluating the measures carried out by the port authorities to reduce or mitigate them.

Since the application of sustainability in Spanish ports is relatively recent, and no specially established bases or methodologies can be found, international experience should be used to see what the main differences are between Spanish ports and the rest.

If an analysis of the situation of port sustainability at European level is carried out, the PORTOPIA project carried out by the European Commission can be taken as a basis. PORTOPIA [12] is a project financed by the European Commission, launched in September 2013, which includes

- 1) Indicators of market trends and structure
- 2) Socio-economic indicators
- 3) Environmental and occupational indicators, safety and protection
- 4) Supply chain and operational performance indicators
- 5) Governance indicators
- 6) Indicators of users' perception of the quality of the port

Some of these indicators refer to the state of the world.

Currently, the report focuses on building on the existing data set of the European Sea Ports Organisation (ESPO, the main trade association of European ports), such as the Rapid Exchange System for traffic data and the ECOPORTS project [13]. The Market Trends and Structure section and the Environmental section of the report are therefore the most developed sections. For the other categories, we currently refer to other sources, or highlight the ongoing developments of the PORTOPIA project [14].

For the management tools to be applied, the current application of the PEST or PESTEL analysis to the port environment is very scarce. Only two final papers from different universities have been found.

The first of these, carried out by Garcia in 2017 [15], with the help of the PESTEL analysis, among others, will attempt to define ways of improving the environment of the three ports managed by the Valencia Port Authority, including the commitments of the companies and/or terminals working in these ports. Thus, based on a company's strategic environmental plan, a strategic environmental plan will be obtained for a group of companies working in the same territory.

The second work was developed in 2019 by Martínez-Moya et. al [16]. In this case no specific aspect related to port sustainability is developed, but it is related to the port environment. Thus, what is done is to undertake an analysis, both externally, through PEST, and internally using a SWOT analysis. The final objective is to analyze the model of optimization of empty container movements and propose its expansion by incorporating the age of the container.

Porter analysis is cited in numerous articles and papers. However, many of them do not carry out an analysis as such, although two works have been found that do carry out the analysis of the five forces in aspects related to Spanish ports.

Esparza et. al, with their work in 2017 [17], aim to provide Port Authorities with a tool for making decisions objectively, both when granting licences and during the service provision period. It also offers a series of measures to improve the quality of service provision as well as saving on the cost of goods passing through the port. The Porter is used to determine which measures have acted on the potential of the Spanish port sector and its competitiveness.

The second work is earlier, from 2007 [18], and applies in a comprehensive way the analysis of the five forces to very specific characteristics. It is a fairly detailed analysis of the Spanish port system. The aim is to improve the efficiency and competitiveness of a port, in accordance with its strategy, which is clearly oriented towards the client, in a world of high competition between ports and between logistics chains in which they are integrated and in which the generation of added value, sustainability and integration into the environment are basic prizes. SWOT analysis is the most widely used analysis methodology in the port environment. There are many works that take SWOT analysis into consideration. An example of this is the 2017 work of Nebot et. al [19], which aims to analyse the organisational structure of port-related organisations, their potential, the relations between them and how this affects port policy. To this end, four SWOTs of different aspects are carried out: on the convenience of formulating a new model of port management, on the port management formulated, on the set of actors of the port policy on the proposals for improvement in the management of the port territory and on the formulation of the new regime for the provision of port services.

Finally, for the CAME analysis there are no real examples in the port environment. However, the Port of A Coruña, together with its Port Authority, in its "Technical Specifications for the Contracting of Technical Assistance to support the design, drafting and implementation of the Strategic Plan 2016-2020 of the Port of A Coruña", establishes that a SWOT analysis and a CAME analysis must be carried out in order to identify strategic alternatives that will allow it to organise itself. After this analysis, a definitive SWOT and a new CAME is carried out to determine the strategic goals, evaluating the necessary resources so that these can be achieved.

3. KNOWLEDGE STATUS

The main objective of this article is to show the results after performing a PPSC analysis, which involves performing a PESTEL analysis, a Porter analysis, a SWOT analysis and a CAME analysis. It should be noted that these analyses have their field of application widely developed for the business and industry field and very little or not at all developed for the port field, sustainability and, much less, in the specific case of port sustainability.

Figure 1 summarises the methodological process that has been followed to prepare and develop the project. Below, it is explained what each of the analyses consists of.

