MEASURING PORT EFFECTIVENESS: WHAT REALLY DETERMINES CARGO INTERESTS' EVALUATIONS OF PORT SERVICE DELIVERY?

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ABSTRACT

For port managers seeking to serve the needs of the beneficial cargo owner users, understanding the key factors critical to their evaluation of the port's customer service delivery efforts is of critical importance. This research examined service delivery effectiveness as perceived by cargo owners and agents in seven North American container ports, with more than 250,000 TEUs in volume. Using an Internet survey instrument and personalized approach, the study finds negligible differences in stated requirements of ports between cargo owners and cargo agents (as indicated by importance scores) but significant differences between the two segments in the influence that the individual criterion has on the performance scores ports receive and on the size and nature of performance gaps. I-P Gap analysis provides slightly different guidance than does Determinance analysis, indicating that there is a need for both approaches and a method for reconciling different outcomes.

Keywords: port performance, measurement, port effectiveness, port management, user criteria

INTRODUCTION

The vast majority of research into port performance has focused on efficiency, or 'doing things right'. While some research has looked at port performance in terms of effectiveness, in almost every case it is concerned with effectiveness as defined by economists, e.g. being profitable. Where effectiveness has a broader interpretation, the studies consider measures like the rate of tonnes or containers per hour loaded onto ships, or the terminal's performance on other criteria, such as trucking services, gate congestion, availability of stevedore services, and so on that are deemed to influence effectiveness. We define effectiveness in a marketing sense, of 'doing the right things,' or those things that are most

valued by the target customer or user. (Customer satisfaction is a common effectiveness measure that one has done the right things.)

Recently, ports are beginning to realize the importance of their overall reputation (Whittle, 2012) in determining the long-term success of the port. As a result, some are investing individually in marketing research (Whittle, 2012) and adopting a marketing perspective for providing service. This means a shift toward understanding and better meeting customer needs that go beyond basic efficiency and effectiveness by recognizing that different customer or user segments may have different criteria for determining satisfactory service.

This paper reports on the third phase in a five-year process to develop a suitable instrument to assist Port Authorities in determining investment priorities that will lead to better overall performance evaluations by the port user segments. Phase 1 was a detailed literature review on existing port studies and used a focus group to reduce a large number of criteria to a more usable number, while Phase 2 comprised of three pilot studies resulting in two articles which have been published (Brooks *et al.,* 2011a, 2011b) and a third that is in press (Schellinck and Brooks, 2013).

In the course of Phase 2, the authors developed the Determinance I-P (Importance-Performance) Gap Space to provide port authorities with guidance for improved service performance by user group. Originally we designed the instrument to examine the Determinance I-P Gap Space for three user groups: the cargo interests, shipping lines and port supply chain partners. In this paper we assess the need for breaking down the cargo interest group further into two segments—those who are cargo owners and those who are cargo agents acting on behalf of the owners. If these two groups tend to have different needs in terms of improvements because of different criteria used in evaluating port service delivery performance, then this may warrant producing additional analyses and reports for these segments so that port managers may focus their improvement efforts on the segments they are most interested in serving well.

The data collected for the Determinance I-P Gap Space analysis allows us to identify three measures—normative importance, the I-P Gap and the Determinance score, each providing an indication of the importance, the disparity between importance and performance, and the influence of the evaluative criteria on perceived overall service performance. We will examine all three measures to identify any differences between the groups on these criteria. If substantive differences are found, then consideration will be given to splitting this group into two.

The next section of this paper reviews the literature of relevance to the topic to provide the background needed to understand the development of the criteria and our thought process on why we have taken a marketing effectiveness approach. The third section presents the methodology used in this phase of the research (how we defined a cargo owner as distinct from an agent, the surveys designed, collected the data, and how we compared the segments). The fourth section of the paper analyzes the data collected from users of seven North American container ports that are members of the American Association of Port Authorities. This is followed by a section presenting our findings and discussion. The paper closes with a section that looks at implications for future research.

