Performance measurement in Port Authority: an exploratory study

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ABSTRACT: *This study is meant propose a method to choose a set of scientific articles about performance measurement in Port Authority. This research includes the analysis of articles in Web Of Science and Scopus. The process selected was taken from the Knowledge Development Process – Constructivist (ProKnow-C). The ports are traditionally evaluated following the multi-port approach with the economic vision and the single-port approach with the engineering vision. The selection of performance indicators is divided into "specific methodology" when the indicators are related to operational objectives and "methodology of the criteria" when they are connected to elements that guarantee the highest quality for the consumer. Single-port approach is based on a comparative analysis of throughput over time. The optimal throughput is based on port's economic objective, for example from the technical efficiency controlled by cost function and operative efficiency founded by profit function.*

KEYWORDS – *ProKnow-C, Port Authority, Performance Measurement, Key Performance Indicator.*

I.   INTRODUCTION

Since the 1990s the process of relocation of production has changed the port's vision. Ports have become important for the countries' development. In this contest the researchers have been developing different models to support decision-making, based on paradigms of efficiency and effectiveness. The study of efficiency and effectiveness is linked to performance measurement. Recently literature reviews have been started for port efficiency studies, because effectiveness is a subsystem of efficiency [1]. However, although there is an extensive literature on efficiency and effectiveness, there are some points where researchers are not united. This problem is connected to port models and Port Authority's functions. Word Bank and UNCTAD give guidelines to improve the efficiency and effectiveness but don't provide a univocal vision for performance measurement in Port Authority.

This study began with three questions: "How to know about the theme performance measurement in Port Authority?"; "How to identify the frontier of the knowledge?"; "Is it really a topic of interest the performance measurement in Port Authority?".
The paper is structured as follows: 2) literature review on the use of Proknow-C; 3) reserch Design; 4) results, 5) conclusion.

II.   LITERATURE REVIEW

According to Behn (2003) [2], performance measurement should be used to measure all the process of a given organizational context. Ghalayini and Noble (1996) affirm that performance measurement is a dynamic process in wich the company establishes what indicators should be evaluated and how they are measured.
In a port context there are more study in literature review. Su-Han Woo et all (2011) [4], use a structured literature review approach to investigate how seaport have been meant during three decades (1980-2000). Palliss et all (2011) [5] study 365 journal papers but the study dosen't show the aim of the research.

Scientific literature presents more information requested from researcher , strategies for extracting a representative cut to support their research topic. In this context the ProKnow-C is divided in four steps: selection of bibliographic portfolio, bibliometrics, systemic analysis and formulation of research question.

This method born in 2005 but first international publication is in 2010 by Ensslln et al. [6] The main purpose of ProKnow-C is to make a correct literature review. In particular, the performance measurement in Port Authority. The literature review is the first step of a research's project. It lets to develop the knowledge in which you to investigate and in which you want to consider the scientific the scientific relevance of the work (Colicchia and Strozzi 2012) [7]. Only finishing a review of the literature, the researcher will be able to make a research question for the topic he wants to investigate. This method supports the researcher in the study's risk

like repeating the work already done [8]. The ProKnow-C is the process which has all the characteristics that a literature review process should search for [6].

Thiel et al (2017) [9] use ProKnow-C to explore what the literature offers on performance evaluation in street lighting management, in order to develop knowledge in the researchers, and presenting research opportunities.

III.   RESEARCH DESIGN

This study is meant propose a method to choose a set of scientific articles about performance measurement in Port Authority.

This research is explanatory-descriptive for two reasons. First of all, its objective is to permit the researchers to strengthen their knowledge about the topic by the mean of a selection process of scientific articles published in periodicals. Secondly, it describes the characteristics of the articles that make up the bibliographic portfolio (Gil 1999) [10]. The **Knowledge Development Process – Costructivist (ProKnow-C)** proposed by Ensslin, Ensslin, Lacerda and Tasca [6] wants to explain the knowledge based on the identification of relevant articles and future research paths.

This methodology is structured in four phases: 1) the selection of bibliographic portfolio, 2) the bibliometric analysis, 3) the systemic analysis, 4) the formulation of research objectives. Fig. 1 presents a schematic summary of the process ProKnow-C.

First phase identifies the scientific publications connected to the fragment of the chosen literature, this phase is the result of three sequential sub-phases: 1) the selection of the "brute" bibliographic portfolio; 2) the filtering of the articles; 3) the representativity test.