3. 1. Study of the working scenario

International Benchmarking

Benchmarking consists of taking "comparators" or benchmarks on those products, services and work processes belonging to organizations that evidence the best practices in the

area of interest, with the purpose of transferring knowledge of best practices and their application.

To this end, a compilation of indicators is made, both at a Spanish and European level, to see which are the main aspects taken into account when assessing the sustainability of ports.

The information on the indicators at the Spanish level comes from the Sustainability Reports documents that are redacted annually in Spanish ports.

Selection of indicators

Once the most important indicators at national and international level have been identified, the most useful indicators for the analyses to be carried out are selected with the help of the expert panel.

In this particular case, the panel of experts chose to select particular indicators for each of the analyses as this allows a more accurate view of each of them and therefore provides much more useful information.

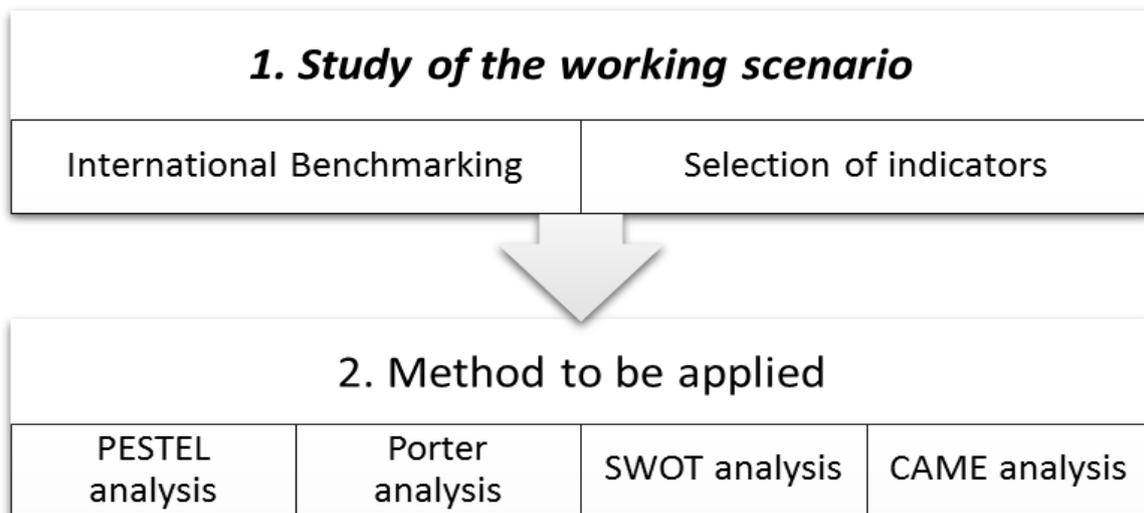


Figure 1. Methodology schedule

Delphi panel

Using a Delphi panel, the aim is to collect opinions from different groups of experts through iterative, anonymous consultation on issues relating to future events. The aim is to reach a single conclusion or consensus, but always with maximum autonomy on the part of the participants. Therefore, the predictive capacity is based on the systematic use of an intuitive judgment issued by a group of experts, so that this type of panel helps to explore in a systematic and objective way problems that require a concurrence and/or a qualified opinion.

In the case of the sustainability of the Spanish port system, so that the result is as complete and as representative of reality as possible, experts from different areas, both from the public and the private sector, as well as students involved in this area have been brought together to provide a fresher and more innovative vision.

3. 2. Method to be applied

PESTEL analysis

According to Yünkel [20], the objective of the PEST analysis is to identify the opportunities and threats that the national context generates on a company. It is a strategic management tool, used mainly to plan strategy based on an analysis of the environment. The precursors of this method of business analysis were Liam Fahey and V.K. Narayanan with the publication in 1968 of their essay on marketing entitled "Macro-Environmental Analysis in Strategic Management". This analysis takes into account political, economic, social and technological factors, forming the acronym PEST. However, legal and environmental factors are often included, thus establishing the name PESTEL analysis.

The information provided by this study allows us to characterise elements of the factors and to outline the macro-environmental panorama of the element in question. Therefore, by using it, it is possible to anticipate events and therefore better visualise decision making. Likewise, the fact of allowing the representation of everything in a scheme makes its complete visualization easier.

