



A Systematic Approach for Evaluating Port Effectiveness

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A SYSTEMATIC APPROACH FOR EVALUATING PORT EFFECTIVENESS

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ABSTRACT

The objective of this paper is to examine how users evaluate port effectiveness and identify those constructs relevant to that evaluation. The three user groups studied are carriers, cargo interests, and suppliers of services at the port. The study team developed an on-line survey instrument and delivered it to Canadian port users with the assistance of eight industry organizations. The findings of the research are based on the contributions of 57 decision-makers with port usage experience, many of whom fit into more than one group of users. The study concludes that the evaluation criteria influencing users' perceptions of satisfaction, competitiveness and service delivery effectiveness are different, and so while the determinants of these constructs have considerable overlap, they are different constructs. This paper also illustrates how independent (or third-party) evaluation of port performance might be used by a port to strategically improve its service to users, and therefore have value from a port perspective in its strategic planning.

BACKGROUND AND PURPOSE

Port users are more than just the buyers of the port's services. Other supply chain partners may not be the purchasers of those services but have experience with, and influence on, the delivery of port services. The three user groups involved in this study are carriers, cargo interests and suppliers of services at the port to the first two of these. Our goal is to understand how port users evaluate ports, what is most important to them in terms of the services received, and how they evaluate the performance of ports they use. In this study, participants were asked to rate the importance of various performance criteria and then to apply them to ports they use by evaluating that port's performance on those dimensions. Based on the findings, port users will be able to see how ports perform on the various dimensions of port performance, and the findings should assist ports in benchmarking their performance against others they see as competitors, and therefore guide them in improving the quality of their services, which will be a significant benefit to the port users.

In addition, governments need to be able to evaluate the effectiveness of the port system in meeting the needs of their trading communities; supply chain participants also need to evaluate whether ports meet their needs. As a result, a program of regular performance

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measurement is recommended. In most port performance assessments, measurement focuses on efficiency but fails to include the port's effectiveness in delivering its services to those who 'use' it. It is the starting premise of this paper that efficiency measurement must be accompanied by the measurement of effectiveness in order to improve the overall and specific performance of the port system. Furthermore, companies that receive independent performance reports learn where continuous improvement activities will pay off in future performance improvements, whether the company itself or its suppliers provide the service.

The purpose of this study is two-fold:

- To understand the evaluation criteria by which users determine that a port's performance is satisfactory (or effective in meeting their needs). As will be seen below, this has not yet been adequately addressed in the scholarly literature.
- To identify a systematic approach by which the assessment of port effectiveness by relevant decision-makers—be they governments, port authorities, or service providers—can be implemented, and to indicate such findings to ports so that they may fine tune operations to meet customers' expectations and competition.

Identifying the user's perceived importance of different dimensions of a service is therefore the first step in evaluating the port's competitiveness relative to other options in the supply chain. Knowing how a port performs is the first step in a program of continuous improvement of benefit to both ports and their users. This study is not about port choice, although port performance evaluation may lead some users to reconsider choices they have made.

LITERATURE REVIEW

The port performance literature

Port performance research can be divided into effectiveness research and efficiency research. These two are like yin and yang, complementing each other. **Efficiency** has been noted as 'doing things right' while **effectiveness** is 'doing the right things'. The right things are those that are important to the customer. If a negative and significant gap exists between the importance of those right things and the performance of them, dissatisfaction is the by-product. In combination, these two port performance components also provide government policy-makers with the essential feedback for assessing the governance structure of ports in meeting national strategic objectives [1].

There is certainly no shortage of research on measuring technical efficiency in container ports; this has been a predominant focus of port research for the last 10 years. This is not irrelevant as ports seeking growth often aim to attract large-scale shipping or terminal operating companies through technical efficiency improvements. Most notable is the work of Cullinane and Wang [2], but as a discussion of port efficiency is not the focus of this research, we recommend readers to Gonzalez and Trujillo [3] for a comprehensive review of the port efficiency literature.

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Improving technical efficiency is not the whole story. Such efficiency measures do not provide an indication of how well a port is managing its current assets to serving its customers. Even when efficiency indicators are extremely positive from a port perspective, port users' complaints may still arise, with such complaints not being reflected in efficiency indicators used [4]. Recognizing and fully understanding port users' needs is a starting point for developing strategies that serve unmet needs that have the potential to grow new business or acquire market share.

Very little research, however, has focused on whether the inefficiencies or inadequacies of ports have created problems for users that require the injection of more assets or non-tangible resources like better communication plans. Users are in the best position to determine if the port, and its tenants and partners, deliver the services required. If the delivery of services does not match expectations, the port does not deliver a value proposition to its customers, and is therefore seen as ineffective. Aiming to fill this gap, the focus of this research is to examine how users evaluate port effectiveness and what evaluation criteria they use in the process. It also seeks to understand the antecedents of the three constructs—satisfaction, competitiveness and effectiveness in service delivery. The study also enables us to explore whether these antecedents are the same for each of the constructs, and therefore whether it is necessary to measure all three.

Effectiveness Measurement in Practice

The need to understand both efficiency and effectiveness in port performance has been only recently recognized by the industry. For example, in 2008 Germanischer Lloyd launched the Container Terminal Quality Indicator, a certification process for quality standards in container terminals. In the European context, consultation towards the definition of such indicators was initiated [5], and recently the European port authorities have announced a collective effort towards this end through the establishment of a European Port Observatory to monitor such indicators [6].

These recent efforts by interested parties in the marine industry head towards an effectiveness (service quality delivery) evaluation that other industries have already implemented. For example, more than a decade ago, the Airports Council International (ACI) teamed up with the International Air Transport Association (IATA) to provide third-party independent customer surveys (first the Global Airport Monitor and later the Airport Service Quality program). The airport industry now measures 34 service items for 130 airports worldwide (<http://airportquality.ch/participants>), administering in excess of 220 000 surveys annually. Each airport is not only able to evaluate through quarterly reports its performance in comparison to other airports, but is able to conduct a gap analysis against other selected airports (whose performance sets a best practice benchmark). While airports certainly have a different type of user (and more of them) than ports do, the general concept of regularly scheduled performance evaluation by users is directly relevant to this research program.

In port research, one can find miscellaneous endeavours for an overall business performance measurement tool [7, 8]. These can be expanded to include externally

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generated information, such as users' perspectives on port choices [9, 10] and port attractiveness [11]. There are also few recent attempts [12-14] to assess port users' satisfaction via the application of SERVQUAL, a well-known multi-item scale developed to assess customer perceptions of service quality in service and retail businesses. The SERVQUAL scale decomposes the notion of service quality into five constructs (i.e., tangibles, reliability, responsiveness, assurance, and empathy). However, SERVQUAL-based research has serious issues; criticisms of the SERVQUAL model focus on: (1) the potential inappropriateness of the five dimensions of choice criteria used by SERVQUAL [15, 16] and (2) the inability of expectations to remain constant over time [16].