The selection of the bibliographic portfolio starts from determining the research topic and then defining the keywords used in the literature. Afterwards, the researcher defines the databases used to search the articles. The databases must meet some needs [6]: 1) the tools that offer the possibility to search in the fields: title of the article, abstract and keywords; 2) the particularity of using Bolean expression; 3) the usefulness of establishing the time horizon of the research; 4) the particularity of selecting the type of publication (only articles present in scientific journal). At this time the researchers establish the time horizon, through the combination of keywords and databases; here the process starts. The set of all articles that show adherence to the research objective compose the Bruto bibliographic Portfolio (BP).

After obtaining the PB, the researcher develops an adhesion test, he randomly selects five articles and compares the keywords with initial keywords of the research in database, if they are the same, there is adhesion, otherwise, he will have to repeat the search procedure from the beginning [6]. Once the BP has been obtained, the filtering of the articles (second sub-phases) involves the exclusion of duplicate articles, congress works and book chapters. The remaining articles are read for the analysis of their alignment with the studied area of knowledge. The next step is to determinate the scientific recognition of each article, obtained from the number of citations received through Google Scholar, based on the recognition the researcher will calculate the average quote. The articles will form the Portfolio K (PK) if article's quote is superior or equal at average quote. The other constitute the Portfolio P (PP). PK's articles must be read again to check the relevance of the studies required: the one in line with the research form Portfolio A (PA). The authors making up the articles of the PA compose the bench of authors. The PP's articles, on the other hand, are analyzed on the date of publication and on the name of the author, because the study made in the last three years and the studies made by the authors present in bench of authors make up the Portfolio B (PB). Finally PB and PA make up the Official bibliographic Portfolio (PO). The PO is the subject of systemic and bibliometric analysis.

The second phase starts from the bibliometric analysis, which tries to generate knowledge for the researcher in order to provide a univocal view on the state of the art. Thiel et al (2017) [9] define it as the "process of quantitative demonstration of statistic data of a defined group of artcles (Bilbiographic Portfolio) for the management of information and the scientific knowledge on a given subject realized through the counting of documents". Bibliometric analysis generates knowledge in the research on some characteristics of the object of investigation allowing him to support his arguments and decisions. In this phase the basic studie's characteristics to be identified are: 1) the researcher with more experience; 2) the journal that publish the article; 3) the article with the greatest scientific impact; 4) the impact factor. After the bibliometric analysis, the researcher has the knowledge on the topics of the literature he is studying, it is an examination on the argument, with the aim of identifying the research opportunities.

The phase of the systemic analysis (third phase) is characterized by a reflexive activity, in which the researcher analyzes the presence of the contributions in the works that make up the bibliographic portfolio. Chaves et al (2013) [11] say that: "systemic analysis is a scientific process used to analyze a representative sample of articles about a given research topic, from a view of the world (theoretical affiliation) that is defined and explained through its lenses, trying to make evident for each les and globally, to the perspective established, the highlights and opportunities (needs) of knowledge found in the sample". "The view of the world" creates the fundaments for building decisive knowledge. The systemic analysis is realized according to criteria-

denominated lensens. The lensens are [6]: 1) approach (harmonizes built model, approach and data, with its application?), 2) singularity (recognizes the problem is unique?); 3) identification process (uses the process to identify the objectives according to the perception of the dicider?); 4) mensurement; 5) integration (as for the determination of the constants of integration, how are the questions presented to the decider?); 6) management (the knowledge generated allows the recongnition of the current profile its monitoring and improvement?)

Finally after the development of these phases, the researcher has an exhaustive knowledge on the fragment of literature, so he can formulate the objectives of the research and he can understand what he must study.