LITERATURE REVIEW

When seeking competitive advantage through cost leadership, managerial thoughts often turn to improving efficiencies and reducing the costs to deliver a given service. As container ports initially sought to use the capacity they had built, they focused on streamlining business processes and delivering a service to the shipping line with the capacity available. By the early 1990s, under pressure to do more with less and the drive to gain efficiency improvements to grow business, port processes had attracted considerable interest and port efficiency as a research stream within the port management literature was inspired by the Data Envelopment Analysis (DEA) efforts to examine port efficiency as published by Roll and Hayuth (1993). As this paper is not about port efficiency but its mirror counterpart effectiveness, the authors suggest that those readers interested in the port efficiency literature consult González and Trujillo (2009) and Cullinane (2010). These two provide a solid base for developing key performance indicators (KPIs) for port efficiency benchmarking. For companies following a differentiation or a focus strategy, suggested strategic management alternatives by Porter (1980), the key activity is benchmarking effectiveness in delivering the particular services that are integral to the competitive strategy and delivering them to the target customer at which they are directed. As Porter recognized that there could only be one cost leader but many differentiators, the task of developing criteria to feed the evaluation of competitive strategy for service-focused ports is much more complex. The company not only needs to identify the primary target market for its strategy, e.g., is it seeking to grow customers that are shipping lines or those cargo owners that are loyal to it, but it must also identify what criteria the target market deems to be important and how well the company performs on those attributes. Roll and Hayuth (1993) also noted in their seminal assessment that DEA models could also include effectiveness performance indicators, like user satisfaction but did not parse user satisfaction into its component parts.

The history of customer service research in transportation services began with the marketing literature of the 1970s and early 1980s. At this time the focus was on carrier choice modeling. The prevailing thoughts of the day were that shippers chose carriers based on price; the work of Saleh and LaLonde (1972) and McGinnis (1978) were seminal in understanding have carriers might better service shippers to gain their custom and their research identified basic criteria by examining importance of various service components. This approach was applied by Brooks (1984) in identifying the importance criteria for cargo interests in choosing a carrier, and extended by Brooks (1985) to assess which of those criteria were determinants of choice of carrier. It was the first time determinance was applied in the shipping industry and the relevance of price was bested by the relationship between the carrier sales personnel and the customer in driving choice of carrier.

As the transportation marketing discipline developed, the principles of understanding choice criteria could also be used in identifying criteria, which were not about choice but about making the best use of funds for service improvements that are relevant to the user group. This provides a framework on which service improvements can be understood. Most of the port literature, having been published by economists rather than marketers, was therefore slow to adopt this second discipline and accept that strategic assessment of poor performance might focus on issues that drive customer satisfaction, customer loyalty and the growth of revenue that could result from increasingly loyal customers who believe they are

well served by the port. Heskett *et al*. (1994) summarize the raison-d'être of effectiveness-focused efforts in the service-profit chain; it is only recently that the service-profit chain has been applied to shipping companies and there is no evidence of its application in the port industry.

While this article is not about either choice or the service-profit chain, these two are complementary to the philosophy underpinning this research. The key underlying principle of the service-profit chain is that the company seeking customer satisfaction and loyalty will identify those factors on which service delivery needs to be improved and execute these through employee action and investment of resources. When a company, in this case an individual port, understands the expectations of its customers and other users, it can harness its managerial skill to alter service delivery so as to meet these expectations in a revenue-generating way. The key will be to ensure that the additional revenue generated is more than adequate to cover the improvement cost.

Notteboom and Winkelmans (2001) identified that, for the port industry, those ports that are service-oriented and customer driven and offer 'best practice' service will be the ones that succeed. This supports the need for an instrument that identifies various user types so that the level of services provided can be improved to a best practice standard.