The best effectiveness metrics (from the managerial perspective of the port) come from questionnaires to users (e.g. [11, 17, 18]). Those studies that do try to get to the heart of the matter are usually one-off exercises and not replicated elsewhere in the literature or year over year. There is not a standard user survey for the industry, hence our focus on identifying, from a list of 12 general and 35 user-specific evaluation criteria, those criteria that best measure port effectiveness. What we wish to measure is port effectiveness, as indicated by perceived performance on individual criteria (attributes) and by the relationship of these with overall satisfaction, whether it is delivered by the port or by the port's partners in the supply chain. Moreover, most effectiveness and 'port choice' studies focus on one type of actor only, whether these are carriers [10], shippers [19], forwarders [20], or even terminal operating companies [21]. The scope of our research is to assess the views of all actors in a single integrated way.

The development of a 'practicable' effectiveness instrument is important for an additional reason: ports are embedded in complex supply chains [22]. The interdependencies of supply chain partners has been rising, thereby reinforcing the role of satisfactory port performance as a lever for the competitive advantage of the various actors in the chain.

The literature on our methodology

Importance–Performance Analysis, first popularized by Martilla and James [23] in the late 1970s, is a commonly used technique for evaluating both customer satisfaction and service quality. It does this by determining the relevance (stated importance) of evaluation criteria or attributes to customers and their assessments of the organization's performance on these criteria. The gaps between importance and performance ratings are then used to identify areas where management should focus their resources when developing a marketing strategy. A two-dimensional graph with mean or median importance and performance ratings on each axis (referred to as an Importance–Performance space) is used to assess how resources should be applied to maximizing customer satisfaction and service quality. The approach has been applied in numerous fields since then, including education [14, 24], food services [25], tourism [26], government services [27] and professional training [28].

Martilla and James [23] identify two issues that need to be considered when implementing this technique: first, the evaluation criteria must be carefully chosen using sound qualitative techniques and, second, the importance and performance questions need to be separated in order to minimize multicollinearity problems. We discuss the first in a later sub-section and

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ensured the second by asking the importance questions in a separate section before the performance questions were asked.

Early on it was recognized that reliance on stated (or self-reported) importance ratings has shortcomings [29, 30]. The direct ratings tend to be high and thus grouped very closely; this is due to the fact that the researchers tend to only include attributes they know are salient to the customers [30, 31]. This compression of rating near the top, or 'concavity bias' [32] makes it difficult to statistically distinguish among the more important attributes and easier to distinguish among the less important attributes in a set. Also, the self-rating nature of stated importance has been found to be subject to response bias due to the influence of social norms. However, the most important shortcoming of importance ratings is that they may not be predictive of satisfaction or any other construct of interest to the researchers. If these ratings are to be used for developing strategy, then there should ideally be a causal relationship between performance on the evaluation criterion and customer satisfaction. The whole purpose of the exercise is to identify where to allocate resources, but resources allocated to an area that has no actual influence on the customer are wasted.

The solution is to incorporate the concept of determinant attributes into the technique. Myers and Alpert [33] defined determinant attributes as "attributes that are both important and that differentiate meaningfully among alternative offerings, the 'hot button'". Operationally, determinant attributes are those where the firm's performance on the attributes predicts customer satisfaction (or some other construct like perceived competitiveness). Determinance approaches use the perceptions of the customer to derive what is important.

There have been several methods proposed for estimating the determinance of attributes. Multiple Regression (MR) is the most often used but this is now recognized as the least effective method [31, 34] since the performance measures suffer from multicollinearity leading to very unstable coefficients. Furthermore, because in multiple regression the variables compete for weight, the results are very sensitive to the set of performance measures included in the analysis. There have been several methods suggested for overcoming these problems, including the use of formative or reflective Partial Least Squares (PLS), Principal Components Regression (PCR), and Normalized Pairwise Estimation (NPE) [31]. The last, NPE, compared direct measurement to the five methods of deriving determinant attributes (MR, both PLS methods, PCR, and NPE) on four criteria—satisfaction variance explained, loyalty variance explained, diagnostic value, and negative measures. All approaches excelled on at least one of these criteria but were weak on others. MR suffered from negative importance weights, which theoretically should be impossible, indicating the overall inappropriateness of the MR approach. The reflective PLS, formative PLS and PCR approaches tended to have lower variance explained but better diagnostic properties. The NPE had high variance explained, for both satisfaction and loyalty, and no negative importance for attributes, which means it overcame the problems of multicollinearity that plagues multivariate analysis. It did however tend to have inflated importance measures for poorer quality measurement models and was deemed to be less diagnostic (e.g., it was less able to identify customers' most important attributes).

Gustafsson and Johnson [31] note that 'the choice of reflective and formative PLS depends on just how comprehensive the attribute specifications are'. In the authors' opinion, this rules

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out the use of PLS and PCR in order to derive determinant attributes as they require a large number of statements that would make the survey instrument unwieldy. Furthermore, they [31] also concluded that if 'the goal is simply to explain variation and provide attribute importance measures that completely avoid the problems of multicollinearity, then NPE would be a suitable approach.' We therefore use NPE in this study, and we describe its use in more detail in the section on Methodology.

None of those comparing determinant importance to stated importance have suggested that the former should replace the latter [27, 31, 35]. The two measures are viewed as complementary, each providing a different perspective on the value of the criterion. The stated importance approach can be used as a backup if use of the performance measures to derive determinant importance does not work; because the stated importance measures can be used in the Importance-Performance space, this also facilitates communication with management [27].

Conclusions from the literature

Importance measures derived based on performance perceptions are more likely to be those attributes that are subject to a greater range of qualities, and more short term in nature. This means the quality of information provided to customers will vary substantially based on the customer and the situation. Thus there will be greater variance in perceptions and greater opportunity for the variable to predict satisfaction. An attribute whose performance changes little in the eyes of customers over time, such as the physical layout of the port, will therefore be a poor predictor of satisfaction. However, a change in the port's physical layout may have a very substantial impact on customer satisfaction when it occurs. This suggests that attributes that have low variance in perceived performance across customers are better measured using the stated importance approach. This also means the stated importance measure looks more toward the future while the derived (determinant) measure is more based on the past and is therefore more useful in the immediate future and day to day operations.