Figure 1 - Summary of the process ProKnow-C
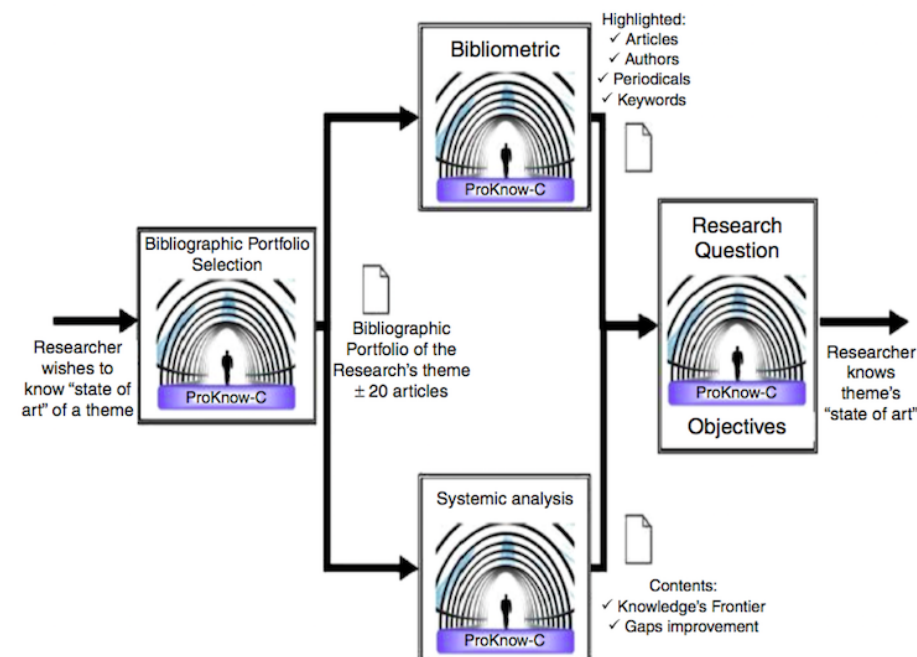
**Source**: Lacerda et al. (2012)

IV. RESULTS

The database used are Web of Science and Scopus, the journal are classified in JCR. The research period covers the last decade (2007 – 2017). The initial keywords are: Performance, Efficiency, Effectiveness and Port Authority (other keywords in the filed "or": Cost Effectiveness, Performance indicator, Port Models, Port). We get 370 articles. We have cut off any duplicate works. An analysis of abstract (the filtering of articles) says that: performance measurement is used for environmental sustainability. These articles have been eliminated, leaving a final portfolio of 31 works published in 14 journal (BP). Through the computation of the average quotation we have built the PP (13 articles) and PK (18 articles). PK's articles are studied to analyze the adherence with research object for to create PA and bench of author. PA is composed by 18 articles. The PB is formed by PP's articles that the publication is after 2014 and those written by the authors present in bench of author (3 articles). Fig. 2 presents a schematic summary of the process. The filtering process resulted in PO (PA+PB) composed of 21 articles listed in Table 1. According to Ensslin et al (2012) [6], the PO is a set of publication that stand out scientifically, with a title a summary and complete content, and are aligned with a determined theme according to the perceptions and limitation of the researchers. The article written by Trujillo & Trovar (2007) [12], "The European port industry: an analysis of its economic efficiency" is a highlighted article. It has 95 citations in Google Scholar. (Graph 1 shows the general results). The Journals that stands out most prominently in PO are: Maritime Economics and Logistics (Q2 in JCR) and Research in Transportation Business and Management (Q2 in JCR). Graph 2 shows the general results. The graph 3 shows the impact of the journals in JCR. We can answer at first research question: "Is it a real topic of interest the performance measurement in Port Authority?". In particular the answer is positive, because the 57% of the articles are in Q1 (see graph 3).

The articles from the bibliographic portfolio are studied according to the lenses (Systemic analysis). The approach is divided in two types, normativist and descrptivist. Normativist approach is related at the search for a solution in the same context, descriptivist approach is linked to the search for a solution in different contexts [11]. All of articles in the PO use normartivist approach.

Ripoll et al. (2015) [8] says: "the singularity lens evaluates whether the articles recognize the context in which the performance is being evaluated and whether there is explicit participation of the decider". All of articles in the PO recognize the environment according to their performances.