At present there are only three initiatives that focus on assessing user perspectives in port service delivery. The first effort to provide a third party effectiveness benchmarking standard for the port industry was when Germanischer Lloyd introduced a certification process for container terminals in 2008—the Container Terminal Quality Indicator (Global Institute of Logistics, 2008); this instrument did not find widespread adoption by the port industry. The second effort has been adopted by the European Sea Ports Organization, PPRISM—Port PeRformance Indicators: Selection and Measurement (ESPO, 2012). While this second effort developed a dashboard for all participating ports, individual ports did not get a specific understanding of their own performance against the criteria their own users consider important and relevant. This third effort is founded on the concept that an individual port will wish to benchmark its efforts against those of other individual ports against which it may compete. It was adopted in 2012 by the American Association of Port Authorities, and the findings presented here are based on the data collected from that effort.

METHODOLOGY

This research examined service delivery effectiveness in seven North American container ports, with more than 250,000 TEUs in volume. This research paper takes the data collected for the American Association of Port Authorities Port Customer Service Initiative Study and analyzes the data supplied from cargo interests and their agents.

How We Defined a Cargo Owner

Users are more than just the buyers of the port's services. Supply chain partners may not be the purchasers of port services but have experience with and influence on the delivery of port services. To allocate responses, users were classified based on their responses to a

statement describing their company. Three user groups were sought and we had responses from all three groups:

1. *Cargo interests*, defined as those responsible for either the purchase of some of the transportation services for either (a) goods they sell/buy or (b) on behalf of some importer and/or exporters.
2. *Shipping lines*, those that call ports with either (a) container or (b) bulk cargo-handling facilities.
3. *Supply chain partners*, defined as (a) warehouse operators that service port(s) with container handling facilities; (b) asset-based logistics service suppliers that use port(s) as part of the services provided; and/or (c) trucking or rail companies that service port(s) with container handling facilities.

This paper will only discuss the findings for the Cargo Interest user group (group 1 above) and its two segments (cargo owners who checked (a) and cargo agents (who checked (b)), and examine similarities and differences between the user groups.

Survey Development

Prior to this study, the Port Performance Research team on Port Effectiveness, based at Dalhousie University, undertook three pilot studies to identify the appropriate criteria for evaluating the effectiveness of service delivery and to winnow the criteria used for evaluation to those in this study. Based on a compilation of efficiency and effectiveness performance metrics from a port studies database of more than 80 journal articles and studies published over the last 15 years, a list of evaluation criteria was constructed. Through field research and discussions with industry experts, the list of potential evaluation criteria was winnowed to those most important in past studies and endorsed by experts; the results of this process was reported for the first pilot study in Brooks *et al.* (2011a). Two subsequent pilot studies examined which criteria were most relevant to each of the user groups and, based on the perceived overlap of criteria, identified a final set of criteria for use in this study. The first two pilot studies have since been published (Brooks *et al.*, 2011a and 2011b). The third pilot study was not published but was executed to pre-test the survey instrument used in this study. The winnowing of criteria is noted in Table 1. As the intent of the study is to measure effectiveness in port service delivery and not value for service, we did not deem the inclusion of the cost criteria as necessary, but opted to include it in the instrument as it was assumed to be of interest to the ports studied.

Table 1: Effectiveness Criteria Development

User	Answered In Pilot Studies	Answered in This Study
Shipping Line	12 general criteria 15 specific criteria total of 27 criteria	19 specific criteria (plus two cost criteria)
Supply chain partners	12 general criteria 13 specific criteria total of 25 criteria	15 specific criteria
Cargo owners and agents	12 general criteria 7 specific criteria total of 19 criteria	11 specific criteria (plus two cost criteria)