This leads to the conclusion that stated importance could be more important for governments as they can change the provision of some service features, such as the connectivity of the port to landside infrastructure through targeted infrastructure investment or the safety and security of the port through security program grants or loans. The service provider can work on other, more determinant attributes that have a more immediate effect on satisfaction such as 'fulfillment of special requests'.

METHODOLOGY

Introduction

Effective performance by a supplier is always measured in terms of what the user of the service expects by way of performance. Satisfaction occurs when the performance of a supplier meets or exceeds expectations on the criterion (or criteria) of importance to the user.

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Hence, in order to understand performance, we need to assess evaluation criteria using a pair-wise methodology in a two-step process of capturing not only the importance rating of a criterion but the performance rating for the port used as well. In other words, we are not only interested in the criteria perceived as important but those where the performance of the port has an influence on outcomes, be they feelings of satisfaction with a port, or a high rating on its performance in effectively delivering a service.

First, it is our goal to understand the evaluation criteria by which users determine that a port's performance is satisfactory, and hopefully effective in meeting their needs. We also asked port users to rate the port in terms of its competitiveness to see if these three concepts (satisfaction, competitiveness and effectiveness in service delivery) had similar or different causes. We viewed competitiveness as a proxy for efficiency. Second, for individual ports, it is our goal to assist each port in understanding its own users' evaluation criteria, so that it may improve its own performance relative to what its users seek in the way of service delivery.

To achieve these two goals requires a three-step process: 1) develop the list of evaluation criteria, 2) seek to understand the relative importance of each of the criteria to the users of a particular port, and 3) conduct a paired analysis of the gap between the importance a particular port's user places on the criterion and that same user's assessment of the performance of that port on that criterion. This type of analysis provides ports with insights on where continuous improvements would pay off from a user and/or customer perspective.

Whether a port is eventually chosen or selected by users is not the purpose of the study. While satisfaction today may not lead to choice tomorrow, dissatisfaction will likely lead to rejection except for those who are captive. When an individual port understands its performance in the context of the expectations of its users, they are able to understand why their users are unhappy or dissatisfied, why they lose business, or how they may win additional business, particularly if they benchmark their performance against other ports they see as being competitors.

Identifying the evaluation criteria—the initial constructs

Research question 1: What are the appropriate evaluation criteria 'users' use to evaluate port performance?

Research question 2: Once research question 1 has been determined and performance data collected on the ports used, how may a port use that information to improve performance?

This paper focuses on answering the first question, and then uses the results to demonstrate how the second might be answered for a sample port. In this section, we first review how we define a user, and then we discuss the qualitative development process used to identify the evaluation criteria. Next we discuss the pre-testing of the instrument and the implementation of the NPE method chosen for analysis. We begin the next section of the paper, findings, with a review of the respondents.

Defining the User Groups

Port users are more than just the buyers of the port's services. Other supply chain partners may not be the purchasers of those services but have experience with and influence on the delivery of port services. Three user groups are approached in this study—ocean carriers, cargo interests (and their agents), and suppliers of services at the port to the first two groups. To allocate responses, users were classified based on their responses to a statement describing their company.

Cargo interests were those that answered positively to either of the following statements:

- We are responsible for the purchase of some of the transportation services for goods we sell/buy/make.
- We are responsible for the purchase of transportation services for goods on behalf of some importer and/or exporters.

Shipping lines were those that answered positively to either of the following statements:

- We are a shipping line that calls ports with container handling facilities.
- We are a shipping line that calls ports with bulk cargo handling facilities.

Supply chain partners were those that answered positively to any of the following statements:

- We are a warehouse operator that services (a) port(s) with container handling facilities.
- We are an asset-based logistics service supplier that uses ports as part of the services we provide.
- We are a trucking or rail company that services ports with container handling facilities.

As we wanted those who had experience with the port, respondents were disqualified from participating in the survey if they answered positively to the following statement:

- We outsource all purchases of transportation services to freight forwarder(s) or other third party logistics service supplier(s).

For all stakeholders, there are a number of port performance attributes (evaluation criteria) that are common and some that are specific to one or two of the three user groups. In all cases, the survey instrument was constructed to ensure that all qualified respondents answered a stated importance query about the common set of services attributes sought by all users, followed by a criteria set specific to their particular user group,. Each set was followed by a section where a user would evaluate specified ports they had already identified as using on these same criteria, before a common closing section in the survey seeking corporate demographics.

Developing the evaluation criteria used in the study

How did we identify the evaluation criteria used in the study? Over the past several years, there has been a concerted effort by various academics within the Port Performance Research Network¹ to understand those criteria of importance to the various players using port services. In addition to examining the port performance literature since 2000, two PPRN researchers (Dr. Mary R. Brooks and Dr. A. A. Pallis) assembled a detailed list of both efficiency and effectiveness performance metrics from a literature search of more than 80 journal articles and studies. Through field research conducted in 2008 as part of a consulting project, and discussions with industry experts, the list of potential evaluation criteria was winnowed to those most critical in past studies and endorsed by experts in one-on-one interviews in early 2008.

Pre-testing the instrument

To pre-test the instrument design, several individuals were approached to go through the preliminary draft. As changes were not substantive, the draft became the final survey instrument. This pilot study was limited to Canadian companies using three Canadian ports and two U.S. ports. To reach the target audience of users, the assistance of eight industry associations was solicited. The company recruitment message was e-mailed by the industry association to its members, and the e-mail message contained a hot-link to the survey. The industry association sent a first request, a follow-up reminder two weeks later, and a final reminder in the few days before the web site link closed.

Explaining the method of implementation for NPE analysis

For each of the performance evaluation criteria, the respondent is asked to rate the importance of the criteria to them in their evaluation of ports (scale 1-7 where 1=not at all important and 7=very important). Also for each of the performance evaluation criteria, respondents are then asked to rate the performance by selecting a level of service provided **in the particular port they have previous indicated as using** (scale 1-7 where 1= very poor and 7=very good). In a few cases, the assessment was on a 1-7 scale of 1=strongly disagree and 7=strongly agree. A 'no experience' option was always provided as not all users will have experience with all criteria in each port. The statistical pair-wise evaluation of importance ratings and performance ratings at the specific port level provides the framework to assess users' perceptions of performance. Overall performance of each port is also rated by each respondent for each port using one of three dependent variables—satisfaction, competitiveness and effectiveness in service delivery—so that we may identify the antecedents of performance.

The value of each attribute (criteria) will be determined based on the normative importance according to respondent ratings. However, normative importance is not be the same as

¹ The Port Performance Research Network was founded at the meeting of the International Association of Maritime Economists in Hong Kong in July 2001. It includes more than 40 researchers interested in port performance in terms of efficiency, effectiveness and governance. It is perhaps best known for its book [42].