The process to identify values and preference analyzes if the perception of the decider is linked to choice of model s of performance evaluation, Ripoll et al (2015). All of articles in the PO don't have this relation. The measurement (lens 4) is divided in two types, qualitative study and quantitative study. The results prove that 15 articles have used the quantitative study, and 6 have uses the qualitative study. In the quantitative study there are dates from financial statements. In qualitative study the variables are service's quality linked to perceptions of port actors. The integration verifies whether the PO articles are linked to holistic models. 10 articles of PO have holistic model.
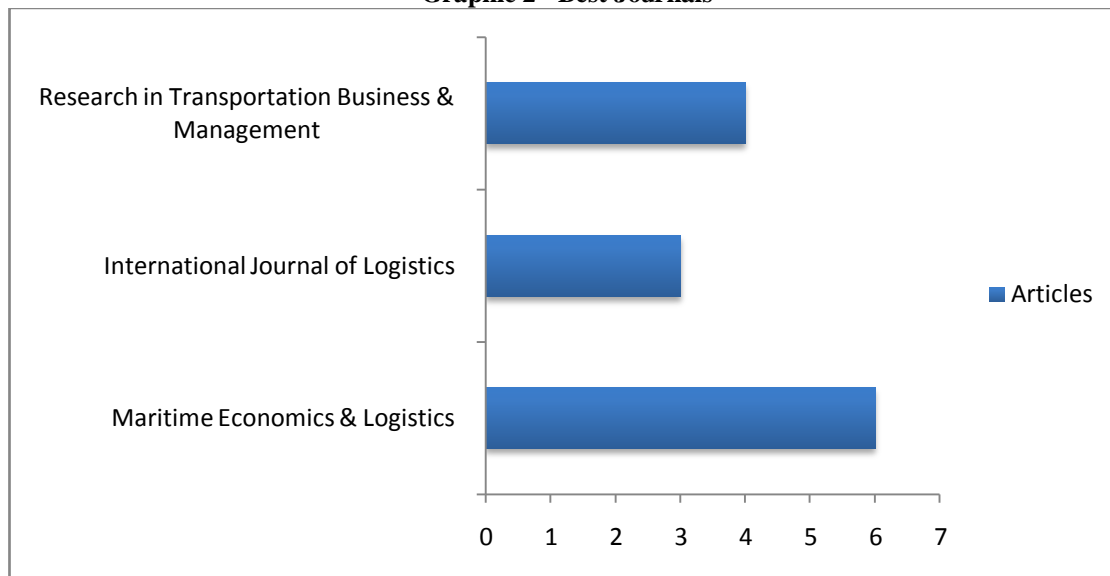
Figure 2 - Summary of the process
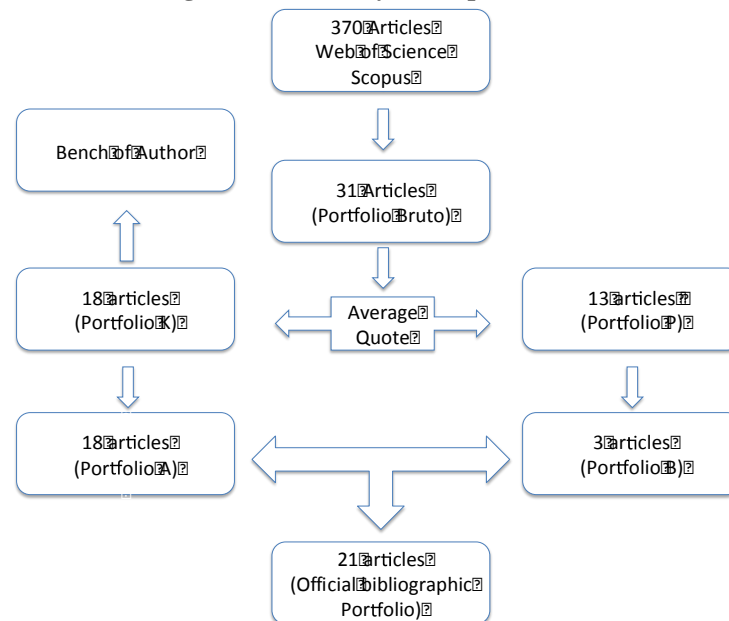
Sourece: Research data
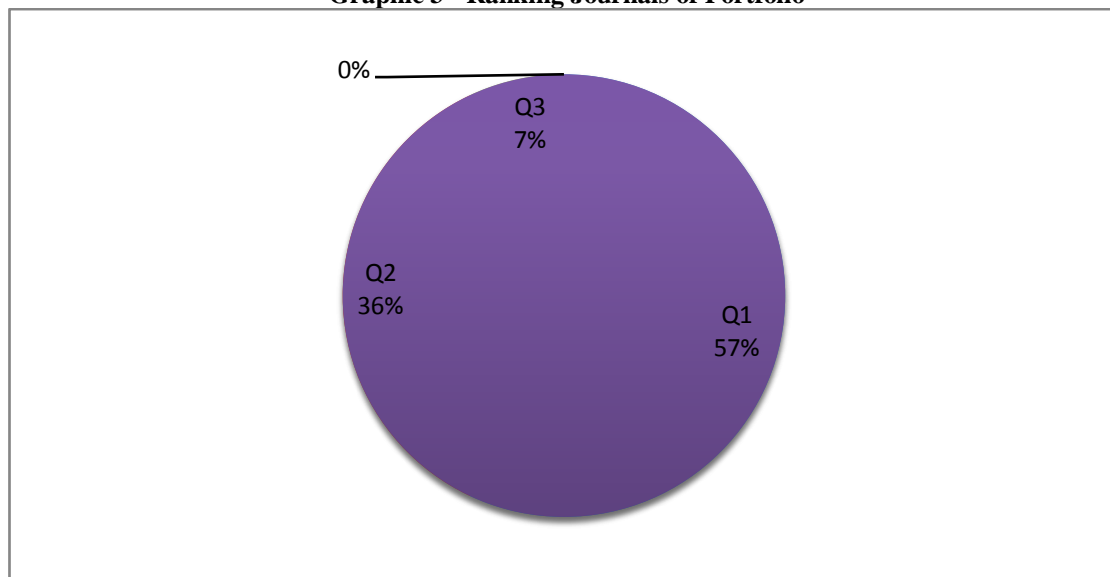
Graphic 1 - Best Articles
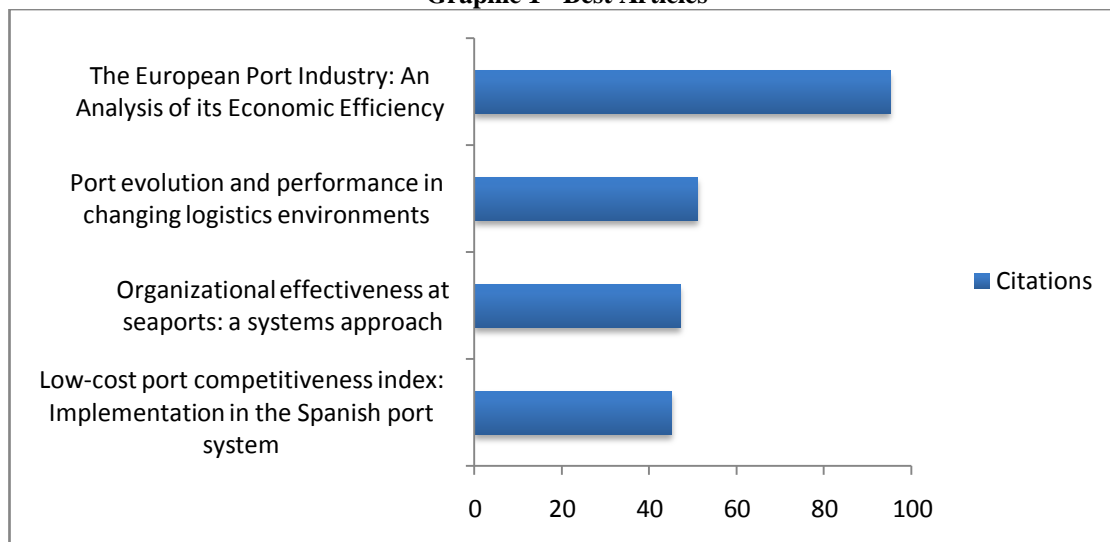
Source: Research Data