Woo, S.-H. and S. Pettit (2010) conducts a meta-analysis of the literature on port performance focusing on those studies where there has been significant modeling of the key components of the constructs of performance, both hard and soft measures, most of which focus on the issues on efficiency but some using mail survey data in addition to the hard data supplied by secondary published sources. Noting that the port industry has failed to capture external measures of effectiveness as seen in the other industries like air, road and rail, except for the work of Brooks (2007), there is one component assessed by Woo and Pettit (2010) that is most relevant to this survey. The constructs of service quality and customer orientation, in the Woo and Pettit (2010) port performance measurement framework, include timeliness, reliability, lead time, cargo damage and accuracy of information along with responsiveness, flexibility and claims. The Woo and Pettit (2010) constructs are somewhat aligned with the more detailed constructs developed in our previous research (three pilot studies over 2009-2010) and used in this study. The challenge is that Woo and Pettit (2010) focused their analysis on port operating companies, shipping companies, public sector players and academic institutions but did not survey the primary payer for the services, the cargo interests, which are target users and subjects for this study.

We developed two surveys, one for the East Coast (with four East Coast ports listed) and one for the West Coast (with three ports listed). The surveys were administered over a seven-week period between mid-May and end of June 2012.

Survey Content

After each respondent self-identified their user type, they were asked to identify the ports they used and the usage rate for that port.

Then, for each of up to three ports, they were asked: *Provide your overall evaluation of the effectiveness of service delivery in [named port]*. (The scale presented was a 7-point scale where 1= not effective in meeting our service requirements, and 7 = very effective in meeting our service requirements.)

Each respondent was then asked: *As a [user type named], what is important to you in evaluating the quality of a service at a port?* The respondent was presented with a criteria list identified by previous research as relevant for that user type.

Next, they were asked to evaluate the performance of the port on those same criteria, with the question: *How do you rate the quality of service in [named port] on the following dimensions:* [the scale was 1-7, with 1= very poor]

Finally demographics and open-ended comments were collected.

Survey Execution and Responses

Each port committed to participate on the understanding that neither it nor its competitors would be revealed by name. This business is highly competitive and it was our assessment, with the concurrence of the AAPA, that the naming of the ports would severely reduce the probability ports would agree to participate.

Participating ports supplied user lists for direct solicitation of users, each supplying more than 550 names; these were cleaned to remove duplicate individuals and to ensure that each

office location did not receive more than one survey, which reduced the contacts considerably. Subsequently, if a response was not received from that office location or the recruitment email was a bounce-back, a different person in the office was approached in a subsequent round.

In total, three rounds of surveys were undertaken over seven weeks. In all cases, a reminder email followed the recruitment email invitation one week later, and a second reminder the day before that round was closed. Each round took between 10 and 14 calendar days. All respondents accessed the survey via controlled token.

In order to augment the sample, we directly approached those who had participated in earlier pilot studies and had indicated a willingness to participate in future studies, as long as their offices were not already included. We also approached eight industry associations that had assisted in earlier studies and solicited respondents from those associations. All enquiries from respondents or potential respondents were replied to with a personal email from the principal investigator.

Of the 198 responses received for the east coast ports and 105 respondents for the west coast ports, 78 east coast respondents self-selected that they fit one or both of the two cargo interest categories, while 41 west coast respondents fit that category. After choosing the categories applicable, each respondent was allowed to select the role for which they wished to complete the survey. As a result, some cargo owners who also fit other definitions because of the integrated nature of their business opted to complete the survey for other user types. As a result of this self-selection process there were 104 respondents from both coasts who stated they are a "Cargo Owner or Cargo Agent" and completed the survey. Of these, 65 indicated they are "responsible for the purchase of some of the transportation services for goods we sell/make/buy", 29 said they are "responsible for the purchase of transportation services for goods on behalf of some importer and/or exporters" and 10 indicated they filled both of these roles. In order to provide a clear profile of these groups, those respondents who were both owners and agents were dropped from the analysis and those remaining comprised the two segments compared in this paper.