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determinant importance in that perceptions on some dimensions that may not as important from a normative point of view can substantially influence satisfaction. To assess the determinant importance of the attributes, correlation analysis will be conducted with the attribute ratings for each port as the independent variables and the overall performance assessment measures as the three dependent variables. We will develop models for each of the three segments, for five ports and for three overall measures of port performance: satisfaction, competitiveness and effectiveness of service delivery.

To determine what influences perceptions of port performance, we need to identify those dimensions that are correlated with port performance. For example, if an increase in a user's rating of port performance increases its perception of the port's ability to fulfill special requests (i.e., these two measures are highly correlated), then we assume that changing a user's perceptions about a port's ability to fulfill special requests will likely lead to a corresponding increase in the user's assessment of the port's performance.

Preliminary multiple regression analysis using the twelve general evaluation criteria to predict the three port performance measures (overall satisfaction, competitiveness and effectiveness of service delivery) found a large amount of multicollinearity among the predictor variables with between seven and nine of the variables in the MR models having a variance inflation factor above the recommended cut-off of 5.0 [36, 37], which confirms the point made by Gustafsson and Johnson [31] that multiple regression is an inappropriate method for deriving the importance of attributes as the derived weights will be unreliable. Therefore, as noted earlier, for analysis of the Port Performance Survey we adopted Normalized Pairwise Estimation, which relies on correlations between the performance rating and the construct of interest, normally satisfaction but in this case three constructs. According to Gustafsson and Johnson [31] and Giannoccaro et al. [38], the method is applied employing the following steps described by Rust and Donthu [39]. First, correlations are obtained between each of the predictor variables and the dependent variable. An ordinary least squares (OLS) multiple regression is run, and the R^2 obtained. If the predictors are uncorrelated, then the sum of the squared correlations equals the R^2 from the multiple regression. If the predictors are correlated, however, the sum of the squared correlations will be larger than the R^2 . Let us call the sum of the squared correlations S^2 , and let r_i^2 be the square of the correlation between predictor (attribute) i and the dependent variable (e.g., satisfaction). Then the estimated importance measure for predictor i is equal to $(r_i R/S)$. Conceptually, NPE adjusts individual correlations based on the total correlation in the model. To be reported the R between the performance rating and the measure of interest (like satisfaction) must be statistically significant. This is then repeated for the other two dependent variables (competitiveness and effectiveness in service delivery).

FINDINGS ON EVALUATION CRITERIA AND DISCUSSION

Respondents

From all port user groups, 102 participants clicked onto the on-line survey; of these, 24 did not complete the survey. Of the 78 completed surveys, the decision-makers in 25 companies

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did not have direct usage experience with ports but outsourced their decisions to a logistics service provider. The findings of this research are based on the contributions of those with port experience, many of whom fit into more than one group of users. In the end, we had 57 usable surveys, 52 complete and 5 mostly complete.

Of those surveys that were usable, the cargo interest group was the largest respondent group at 40 of the 57 companies responding, with seven of the companies in this group both purchasing for themselves as well as for others. The smallest group of respondents was those offering marine transportation services, but even they may be acting on behalf of cargo interests, offering logistics services or trucking operations. There is considerable overlap in terms of supply chain partners and those who are acting as agents for cargo owners (or the direct cargo owners). For example, of the supply chain partners offering trucking (or rail services), more than half are also acting as cargo owners or their agents. As a result, many who responded to the survey would have found it excessively long to answer and so the structure of the survey will need to be re-designed to ask individuals to 'put on only one user hat' when completing the survey.

General quality criteria

We start by looking at the importance of evaluation criteria for the entire group of respondents, and then for each of the user groups. This is presented in table 1. What becomes clear in reviewing table 1 is that samples are small but the numbers are illustrative of possible outcomes. We did not have enough respondents in either the supply chain partner category or the shipping line group to draw any definitive conclusions. However, we did have enough of the cargo interests respondents to understand what it is that is of considerable importance to them.

Table 1 about here

In research of this type, it is common to find a narrower distribution range on importance scores, particularly where the criteria have been refined through a personal interview approach. As this research had a number of earlier studies contribute to the pool of evaluation criteria being tested, it is not surprising that these general criteria all have a mean above 5 on a 7-point scale (table 1). If we look more closely at the ranges for each of the criteria from all groups (data not provided here), it is noticeable that the full range of 1 to 7 has been indicated for all criteria. In other words, not all criteria are relevant for all types of users. A clearer picture should be available with a second round of research currently under way.

General determinants of satisfaction, competitiveness and effectiveness of service delivery

The importance scores reported in table 1 indicate what users consider to be important to them when they consider the performance of a port. However, at any given time these particular criteria may not be influencing their perceptions of the relative performance of the ports. For example, connectivity to rail/truck/warehousing companies is generally rated as

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important by users, but if this criteria is independent of the users' perceptions of the port's performance (perhaps because all ports are perceived as equally connected or because users then ignore this aspect when assessing a port's performance), then their perception of the port on this dimension will not influence their perceptions of port performance. If a port wishes to improve users' perceptions of its performance, it needs to focus its efforts on those criteria that actually influence those perceptions.

Table 2 presents the results of NPE analysis that examines the relationship between perceptions on the evaluation criteria and the output measures—overall satisfaction, competitiveness and effectiveness of service delivery. The evaluation criteria are listed in order of their relative influence on overall satisfaction (column 2).

Of particular note, 'fulfillment of special requests' has the most influence on both 'satisfaction' and 'effectiveness in service delivery' (0.287 and 0.280 respectively) and is one of the top four influences on perceived 'competitiveness. (0.210)' This is in direct contrast to the overall rated importance of 5.26 (table 1), which is the lowest among the twelve evaluation criteria rated. Most users, therefore, do *not* see this as relatively important, but if they feel the port is good at fulfilling special requests, then they are more likely to rate the port's performance as better. Because users tend to rate this as low importance, ports may not know the value of this aspect of their service in influencing user perceptions and, therefore, may not provide or emphasize this aspect of service when communicating or dealing with users; this results in a missed opportunity to improve service (and offset a competitive weakness) if other ports are doing this.

Table 2 about here

In contrast, provision of accurate information is seen as relatively important (6.05, ranked first in table 1) but comes out near to last in terms of influence for all three aspects of port performance (0.146–0.185 in table 2); while most users rate this as important, it rarely enters into their evaluation of a port's performance. This could be due to the fact that once a port is selected, the connectivity does not change much over time and the other day-to-day dealings, such as fulfillment of special requests, reliability, cargo handling, security and the provision of information, are more likely to influence perceptions of port performance. Therefore, although connectivity is reported in the literature as an important criterion in port choice, it is really less influential in evaluation of a port's performance than its importance rating would suggest.