Graphic 2 - Best Journals

Source: Research Data

Graphic 3 - Ranking Journals of Portfolio

Source: Research Data

Table 1 - PO's articles

Van Den Berg, R., De Langen, P. W., & Van Zuijlen, P. C. (2017). Revisiting port pricing; a proposal for seven port pricing principles. *WMU Journal of Maritime Affairs*, *16*(3), 421-438.
Schellinck, T., & Brooks, M. R. (2016). Developing an instrument to assess seaport effectiveness in service delivery. *International Journal of Logistics Research and Applications*, *19*(2), 143-157.
Martínez Moya, J., & Feo Valero, M. (2017). Port choice in container market: a literature review. *Transport Reviews*, *37*(3), 300-321.
Schellinck, T., & Brooks, M. R. (2016). Does superior service performance provided to shipping lines improve the perceived value of a port?. *International Journal of Shipping and Transport Logistics*, *8*(2), 175-193.
Tovar, B., & Rodríguez-Déniz, H. (2015). Classifying ports for efficiency benchmarking: A review and a frontier-based clustering approach. *Transport Reviews*, *35*(3), 378-400.
Panayides, P. M., Parola, F., & Lam, J. S. L. (2015). The effect of institutional factors on public–private partnership success in ports. *Transportation research part A: policy and practice*, *71*, 110-127.
Lee, P. T., & Hu, K. C. (2012). Evaluation of the service quality of container ports by importance-performance analysis. *International Journal of Shipping and Transport Logistics*, *4*(3), 197-211.