Methods for Comparison of the Two Cargo Interest Segments

The primary goal of the analysis is to determine whether the two cargo interest segments differ in their assessment of the areas of service in terms of what requires investment for improvement by the ports. However, before the two segments were analysed we compared their profile on three dimensions in order to help rule out alternative hypotheses as to the cause of discovered differences in the two segments. They were compared on the company's total number of employees, the company's annual sales and the number of ports used by the company in the last year. If no significant differences are found in the company profile of the two segments then they will not be used as covariates when comparing the segments.

Three measures, which were normative importance, importance-performance gaps (I-P Gap) and normalized pairwise estimation (NPE), were produced to identify differences between the segments. We then deploy the use of the Determinance I-P Gap Space developed by Schellinck and Brooks (2013) to assess the results on the last two measures.

First, the mean importance ratings on the thirteen evaluative criteria were compared between the segments. Normative importance for each group was measured by calculating the mean response to the question "As a cargo owner or agent for one, what is important to you in evaluating the quality of a service at a port?" on a seven point scale ranging from not at all important to very important for each criterion. This represents the most common and simplest approach to determining the relevance of criteria to different segments. If significant differences are found between these segments, this would suggest they could be treated differently when formulating future action to address these criteria.

The second analysis compared the mean I-P Gap sizes between the two segments. Respondents were asked in the survey to rate the performance of up to three ports depending on their experience with the ports listed. The performance of each port on a particular criterion was then subtracted from the importance rating that respondent gave that criterion to derive an importance-performance gap for that respondent for that port. A positive number would indicate a deficiency in the port's performance on that criterion. The mean of all I-P Gaps reported on a criterion by each group was compared. As some respondents did not have experience with all components of service, they did not rate the performance of the ports on all criteria. This means that the sample sizes were expected to vary somewhat among the criteria with each segment. This analysis would identify criteria where one or the other segment is more likely to feel the ports are underperforming on criteria they rate as important. This would suggest which areas might be differentially targeted for investment or marketing support.

The third analysis identified the relative influence of the evaluative criteria when each respondent gave their overall performance assessment of the ports using Normalized Pairwise Estimation (Gustafsson and Johnson, 2004). The rationale for using NPE is described in detail in Brooks *et al.* (2011a); it provides a measure of the how much the criterion determines the overall performance score and is therefore another way to identify criteria that ports need to focus on in order to improve their performance. Conceptually, the NPE represents the correlation between the performance rating and the overall performance measure adjusted downward to account for the total correlation in the model. The estimated importance measure (the NPE score) for predictor i is equal to (r_iR/S), where r_i is the correlation between the criterion and the overall measure, R is the square root of the variance explained by an OLS multiple regression using the criteria as independent variables predicting overall performance and S is the square root of the sum of the squared correlations between the criteria and the overall measure. For the NPE to be reported as having a value greater than 0, however, the correlation between the performance rating and the measure of interest (e.g., provision of adequate on time information) must be statistically significant.

There are no reported statistical tests for comparing two NPE scores; however, the primary component of the score is the correlation between the rating and the overall performance score. When examining differences between the two segments, we therefore tested to see if there were significant differences in the underlying correlations using a technique described in Kleinbaum and Kupper (1978, pp 106-108). This involves first transforming the correlation values using Fisher's *Z* transformation, which normalizes these values and provides standard mean and variance estimates. This *Z* value can be treated as a standard *Z* with traditional

values such as Z = 1.96 for α = 0.05. The sample sizes vary among the criteria since not all respondents had the required experience to rate each criterion.

On the surface it appears that the three measures will likely lead to similar results; however, each has the potential to identify different criteria that are worthy of attention by ports when providing service to the chosen target segment. This analysis will highlight the potential for different criteria to be identified for attention depending on the measure used, and the benefits of using these measures will be illustrated. We report our findings at two significance levels, treating those that are significant at the $p < 0.05$ level as conclusive and those at the $p < 0.10$ level as suggestive and warranting further investigation.