Table 3 about here

Table 2 also illustrates that security (0.238) has the highest level of relative influence on the outcome measure of competitiveness, with the user relationship criteria provision of on-time updates of information (0.219) and fulfillment of special requests (0.214) not far behind. The overall reputation of the port (0.214) is also an important determinant of competitiveness. For effectiveness in service delivery, fulfillment of special requests (0.280) and overall quality of cargo handling (0.271) are key determinants of performance, with the overall reliability (0.252) and reputation (0.250) of the port also influencing perceived effectiveness of service delivery.

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What we can conclude from these results is that all three aspects of port performance have common influences, in particular the fulfillment of special requests, the overall reputation of the port, and the overall quality of cargo handling, but that security is particularly influential when it comes to perceived competitiveness. We can also conclude that the pattern of determinance is such that satisfaction and effectiveness of service delivery have common antecedents while the antecedents of competitiveness are different (Table 2).

Criteria specific to each of the three user groups

We also tested criteria used by the three user groups that were specific to each group.

Supply chain partners (port-related rail / truck / warehousing companies)

Nineteen of 20 supply chain partners assessed the performance of ports against specific criteria for the sub-group. Mean importance scores on the criteria were above a threshold of 5 on a scale of 1-7; however, as can be seen in table 3, the range on some of these indicates that about half of the companies did not see the criteria as being of importance to them.

The number of respondents in the supply chain partner sub-group was insufficient to evaluate performance of individual ports against importance. What can be said is that three ports had a wider range of performance scores than the other two, but port numbers were too low to draw any conclusions from this pattern (Halifax n=9; Montreal n=11; New York n=4; Seattle n=3; Vancouver n=10).

Shipping lines

Only five of the 11 shipping lines responding chose to answer these questions on their specific criteria (table 4). We believe that this was because of the considerable overlap between supply chain partners and lines, and they had already responded to the supply chain partner criteria reported above. Also, there are also fewer companies of this type than for the other groups. Unlike the previous set, the range of ratings was not the full range possible, indicating that it is possible the criteria presented are relevant to this group but we must focus on this group further in future research to confirm that their criteria are both different and appropriate.

Table 4 about here

A quick survey of performance ratings by this group (Halifax n=3; Montreal n=4; New York n=2; Seattle n=2; Vancouver n=4) indicates that three ports had performance scores on these criteria in the 4-7 range. However, two ports had received some 1s on their performance on some of these criteria indicating that there are service failures for some customers. The number of respondents in this group was insufficient to meaningfully evaluate performance against importance, and whether or not there was a significant importance–performance gap.

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Cargo interests and their agents

Mean importance scores on the evaluation criteria were all above a threshold of 5 on a scale of 1-7; however, as can be seen in Table 5, the range on some of these indicates that the some cargo interests did not see the criteria as being of importance to them. Performance scores for the five ports (Halifax n=19; Montreal n=23; New York n=7; Seattle n=5; Vancouver n=23) on these evaluation criteria was generally wide, with scores ranging from 3 to 7 but two ports received some 1s and 2s on their performance on some of these criteria indicating that there are service failures for some customers.

Table 5 and 6 about here

There were enough respondents in the cargo interests user group to provide a meaningful evaluation of the performance of ports for this specific group. NPE analysis was performed using the ratings of this group to predict their evaluation of the ports on the three performance components (table 6).

It is clear that the main determinant of receiving an excellent performance rating by a service provider is responsiveness. Effectiveness of decision making, a measure of responsiveness, scores highest on all three components (0.384, 0.333 and 0.296 for overall satisfaction, competitiveness and effectiveness of service delivery respectively). Responsiveness to requests by the port authority is also rated highly for overall satisfaction (0.309) and competitiveness (0.299). Finally, an ability to develop tailored services to different market segments determines a port's competitiveness (0.270). Cargo interests' rating of a port's expensiveness in terms of overall cost of using the port proved not to be significantly related to any of the components of performance and was scored as 0.000 for all three. On schedule performance received the highest stated importance rating (6.03) but scored 0.215 – 0.295 in terms of influence, ranking fourth for overall satisfaction and competitiveness and second for port effectiveness in service delivery.

HOW A SPECIFIC PORT MIGHT USE ITS RESULTS

It is important to consider, from the perspective of the port, the port's performance against those measures that are considered important by its users. The common approach is to identify the importance scores for all respondents, and then the aggregated performance scores of that port on those same criteria, and assess the gap existing between the scores. This may be misleading, as respondents not having experience with the port are included in the importance group. More accurate results can be gained by doing a direct pair comparison, by respondent, of the differences in scores and determine for those with experience in, say Port A, not only what is important to them but how Port A performs against those desires. It is reasonable to expect, in doing pair-wise analysis, a narrow distribution range on importance ratings with a broader distribution range but lower mean score on performance ratings.

While a number of companies had experience with the ports of Seattle and New York, in this pilot project we only had enough responses to illustrate the performance gap results for three ports—Halifax, Montreal and Vancouver, and for the general criteria and those of the cargo

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interest sub-group. There were not enough respondents in the other two sub-groups for us to present a meaningful result. Therefore we present table 7 to illustrate the results from a port perspective, and explain how a port might use the data in its strategic management and continuous improvement programs.

Table 7 about here

To explore how gap analysis can be used for continuous improvement, we use the data for one port, Port A, and take a closer look at the general evaluation criteria used by all users. How would the business strategist from Port A interpret the results found in table 7? First, it is particularly interesting that on one criterion—overall reputation—this port performs better than sought by customers; this is unusual as gap analysis is generally used to identify areas for port continuous improvement efforts. Second, for eight of the 12 criteria—provision of accurate information, perceived safety, perceived security, overall quality of cargo-handling, fulfillment of special requests, provision of adequate information, the availability of direct service, and the incident of cargo damage—the performance of the port is not statistically different from the user's requirements. This leaves three criteria on which the port might wish to take a closer look at its performance as all three have a measurable and statistically significant gap between the user's stated importance and the performance it receives—in this case the provision of on-time updates of information, the port's connectivity/operability to rail / truck / warehousing companies and the overall reliability of the port.