Porter Analysis

The Porter analysis was developed by the American economist Michael Porter in 1992. It is a model that studies the forces that intervene in the market and through it allows to place an activity in relation to the others. In this way, it is possible to maximize resources and, if necessary, overcome competition.

SWOT Matrix

The SWOT analysis responds to the initials of Weaknesses, Threats, Strengths and Opportunities. It is a self-analysis tool for companies that want to know their situation or that of their products in the market. The results obtained from this type of analysis can also help in decision-making.

The SWOT analysis is represented in a matrix divided into two parts:

- 1) Internal analysis (Strengths and Weaknesses): this part details the strengths and weaknesses of the company's situation.
- 2) External Analysis (Threats and Opportunities): this part shows the external part of the company that may affect its activity, either negatively (threats) or positively (opportunities).

The objective is to identify each element and define a strategy that will enhance strengths, overcome weaknesses, control threats and take advantage of opportunities.

CAME Analysis

For its part, the CAME analysis responds to the Correct, Adapt, Maintain and Explore initiations. It consists of a methodology that complements the SWOT analysis and suggests guidelines for action based on the results obtained.

To carry out this type of analysis, first a strategy will be established with the general objectives, so that the second step is to complete a SWOT analysis and see the situation in which the company is. Then the results obtained in the analysis will be taken and organized

hierarchically. The fourth step is to perform the CAME analysis itself. For this purpose, for each SWOT element previously selected, actions will be associated whose objective is to correct, face, maintain or exploit (Figure 2).

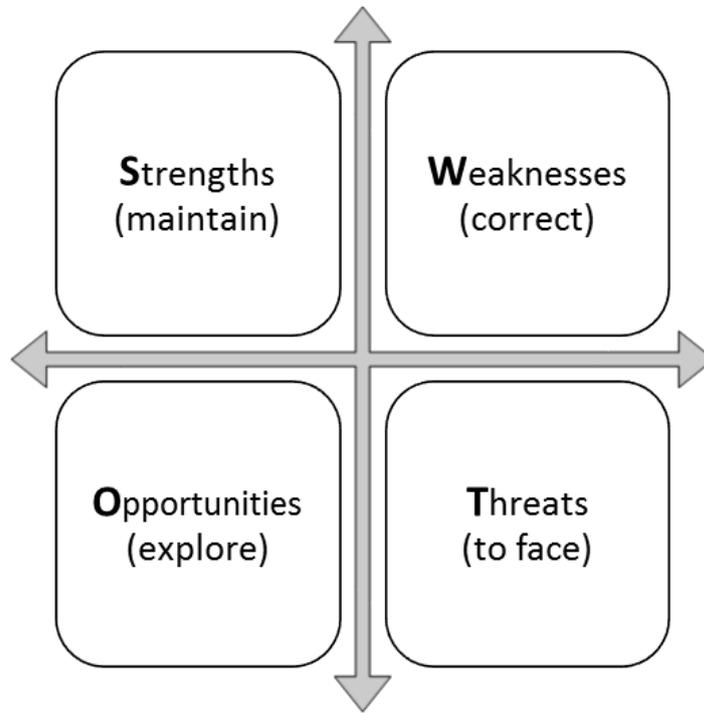


Figure 2. SWOT analysis

The fifth and final step is to carry out a follow-up to check that the actions taken have been useful and that the objectives have been met.

3. 3. Analysis of results

After the various analyses have been carried out, a compilation is made of the most important aspects arising from the selection of indicators and the processing of the four analyses carried out. In this way, a series of results will be obtained, making it possible to compare them with the results obtained by other authors. Likewise, based on the results obtained, the subsequent conclusions will be obtained.

4. RESULTS

4. 1. Study of the working scenario

A fundamental part of the research consists of compiling representative indicators for measuring sustainability in the Spanish port system. This process of identification, selection and subsequent assessment of variables is a priority since these indicators must objectively characterise the current situation of the ports.

Initially, the indicators used in the Spanish port sustainability reports and those of the PORTOPIA project are collected so that, once compiled and analysed, the most representative ones are selected for analysis.

In the sustainability reports, the indicators are divided into the four dimensions of sustainability (institutional, economic, social and environmental) and within each of them, different groups are differentiated, which in turn include another series of more specific variables. Thus, within each of the dimensions, the variables included are

- 1) Institutional dimension: there are 10 groups that contain 37 indicators
- 2) Economic dimension: there are 5 groups with a total of 15 indicators
- 3) Social dimension: 7 groups with 24 indicators
- 4) Environmental dimension: there are 7 groups and 35 indicators

By merging the indicators of the Spanish reports and those used in the PORTOPIA project, the 165 indicators considered in the analyses are those shown in Figure 3.