The final comparison between the segments examined whether the evaluative criteria were placed in the same inference area of the Determinance I-P Gap space. There are five inference areas as described in Figure 1. Criteria that are located in area A are those that receive relatively high NPE scores and have large I-P Gaps meaning they meet both criteria for investment (i.e., the port is underperforming on a deterministic criterion). The evaluative criteria in area B are those that score highly on one dimension (either highly deterministic attributes [B1] or large I-P Gaps [B2]) or score at a medium level for both and therefore warrant secondary attention for investment. Area C contains those attributes that receive the lowest priority and area E has the attributes where the ports are performing well on low deterministic attributes and therefore do not require attention at this time. Inference area D contains those attributes that are deterministic and where the firm is performing well compared to importance. If the firm is performing well compared to other ports they can use attributes located in this inference area for promotion in a marketing campaign aimed at increasing user awareness of these strengths.

Figure 1: Interpreting the Determinance I-P Gap Space
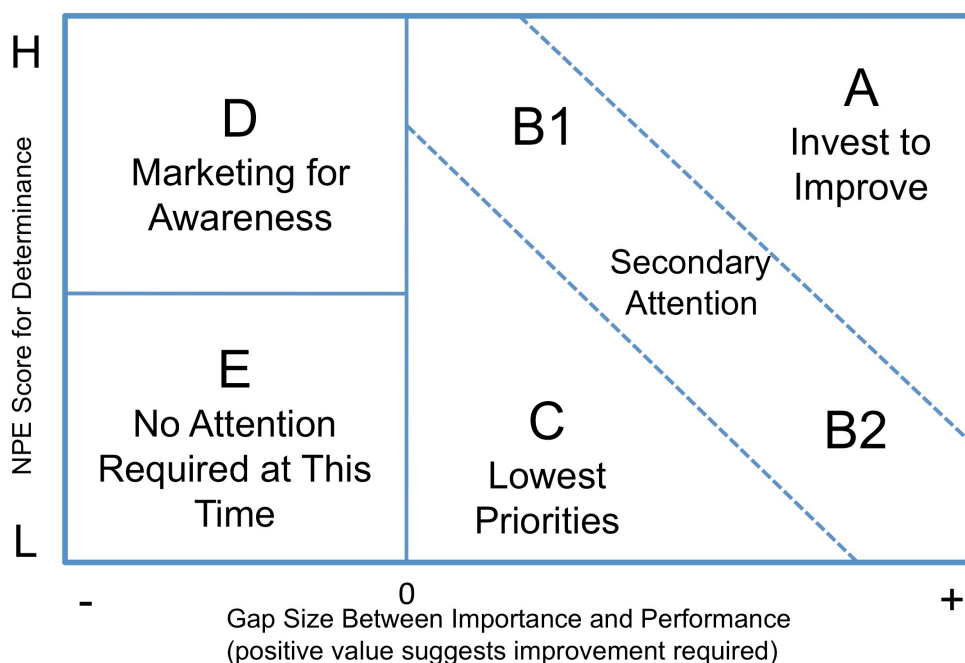
The survey measured thirteen evaluative criteria of which two are strictly cost related while eleven measure aspects of service delivery performance. When generating the Determinance I-P Gap Space, we only graph the service performance attributes so that the space represents the potential for investments related to service quality and identifies how the remaining criteria should be treated by port managers.

DATA ANALYSIS

Table 2 presents the company profiles of respondents in terms of the number of employees, annual total sales and the number of ports visited yearly. The two segments are not significantly different on any of these three dimensions. Therefore, while we have found differences between the types of users within the cargo inter user group, the respondent companies of the cargo agents and cargo owners have similar profiles.