Cheon, S. (2009). Impact of global terminal operators on port efficiency: a tiered data envelopment analysis approach. *International Journal of Logistics: Research and Applications*, *12*(2), 85-101.

Ferrari, C., & Basta, M. (2009). Port concession fees based on the price-cap regulation: A DEA approach. *Maritime Economics & Logistics*, *11*(1), 121-135.

Garcia-Alonso, L., & Martin-Bofarull, M. (2007). Impact of port investment on efficiency and capacity to attract traffic in Spain: Bilbao versus Valencia. *Maritime economics & logistics*, *9*(3), 254-267.

Pallis, A. A., & Syriopoulos, T. (2007). Port governance models: Financial evaluation of Greek port restructuring. *Transport Policy*, *14*(3), 232-246.

Cetin, C. K., & Cerit, A. G. (2010). Organizational effectiveness at seaports: a systems approach. *Maritime Policy & Management*, *37*(3), 195-219.

Woo, S. H., Pettit, S., & Beresford, A. K. (2011). Port evolution and performance in changing logistics environments. *Maritime Economics & Logistics*, *13*(3), 250-277.

Vaghi, C., & Lucietti, L. (2016). Costs and benefits of speeding up reporting formalities in maritime transport. *Transportation Research Procedia*, *14*, 213-222.

Ferrari, C., Puliafito, P. P., & Tei, A. (2013). Performance and quality indexes in the evaluation of the terminal activity: A dynamic approach. *Research In Transportation Business & Management*, *8*, 77-86.

Junior, A. G. M., Junior, M. M. C., Belderrain, M. C. N., Correia, A. R., & Schwanz, S. H. (2012). Multicriteria and multivariate analysis for port performance evaluation. *International Journal of Production Economics*, *140*(1), 450-456.

Castillo-Manzano, J. I., Castro-Nuño, M., Laxe, F. G., López-Valpuesta, L., & Arévalo-Quijada, M. T. (2009). Low-cost port competitiveness index: Implementation in the Spanish port system. *Marine Policy*, *33*(4), 591-598.

de Langen, P. W., & van der Lugt, L. M. (2017). Institutional reforms of port authorities in the Netherlands; the establishment of port development companies. *Research in Transportation Business & Management*, *22*, 108-113.

Havenga, J., Simpson, Z., & Goedhals-Gerber, L. (2017). International trade logistics costs in South Africa: Informing the port reform agenda. *Research in Transportation Business & Management*, *22*, 263-275.

Verhoeven, P., & Vanoutrive, T. (2012). A quantitative analysis of European port governance. *Maritime Economics & Logistics*, *14*(2), 178-203.

Trujillo, L., & Tovar, B. (2007). The European port industry: An analysis of its economic efficiency. *Maritime Economics & Logistics*, *9*(2), 148-171.

V. CONCLUSION

This study is meant propose a method to choose a set of scientific articles about performance measurement in Port Authority. The research questions are: "How to knowledge about the theme performance measurement in Port Authority?"; "How to identify the frontier of the knowledge?"; " Is it really a topic of interest the performance measurement in Port Authority?".

Ports have traditionally evaluated their performance by comparing their actual and optimum throughputs [13]. There are two types of performance evaluation: a single port approach and multi port approach, in the first case there are more different in port governance (public or private). The private port's governance maximizes profits or throughput. The public port's governance attempts to go to zero operating deficit (port revenue equal cost). In second case the analysis based on technical efficiency generally calculated using frontier statistical models. Technical efficiency is determined by the equality between maximum port efficiency and the use of productive resources.

The service price is the sum of four factors: 1) the prices for the service (loading costs); 2) the time price of external carriers; 3) the time price of internal carriers; 4) shippers costs. Conclusion section must be included and should clearly indicate the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract like the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extentions.

According to Marlow and Pixao Casaca (2003) [14], as a result, technical inefficiency causes longer waitings of the ships inside the port; in this case the shipping companies increase their fleet on a route. The port loses attractiveness. Tovar et al (2015) say that financial indicators may not be sufficient to reveal the present or future of a port because attractiveness depends on many factors.

Bichou and Gray (2004) [15] state that the analysis of financial performance can't be the only trend to be measured, it describes quantitative and qualitative managerial decisions and political implications. Finacial profitability plays a fundamental role in measurement efficiency and effectiveness.

The limits of this work are the researcher's vision. This study starts by paradigm the free choice during the filtering of the articles. The same work could be a different results if carried out by two different researchers.

This model should be more restrictive on the analysis of abstract.

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