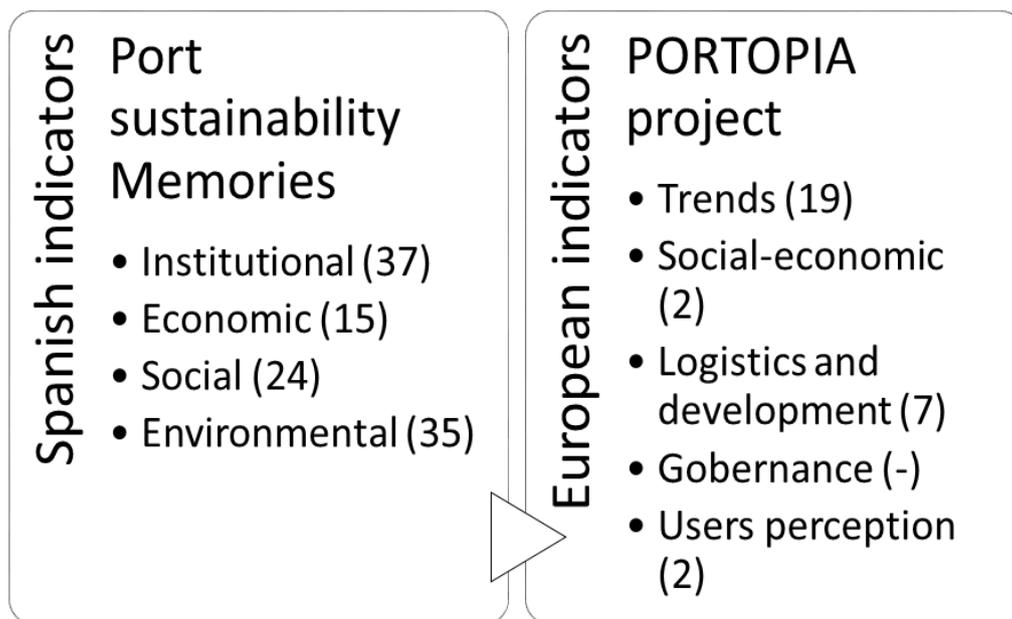


Figure 3. Considered indicators

4. 2. Results of the methods applied

PESTEL analysis

In order to develop the PESTEL analysis it is necessary to assimilate the six aspects that make up the name of this analysis, i.e. political, economic, social, technological, ecological and legal. Each aspect must be associated with a series of indicators that fit in with the object of the analysis and that allow the state of Spanish port sustainability to be understood in its national context.

After summarising various documents and scientific articles, the conclusion has been reached that the indicators to be analysed in each of the parts are those shown in Table 1.

Table 1. PESTEL analysis indicators

Dimension	Description
Political	Infrastructure and service
Economic	Economic situation Investments
Social	Employment Training Staffing structure Health and Safety
Technological	Information Technology Innovation in the Port System
Environmental	Environmental Management Environmental qualities Waste management Eco-efficiency
Legal	Institutional Economic Social Environmental

Porter Analysis

In this case, the first step is to relate aspects of port sustainability to the different actors in the model developed by M. Porter. Thus:

- 1) Clients: in this case the clients of port sustainability are the cities and the shipping companies.
- 2) Competition in the market: this is understood as competition between ports at an international level, for example, how the port sustainability system in Spain affects the way it competes with other ports in the surrounding area.
- 3) New entrants: how it affects the other ports at an international level to improve their performance in terms of port sustainability.
- 4) Suppliers: those in charge of providing sustainability are the European and Spanish institutions in the area of sustainability.
- 5) Substitutes: to study which can be the possible substitutes for the sustainability model.

Once this simulation has been carried out, the indicators of each of Porter's five forces will be those shown in Table 2.