Table 2: Profile Comparison Between Cargo Interest Segments

Number of Employees (Corporate Total)	Cargo Owner N = 63	Cargo Agent N = 24	Total Cargo Interests N = 87
Under 100	22%	38%	26%
100 - 999	33%	21%	30%
1,000 - 19,999	24%	17%	22%
20,000 or more	21%	25%	22%
Total	100%	100%	100%
$\chi 2 = 3.001$ df = 3, p = 0.392			
Annual Sales (Corporate Total)	N = 58	N = 24	N = 82
Under $49 Million	21%	38%	26%
$50 - $999 Million	40%	25%	35%
$1 Billion or more	40%	38%	39%
Total	100%	100%	100%
$\chi 2 = 2.924$, df = 2, p = 0.232			
Number of Ports Used Last Year	N = 63	N = 26	N = 89
1 - 4 ports	44%	39%	43%
5 - 9 ports	33%	27%	32%
10 + Ports	22%	35%	26%
Total	100%	100%	100%
$\chi 2 = 1.489$, df = 2, p = 0.475			

To assess the role of importance, the two segments were compared in terms of mean importance ratings on the 13 evaluative criteria in Table 3. Of the 13, only one pair of means was close to significantly different between the two segments with Cargo Owners stating a greater concern for overall cost of using the port (F = 3.488, p = 0.065). This is likely related to who bears the brunt of the costs.

Table 3: Mean Importance of Evaluative Criteria for Cargo Segments

Evaluative Criteria	Cargo Owners N = 65	Cargo Agents N = 29	Total User Group
Overall reliability of the port	6.55	6.48	6.53
Overall cost of using the port	6.42*	6.03	6.30
Provision of adequate, on-time information	6.26	6.34	6.29
Cost of rail / truck / warehousing	5.95	5.48	5.81
Capability of employees (can they accommodate our needs?)	5.80	5.79	5.80
Availability of direct service to the cargo's destination	5.92	5.48	5.79
Terminal operator responsiveness to special requests	5.62	6.07	5.76
Incidence of cargo damage	5.54	5.90	5.65
Port security	5.54	5.83	5.63
Connectivity/operability to rail / truck / warehousing	5.37	5.62	5.45
Port authority responsiveness to special requests	5.23	5.45	5.30
Choice of rail / truck / warehousing companies	5.09	5.24	5.14
Ability to develop/offer tailored services to different cargo interests	4.66	4.83	4.71

* Difference between segments is significant at the $p < 0.10$ level.

To assess gaps in service delivery found, Table 4 compares the I-P Gap sizes of the two cargo interest segments. Positive gaps are those that need attention in order to improve performance. The evaluative criteria are ranked in order of the difference in I-P Gap sizes between the two segments reported in the last column with larger I-P Gaps for Cargo Owners on the top rows and for Cargo Agents on the bottom rows. The I-P Gap is larger for Cargo Owners for the cost of rail/truck/warehousing ($p < 0.05$) and for the overall cost of using the port ($p < 0.10$). At the other end of the table the Cargo Agents have larger I-P Gaps for terminal operator responsiveness to special requests, the provision of adequate, on-time information ($p = 0.05$) and for the incidence of cargo damage ($p < 0.10$).

Table 4: Importance-Performance Gap Sizes for Cargo Interest Segments

Evaluative Criteria	Cargo Owners n = 55 - 96	Cargo Agents n = 26 - 38	I-P Gap Difference
Cost of rail / truck / warehousing	2.98	1.83	1.14**
Overall cost of using the port	3.15	2.54	0.61*
Ability to develop/offer tailored services to different cargo interests	-0.11	0.04	-0.15
Overall reliability of the port	0.71	0.95	-0.24
Availability of direct service to the cargo's destination	0.14	0.40	-0.26
Port security	-0.36	-0.03	-0.33
Connectivity/operability to rail / truck / warehousing	-0.05	0.29	-0.34
Port authority responsiveness to special requests	0.02	0.41	-0.39
Capability of employees (can they accommodate our needs?)	0.38	0.86	-0.48
Choice of rail / truck / warehousing companies	-0.54	-0.05	-0.49
Provision of adequate, on-time information	0.54	1.08	-0.53**
Incidence of cargo damage	-0.34	0.23	-0.58*
Terminal operator responsiveness to special requests	0.42	1.06	-0.64**

** Difference between segments is significant at the $p < 0.05$ level.

* Difference between segments is significant at the $p < 0.10$ level.