Second, if we do the same performance test on the other two ports, that we will call Ports B and C, do the same gaps occur? The answer is no. While we have not provided the data here due to space limitations, we can say that there are three differences: 1) neither Port B nor Port C have performance gaps where its performance exceeds importance in a statistically significant way; 2) Port B's performance scores are statistically inferior to the importance scores on five of the twelve criteria, not just the three criteria on Port A's list of criteria needing improvement; and 3) Port C's performance is statistically inferior on seven of the twelve criteria, but one of these is not on Port A's list for performance improvements. If Port A had access, via a third party survey to information on the one criterion where it fails to meet importance scores and Port C does not, this would provide the impetus for Port A to focus on improving its performance on this metric to level the field if it felt Port C was one of its competitors. Meanwhile, it appears that Port A has less work to do to bring its performance up to the standard that meets its users' needs.

CONCLUSIONS

Scholarly implications and future research

While there has been a burgeoning amount of research on the efficiency component of the efficiency–effectiveness performance dyad, not enough research on effectiveness has previously been conducted to provide meaningful constructs for developing an instrument and methodology to examine the effectiveness of port performance. Therefore, this research has focused on defining the constructs, identifying an approach to a broad groups of users, and a methodology for implementing a independent assessment system.

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The companies responding had a wide range of port experiences and a multiplicity of roles, indicating that the survey would have taken them an excessive amount of time to complete. While we expected some supply chain integration, the extent of integration is greater than anticipated, and necessitates a survey structure modification to account for considerable integration within supply chains. This will require another round of instrument testing to make the instrument more respondent-friendly.

We have found that the evaluation criteria influencing users' perceptions of satisfaction, competitiveness and service delivery effectiveness are different, and so while the determinants of these constructs have considerable overlap, they are different constructs. The use of Normalized Pairwise Estimation (NPE) proved effective in identifying statistically significant determinant attributes even with the relatively small sample size in this pilot study. Identifying these attributes as well as their stated importance provides considerably more useful information for the development of port management strategies. Determinant attributes tended to be those evaluation criteria that varied on a day to day basis and had more to do with the interactions between the parties than structural, stable properties of the port. This highlights the importance of the relationship maintained between the ports and their users, particularly in terms of being responsive to their needs. Thus identifying determinant attributes has more value to port management in their operations while the stated importance attributes are more useful in developing long-term strategies that may involve major changes and investments in the port's service characteristics.

We have been also able to illustrate how independent evaluation of port performance might be used by a port to strategically improve its service to users, and therefore have value from a port perspective in its strategic planning.

We have found enough confirmation of the proposed effectiveness criteria with this survey to test a revised survey instrument in other geographic markets, and subsequent research will be used to assess if geographic differences exist.

Managerial practice implications

This paper is not about port choice but about how well ports deliver services to their customers. Much of the effectiveness research assumes that performance outputs like competitiveness drive port choice. We have made no such assumption but leave the port choice analysis for another time and other researchers. We have illustrated to ports that if this survey were used on a wider geographic scale, individual ports would be able to read third-party provided aggregated users' assessments and compare their performance against the aggregated performance of other similar ports (similar in terms of size, geography, or operating characteristics). Then, if the criteria of importance and/or determinance is not under the jurisdiction of the port, the rating of performance enables the port to go back to the responsible parties to indicate that the criteria is of importance to the decision-maker and that there are performance shortfalls. Like a 'dashboard,' such an effectiveness evaluation program provides a basis for understanding what possibilities exist for continuous improvement. If done right, it focuses a particular port's improvement efforts on fixing performance on those importance criteria, using pair-wise statistical comparisons, where

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performance is poor and an investment of resources will have the biggest impact. The ultimate better allocation of port resources benefits users and ports alike.

Furthermore, in recent years, there has been considerable debate about who chooses a port. Early thinking was that the shipping line chose the port and the cargo chose the shipping line. The rising power of global cargo interests and the consolidation of lines has meant that ports have less power in their relationships with these users than they previously had [40]. Today, the power that cargo interests or large logistics service providers wield makes it ever more important that ports make strategic changes fully informed and based on the group of users they wish to attract or serve. Therefore, while this paper is not about port choice, its findings offer a first step in understanding what an individual port might do to enhance its ability to address contributing factors in its own users' satisfaction, perceptions of competitiveness or effectiveness in delivery of service quality.

The knowledge learned through wider application of this research has, therefore, both scholarly and practitioner contributions.

REFERENCES

1. BROOKS, M.R. and A.A. PALLIS, 2008, Assessing port governance models: Process and performance components, *Maritime Policy & Management*, 35 (4), 411-432.
2. CULLINANE, K. and WANG, T.-F., 2006, The efficiency of European container ports: A cross - sectional data envelopment analysis, *International Journal of Logistics: Research and Applications*, 9 (1), 19-31.
3. GONZALEZ, M.M. and L. TRUJILLO, 2009, Efficiency measurement in the port industry: A survey of the empirical evidence, *Journal of Transport Economics and Policy*, 43 (2), 157-191.
4. FARRELL S. 2009, Factors influencing port efficiency – a case study of Dar es Salaam, International Association of Maritime Economists (IAME) Conference (proceedings CD-Rom), Copenhagen, 24-26 June, 2009.
5. EUROPEAN COMMISSION, 2007, Communication on a European ports policy, COM(2007)616, final, Brussels: European Commission.
6. EUROPEAN SEA PORTS ORGANISATION, 2009, ESPO to lead the port performance project PPRISM. ESPO News 15.32, November –December 2009. Brussels: ESPO.
7. GUARDADO M., M. FRASQUET and A. CERVERA, 2004, Benchmarking the port services: a customer oriented proposal, *Benchmarking: An International Journal*, 11, 3, 320-330.
8. SU, Y., G.S. LIANG, C.F. LIU and T.Y. CHOU, 2003, A study on integrated port performance comparison based on the concept of balanced scorecard, *Journal of E. Asia Society for Transportation Studies*, 5, 609-624.
9. LIRN, T.C., H.A. THANOPOULOU and A.K.C. BERESFORD, 2003, Transshipment Port Selection and Decision - Making Behaviour: Analysing the Taiwanese case, *International Journal of Logistics: Research and Applications*, 6, 4, 229-244
10. SAEED, N., 2009, An analysis of carriers' selection criteria when choosing container terminals in Pakistan, *Maritime Economics & Logistics*, 11, 3, 270-288.