Table 2. Porter analysis indicators

Force	Description
1. Bargaining power with customers	Port-city relationship Relationship with navy companies
2. Competition between ports	Study of the main competitors in Spain
3. Threat of potential entrants	New entrants
4. Bargaining power with suppliers	European level negotiation Spanish level negotiation Negotiation model
5. Threat of substitute products	Substitute products

SWOT matrix

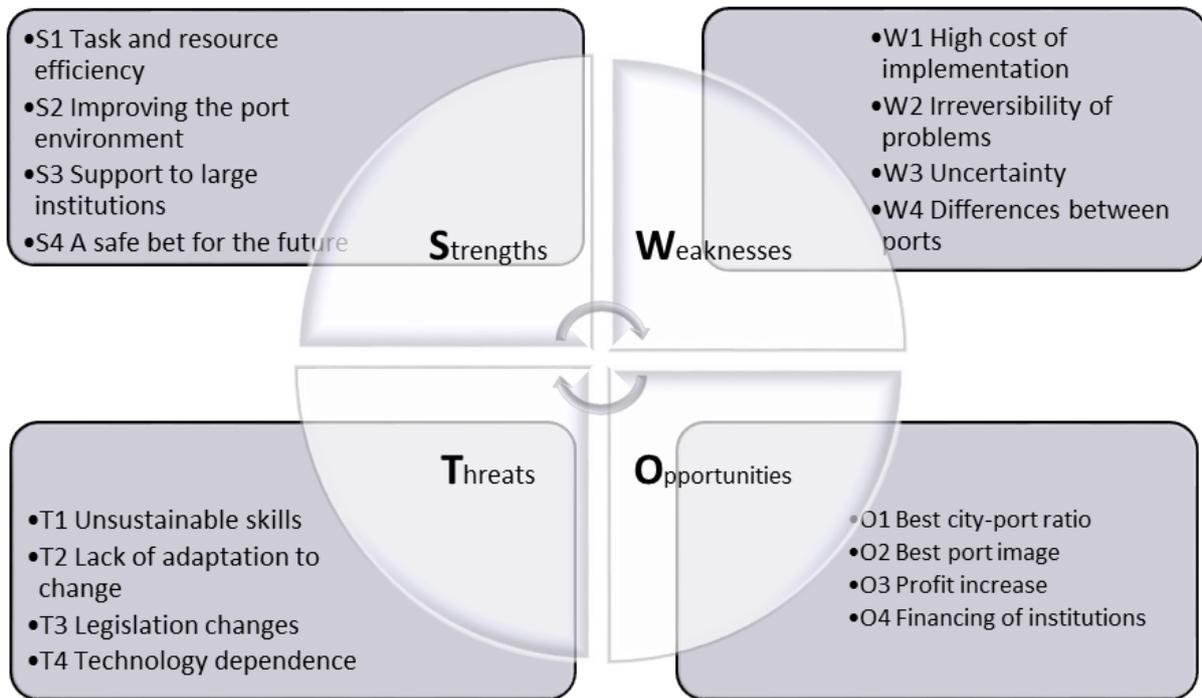


Figure 4. Results of SWOT analysis

With the SWOT analysis, a comprehensive analysis is made internally and externally of weaknesses, threats, opportunities and strengths. Therefore, it is not necessary to establish some indicators as such, but simply to make a global synthesis of other analyses and of the

information from different documents that have been reviewed to obtain the virtues and problems of each of the aspects.

The panel of experts, many of them with long careers in aspects related to the port environment and with numerous scientific articles published on the subject, provides an accurate view of the state of the Spanish port system. Likewise, the fact that we also have experts who are studying and training in this area provides a much fresher and innovative vision to the analysis and the fact that we have experts who are developing their professional career in the educational field of the School of Marine, Canals and Ports of the Polytechnic University of Madrid also provides important background in teaching and lecturing on the port system.

A total of sixteen people actively participate in this analysis and, on occasion, a total of some thirty people, ensuring accurate and contrasted information on the current situation of the sustainability of the Spanish port system.

The results obtained for the SWOT matrix are shown in Figure 4.

CAME analysis

For the realization of CAME, a numerical SWOT is elaborated, through a survey with experts from all fields. For this purpose, two rounds of the survey were carried out to contrast the results among the experts and thus make a more complete analysis. The results are shown in Table 3.

Table 3. CAME analysis results.

First round	Quadrant I	Quadrant II
	96	102
	Quadrant III	Quadrant IV
	93	124
Second round	Quadrant I	Quadrant II
	97	1032
	Quadrant III	Quadrant IV
	90	126

In view of the results of the second round, the quadrants with the lowest and highest scores are, respectively, the Weakness-Opportunity ratio. Therefore, it will be necessary to establish reorientation strategies and the Strength-Opportunity relationship, so offensive strategies will be developed.

The types of strategies to be developed are of two types:

(1) Reorientation Strategies

The relationship within the highest scoring quadrant is that of high cost of implementation of measures with financing by large institutions (D1-O4).

In this case, although it is true that there is funding from organisations and companies such as the European Union or ESPO, the available budget does not cover a significant part of the proposals and actions that improve areas of sustainability such as the improvement of pipeline systems, the implementation of automated terminals or the improvement of intermodality.

The study carried out by ESPO [21] concludes that European ports need around 48,000 million euros in the period from 2018 to 2027. This same study shows that the port authorities require 2.5 billion euros between 2014 and 2017, of which they receive 860 million euros, representing 35% of the investment required and 4% of the funds available from the European Union.

According to Eamonn O'Reilly, President of ESPO, investment in Europe's seaports is essential if critical policy objectives are to be achieved in a wide range of EU policy areas. If Europe's seaports cannot undertake the necessary investments, then key policy objectives in transport, energy and the environment will be compromised.

Therefore, ESPO is committed to the Connect Europe Mechanism taking into account the following elements:

- 1) Subsidies as an essential component of the financing of port projects with high added value but low financial returns.
- 2) A well-defined and transparent methodology to de-finance the European Union's added value, which goes beyond "cross-border" projects.
- 3) Responsible management of grants, through a more rigorous cost-benefit analysis.
- 4) A long-term vision of funding priorities to enable ports to prepare high quality projects
- 5) Co-financing will be defined on the basis of the funding gap.
- 6) The appropriate level of support: port projects not involving national or regional funds should not require prior support from the Member State.

In addition to the economic aspects, it is important to raise awareness among port employees about their future, as computer developments, to a greater or lesser extent, affect their work and staff may become reluctant to change. It is therefore proposed that conferences or talks be held to inform staff of these issues and thus make them understand how their work will change and how they must adapt to them in order to achieve an inclusive and sustainable port environment.

(2) Offensive Strategies

In this case, the relationship with the highest score is between support from large institutions and funding from large institutions (F3-O4).

As in the case of the reorientation strategy, reference is made to the funds allocated to the ports by institutions such as the European Union, since, to a large extent, the more funding there is, the more support they show. However, it is not only a question of economic funds but also of the obstacles that these bodies can impose on ports when developing new measures or approving projects.

The European Commission has repeatedly stressed that the administrative burden reduces the attractiveness of ports, which affects their overall performance [22]. The main problem is that EU Short Sea Shipping has to compete with other modes of transport that are not subject to the same controls. In recent years, a number of EU initiatives have been launched to reduce red tape in ports, including the rationalisation of the forms of ship reporting to ports applicable from 19 May 2012. These initiatives should be encouraged and complemented in order to

achieve bottom-up, networked and consumer-oriented port services. It is therefore decided to take the following actions, in line with the project "Ports: engine of growth". The Commission will continue to develop its initiatives in the following areas:

- 1) The 'Blue Belt' initiative, which aims to reduce the administrative burden for EU goods carried by ships sailing between EU ports to a level comparable to that of other modes of transport, including further simplification of customs procedures [23]. This initiative also occupies a prominent place in the framework of the Single Market Act II.
- 2) Reinforcing the harmonisation and coordination of the implementation of Directive 2010/65/EU on formalities for ships arriving in and/or departing from ports of the Member States by establishing guidelines for 'national single windows', which should be operational by 1 June 2015.
- 3) The "e-Maritime" initiative, aimed at promoting the use of electronic information for administrative burden reduction and business activity.
- 4) The e-Freight initiative, which aims at facilitating the exchange of information in multimodal logistics chains and will contribute to improving the efficiency of ports as important multimodal platforms.

Furthermore, new legal provisions are being introduced to promote dialogue between port stakeholders (users, service providers, authorities and workers) and to contribute to the effective implementation of the above-mentioned actions.