A Systematic Approach For Evaluating Port Effectiveness

11. NG, K.Y.A., 2006, Assessing the attractiveness of ports in the north European container transshipment market: an agenda for future research in port competition, *Maritime Economics & Logistics*, 8, 3, 234-250.
12. UGBOMA, C., I.C. OGWUDE, O. UGBOMA and K. NNADI, 2007, Service quality and satisfaction measurements in Nigerian ports: An exploration, *Maritime Policy & Management*, 34, 4, 331-346.
13. PANTOUVAKIS, A., C. CHLOMOUDIS and A. DIMAS, 2008, Testing the SERVQUAL scale in the passenger port industry: a confirmatory study, *Maritime Policy & Management*, 35, 5, 449-467.
14. UGBOMA, C., O. UGBOMA and B. DAMACHI, 2009, A comparative assessment of service quality perspectives and satisfaction in ports: evidence from Nigeria, *International Journal of Shipping and Transport Logistics*, 1, 2, 172-193.
15. CRONIN, J.J. Jr and S.A. TAYLOR, 1992, Measuring service quality: a re-examination and extension, *Journal of Marketing*, 56, July, 55-68.
16. CARMAN, J.M., 1990, Consumer perceptions of service quality: an assessment of the SERVQUAL dimensions, *Journal of Retailing*, 66, 1, 33-55.
17. SÁNCHEZ, R., J HOFFMANN, A. MICCO, G.V. PIZZOLITTO, M. SGUT and G. WILMSMEIER, 2003, Port efficiency and international trade: port efficiency as a determinant of maritime transport costs, *Maritime Economics & Logistics*, 5, 2, 199-218.
18. U.S. DEPARTMENT OF TRANSPORTATION, MARITIME ADMINISTRATION 2004, *Industry Survey Series Mainstream Container Services*, 2003.
19. LIRN, T.C., H.A. THANOPOULOU, M.J. BEYNON and A.K.C. BERESFORD, 2004, An application of AHP on transshipment port selection: A global perspective, *Maritime Economics & Logistics*, 6, 1, 70-91.
20. TONGZON J.L., 2008, Port choice and freight forwarders, *Transportation Research Part E*, 45, 1, 186-195.
21. DE LANGEN, P.W. and A. CHOULY, 2009, Strategies of terminal operating companies in changing environments, *International Journal of Logistics Research and Applications*, 12, 6, 423-434.
22. NOTTEBOOM, T.E. and RODRIGUE, J.-P., 2005, Port regionalization: towards a new phase in port development, *Maritime Policy & Management*, 32(3), pp. 297-313.
23. MARTILLA, J.A., and J.C. JAMES, 1977, Importance-performance analysis. *Journal of Marketing* 10, 1, 13–22.
24. ORTINAU, D.J., BUSH, R.P., BUSH, A., and J.L. TWIBLE, 1989, The use of importance-performance analysis for improving the quality of marketing education: Interpreting faculty-course evaluations, *Journal of Marketing Education*, 1, 2, 78–86.
25. SAMPSON, S.E., and M.J. SHOWALTER, 1999, The performance importance response function: Observations and implications. *The Service Industries Journal*, 19 (3), 1–25.
26. OH, H., 2001, Revisiting importance-performance analysis. *Tourism Management*, 22, 6, 617–27.
27. VAN RYZIN, G. G. and IMMERWAHR, S., 2007, Importance-performance analysis of citizen satisfaction surveys, *Public Administration*, 85, 1, 215-226.

A Systematic Approach For Evaluating Port Effectiveness

28. SINISCALCHI, J. M., BEALE E. K., and FORTUNA, A., 2008, Using importance–performance analysis to evaluate training, *Performance Improvement*, 47, 10, 30 – 35.
29. NESLIN, S. A., 1981, Linking product features to perceptions: self-stated versus statistically revealed importance weights, *Journal of Marketing*, 18, 80 – 6.
30. CHU, R ., 2002, Stated-importance versus derived-importance customer satisfaction measurement, *Journal of Service Marketing*, 16, 285 – 301.
31. GUSTAFSSON A. and M.D. JOHNSON, 2004, Determining attribute importance in a service satisfaction model, *Journal of Service Research*, 7, 2, 124-141.
32. DOYLE, J. R., GREEN, R. H., and P. A. BOTTOMLEY, 1997, Judging relative importance: Direct rating and point allocation are not equivalent, *Organizational Behavior and Human Decision Processes*, 70, 65-72.
33. MYERS, J. H. and M. I. ALPERT, 1968, Determinant buying attitudes: meaning and measurement, *Journal of Marketing*, 32, 13 – 20.
34. RYAN, Michael J., Robert RAYNER, and Andy MORRISON, 1999, Diagnosing customer loyalty drivers: partial least squares vs. regression, *Marketing Research*, 11 (Summer), 19-26.
35. VAN ITTERSUM, K., PENNING, J. M.E., WANSINK, B., and H. C.M. VAN TRIJP, 2007, The validity of attribute-importance measurement: A review, *Journal of Business Research*, 60, 11, 1177-1190,
36. KLEINBAUM, D. G., KUPPER, L. L., and K. E. MULLER ,1988, *Applied Regression Analysis and Other Multivariate Analysis Methods*. PWS-Kent Publishing Company, Boston.
37. STEVENS, J., 1996, *Applied Multivariate Statistics for the Social Sciences* (Third ed., Lawrence Erlbaum Associates, Inc. Mahwah, New Jersey,
38. GIANNOCARO, R., COSTANTINO, N., LUDOVICO, A. D., and R. PIETROFORTE, 2008, Measuring citizen satisfaction with aspects of public services from a local authority and determining their importance: A case study, *Public Organization Review*, 8, 1–15.
39. RUST, R. T. and N. DONTU, 2003, Addressing Multicollinearity in Customer Satisfaction Measurement. Working paper, Robert H. Smith School of Business, University of Maryland at College Park.
40. INTERNATIONAL TRANSPORT FORUM, 2009, *Port Competition and Hinterland Connections: Summary and Conclusions* (Discussion Paper 2008-19), Paris: Joint Transport Research Centre.
<http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP200819.pdf>

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Table 1: The general evaluation criteria—importance ratings

Evaluation criteria (1)	Mean importance all groups	Mean importance supply chain partners	Mean importance shipping lines	Mean importance cargo and agents
Provision of accurate information	6.05	5.75	6.64	6.05
Overall quality of cargo handling	6.04	5.75	6.73	6.13
Overall reliability of the port	5.98	5.60	6.64	6.15
Connectivity/operability to rail / truck / warehousing companies	5.89	5.95	6.18	5.85
Provision of adequate information	5.84	5.70	6.27	5.80
Provision of on-time updates of information	5.84	5.65	6.18	5.90
Port is safe	5.81	5.35	6.36	6.03
Port is secure	5.72	5.10	6.18	5.95
Incidence of cargo damage	5.63	5.40	5.73	5.73
Availability of direct service to the cargo's destination	5.49	5.20	6.27	5.53
Overall reputation of port	5.30	4.75	5.82	5.38
Fulfillment of special requests	5.26	5.25	5.73	5.20
n=	57	20	11	40

Note: (1) These criteria have been sorted by overall ranking. For 'Port is (perceived as) secure' and 'Port is (perceived as) safe', the question of importance includes 'perceived as' while in rating the performance of a specified port, the question does not.