5. ANALYSIS OF RESULTS. DISCUSSION

The main results derived from the analyses are:

- 1) Future traffic demand per port is expected to be met with the current port area. Therefore, the investments destined to this aspect will be reduced.
- 2) Investments by the public sector continue to decrease while the relative importance of outside investment has increased.
- 3) Workers are increasingly better trained due to the application of ICT technologies and the implementation of courses. However, the average age of workers is quite high. Women are becoming more important in the structure of the workforce.
- 4) The future is innovation, through digitalisation and automation of terminals. It is a safe bet due to the high value in the short, medium and long term.
- 5) More funds are being allocated to improve environmental quality by developing actions and projects focused on this. In addition, measures are being implemented to reduce the consumption of resources.
- 6) The measures resulting from effective collaboration between ports and cities are more successful and beneficial to both. Investment in this area is needed because of its growing importance.
- 7) Although the influence of ports on shipping companies is limited, certain measures can be developed to attract them. In fact, thanks to sustainable measures, bonuses can be applied to operators who meet a number of requirements.
- 8) The average rates in Spanish ports are usually higher than those in other ports, although this depends on the type and size of the ship and the Spanish seafront, with the

Mediterranean being the cheapest, while the Atlantic and southern ports have higher prices.

- 9) The threat of possible entrants is seen as something positive, since as more ports have the same vision and values more efforts will be made to improve. They will even be able to share proposals to be adapted in other ports.
- 10) The negotiating power of ports with the European Union is direct, however, it is not possible to estimate well to what extent they can influence the proposals that are made. At country level the negotiation is indirect, as rules are made according to what the European Union deems appropriate.
- 11) In view of the opportunities, weaknesses, strengths and threats, efforts must be combined to obtain more funding from the European Union and to reduce bureaucratic obstacles in ports. The European Union is already carrying out projects whose strategic lines are focused on this.

6. CONCLUSIONS

Following the development of the PPSC Analysis (PESTEL-Porter-SWOT-CAME) of sustainability in the Spanish port system, it has been seen that thanks to the methodology of these analyses, the objective of applying management strategies to analyse sustainability in the Spanish port system has been achieved, thus defining the positive aspects to be promoted and the negative ones to be corrected.

It has been observed that there is a great deal of literature on ports but that it is necessary to unite, analyse and filter all the information to see which are the strategic lines on which action should be taken in order to ensure that sustainability is not a future and intangible objective, but that it can begin to be implemented as soon as possible for the benefit of society as a whole.

The port industry is in a period of change and needs innovation to meet future challenges. Above all, models of change and innovation must be in favour of the environment and the progress of countries. Therefore, much attention needs to be paid to the main driver of innovation: human capital. In this way, the opportunities offered by new technologies will be better exploited, and it is important that change is approached as an opportunity since the ultimate goal is to underline the importance of operating in a more sustainable manner.

In conclusion, there are a number of future trend lines that ports will experience over time and to which they will have to adapt in order to achieve the greatest benefits and be stable in the long term.

The current trends grouped by dimensions are:

Institutional Dimension

- 1) There will be more and more cooperation between European ports. Projects are being carried out to connect Europe and thus the various ports. In addition, transparency, streamlined processes, increased investment, etc. are being sought.
- 2) There is a commitment to technological innovation such as digitalisation or terminal automation as they streamline processes and improve areas such as worker training through online courses.
- 3) Synchronisation between the different means of transport is sought, by means of logistics and intermodal solutions, platforms, etc.

- 4) The Port Authorities will be in charge of coordinating cyber security in the port communities.

Economic Dimension

- 5) In an increasingly global world, the aim is to stand out from the rest of the ports by increasing efficiency and competitiveness, as this reduces the time that shipping companies spend in the ports, thus reducing their cost and saving on resources.
- 6) Transparency in processes and management is sought, since this attracts investment, especially from private entities and therefore benefits. This is being achieved through the implementation of computer systems through which economic data are public and anyone can have access to them.

Social Dimension

- 7) The relationship between the port and the city is becoming more and more relevant as we can see that the better the relationship, the greater the possibilities of growth in the economy, employment and trade.
- 8) Respecting skills, social dialogue in ports, training, talent management, change management, diversity and the inclusion of women.
- 9) Horizontal and vertical cooperation, connectivity with customers and service providers. Vertical integration.

Environmental Dimension

- 10) Due to Agenda 2030 and the objectives of Sustainable Development, environmental quality and the fight against climate change will be very important in the ports of the future. This is because ports bear as much responsibility for the effects produced on the environment as they do for the task of protecting themselves against the future effects of global warming.
- 11) Becoming Green Ports in terms of equipment and use of renewable energy to meet the expectations of customers and neighbouring cities.

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