Table 2: relative influence of general evaluation criteria on perceptions of port performance

General evaluation criteria	Port performance component		
	Overall satisfaction	Competitiveness	Effectiveness in service delivery
Fulfillment of special requests	0.287	0.214	0.280
Overall reliability of the port	0.284	0.174	0.252
Overall reputation of port	0.277	0.214	0.250
Overall quality of cargo handling	0.263	0.192	0.271
Port is secure	0.209	0.238	0.195
Provision of adequate information	0.207	0.163	0.184
Provision of on-time updates of information	0.202	0.219	0.182
Port is safe	0.198	0.162	0.145
Connectivity/operability to rail / truck / warehousing companies	0.197	0.167	0.194
Incidence of cargo damage	0.194	0.132	0.186
Provision of accurate information	0.185	0.146	0.159
Availability of direct service to the cargo's destination	0.100	0.113	0.096

Note: Read as 'The fulfillment of special requests is the most influential evaluation criterion in determining a user's overall satisfaction with a port with an NPE score of 0.287'.

Table 3: Importance of evaluation criteria to supply chain partners

Evaluation criteria	Mean importance	Range (1-7)
Efficiency of documentary processes	6.16	4-7
Incidence of delays	6.16	4-7
Accessibility to port for pick-up and delivery (gate congestion)	6.11	1-7
Adequacy of integrated communications infrastructure	5.95	3-7
Availability of capacity	5.89	1-7
Availability of labour (do we have to wait to find someone?)	5.84	1-7
Invoice accuracy	5.79	3-7
Speed of stevedore's cargo loading/unloading	5.68	1-7
Ocean carrier schedule reliability/integrity	5.53	1-7
Punctuality of arrival times	5.53	1-7
Reasonableness of port charges	5.53	1-7
Punctuality of departure times	5.42	1-7
Timely vessel turnaround	5.26	1-7
n=	19	

Note: These criteria have been sorted by mean importance from highest to lowest.

Table 4: Importance of evaluation criteria to shipping lines

Evaluation criteria	Mean importance	Range (1-7)
Capability of dockworkers (can they accommodate our needs?)	6.80	6-7
Speed of stevedore's cargo loading/unloading	6.80	6-7
Timely vessel turnaround	6.80	6-7
Availability of capacity	6.60	6-7
Availability of labour (do we have to wait to find someone?)	6.60	5-7
Incidence of delays	6.60	6-7
Timeliness of maritime services (pilotage, mooring, etc)	6.60	6-7
Overall cost of using the port	6.60	6-7
Invoice accuracy	6.40	6-7
Quality of rail / truck / warehousing companies	6.40	6-7
Availability of rail / truck / warehousing companies	6.20	5-7
Reasonableness of port charges	6.20	5-7
Quality of maritime services (pilotage, mooring, etc)	6.00	5-7
Sufficiency of size of hinterland	6.00	5-7
Adequacy of integrated communications infrastructure	5.80	5-7
Availability of logistics providers serving the port	5.60	4-7
n=	5	

Note: These criteria have been sorted by mean importance from highest to lowest.

Table 5: Importance of evaluation criteria to cargo interests

Evaluation criteria	Mean importance	Range (1-7)
On-schedule performance	6.03	3-7
Terminal operator responsiveness to requests	5.97	3-7
Overall cost of using the port	5.95	2-7
Availability of rail / truck / warehousing companies	5.73	3-7
Cost of rail / truck / warehousing	5.59	2-7
Capability of employees (can they accommodate our needs?)	5.51	2-7
Effectiveness of decision-making process (e.g., altering schedules, amending orders, changing processes to meet our demands)	5.46	2-7
Port authority responsiveness to requests	5.41	1-7
Ability to develop/offer tailored services to different market segments	5.08	1-7
n=	37	

Note: These criteria have been sorted by mean importance from highest to lowest.

Table 6: Determinant attributes for cargo interests

General evaluation criteria	Port performance component		
	Overall satisfaction	Competitiveness	Effectiveness in service delivery
Effectiveness of decision-making process (e.g., altering schedules, amending orders, changing processes to meet our demands)	0.384	0.333	0.296
Port authority responsiveness to requests	0.309	0.299	0.206
Terminal operator responsiveness to requests	0.300	0.178	0.211
On-schedule performance	0.295	0.257	0.215
Capability of employees (can they accommodate our needs?)	0.286	0.143	0.200
Ability to develop/offer tailored services to different market segments	0.267	0.270	0.205
Cost of rail / truck / warehousing	0.213	0.229	0.179
Availability of rail / truck / warehousing companies	0.190	0.184	0.118
Overall cost of using the port	0.000	0.000	0.000

Note: Read as 'Effectiveness of decision-making is the most influential evaluation criterion in determining a user's overall satisfaction with a port with an NPE score of 0.384'.

Table 7: Pairwise comparisons on general evaluation criteria for port A

Evaluation Criterion	Mean importance port A	Mean performance port A	Gap	Direction of performance gap	p<
Provision of on-time updates of information	5.71	4.93	-0.79	Lower	0.056
Connectivity/operability to rail / truck / warehousing companies	5.90	5.14	-0.76	Lower	0.072
Provision of accurate information	6.00	5.43	-0.57	Same	0.118
Overall reliability of the port	6.17	5.83	-0.34	Lower	0.077
Port is safe	6.00	5.66	-0.34	Same	0.252
Overall quality of cargo handling	6.14	5.82	-0.32	Same	0.142
Port is secure	5.86	5.59	-0.28	Same	0.368
Fulfillment of special requests	5.19	4.92	-0.27	Same	0.183
Provision of adequate information	5.68	5.43	-0.25	Same	0.458
Availability of direct service to the cargo's destination	5.55	5.34	-0.21	Same	0.576
Incidence of cargo damage	5.44	5.72	0.28	Same	0.356
Overall reputation of port	5.17	5.69	0.52	Higher	0.066

Note: These criteria have been sorted by the importance-performance gap rank (from largest negative to largest positive) to illustrate the interpretation. Using a 90% confidence interval, only those deemed to be statistically relevant have been **bolded**. (Those with a p value < .10 are the only ones deemed to be statistically different—e.g. the score on importance is not the same as the score on performance—and therefore relevant to the port at a 90% probability level.)

BIONOTES

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