To assess the relative role of evaluative criteria influencing overall performance scores, Table 5 presents the NPE scores for both cargo segments and the difference between them. The evaluative criteria are ranked in terms of the difference between the NPE scores with those evaluative criteria where the Cargo Owners had larger NPE scores located at the top of the table. The results suggests ($p < 0.10$) that perceptions of a port's performance in terms of port security, the cost of rail/truck/warehousing and the overall cost of using the port have a greater impact on the rating of overall service performance for Cargo Owners than for Cargo Agents. On the other hand, perceptions of terminal operator responsiveness to special requests are significantly ($p < 0.05$) more likely influence a Cargo Agent's evaluation of a ports overall service performance.

Table 5: Differences in Cargo Owner and Cargo Agent NPE Scores

Evaluative Criteria	NPE for Cargo Owners N = 79 - 112	NPE for Cargo Agents N = 34 - 43	NPE Difference
Port security	0.20	-0.01	0.21*
Cost of rail / truck / warehousing	0.17	0.01	0.16*
Overall cost of using the port	0.16	0.02	0.14*
Availability of direct service to the cargo's destination	0.16	0.12	0.04
Connectivity/operability to rail / truck / warehousing	0.13	0.11	0.03
Ability to develop/offer tailored services to different cargo interests	0.23	0.24	-0.01
Provision of adequate, on-time information	0.32	0.35	-0.03
Overall reliability of the port	0.33	0.39	-0.06
Incidence of cargo damage	0.13	0.18	-0.06
Capability of employees (can they accommodate our needs?)	0.29	0.39	-0.10
Port authority responsiveness to special requests	0.14	0.27	-0.13
Choice of rail / truck / warehousing companies	0.05	0.19	-0.14
Terminal operator responsiveness to special requests	0.10	0.40	-0.29**

** Difference between segments of correlations is significant at the $p < 0.05$ level.

*   Difference between segments of correlations is significant at the $p < 0.10$ level.

Figures 2 and 3 present the Performance I-P Gap Space for Cargo Owners and Cargo Agents respectively. Cargo Owners have two attributes that fall into the 'invest to improve' area while Cargo Agents have four attributes in this area. However, Cargo Owners uniquely have two attributes that fall into the 'marketing for awareness' area. There are four criteria that fall into the same inference areas in the two graphs (these have square markers while criteria that fall into different areas have diamond shaped markers). Two of these—overall reliability of the port (D) and the provision of adequate, on-time information (K)—fall into the 'invest to improve' area for both groups. The availability of direct service to the cargo's destination (E) consistently falls into the lowest priority area and the choice of rail/truck/warehousing companies (J) falls into the 'no attention required at this time' area for both groups.

Two criteria that are in the 'invest to improve' area for Cargo Agents are either in the 'secondary consideration' area (capabilities of employees in accommodating needs [I]) or in the 'low priority' area (terminal operator responsiveness to special requests [M]) for Cargo Owners. For Cargo Owners, two attributes are located in the 'marketing for awareness' area: the ability to develop/offer tailored services to different cargo interests (C) and port security (F). The remaining three attributes never appear in the 'invest to improve' or 'marketing for awareness' areas.

Please note that we do not recommend the use of the results illustrated here by ports for their strategy development as our experience shows that the location of specific attributes varies considerably among ports. These graphs report the average position of these

attributes over seven ports for the two segments with the sole purpose of illustrating the average difference in attribute placement between the two groups. Each port's individual results are very much unique.

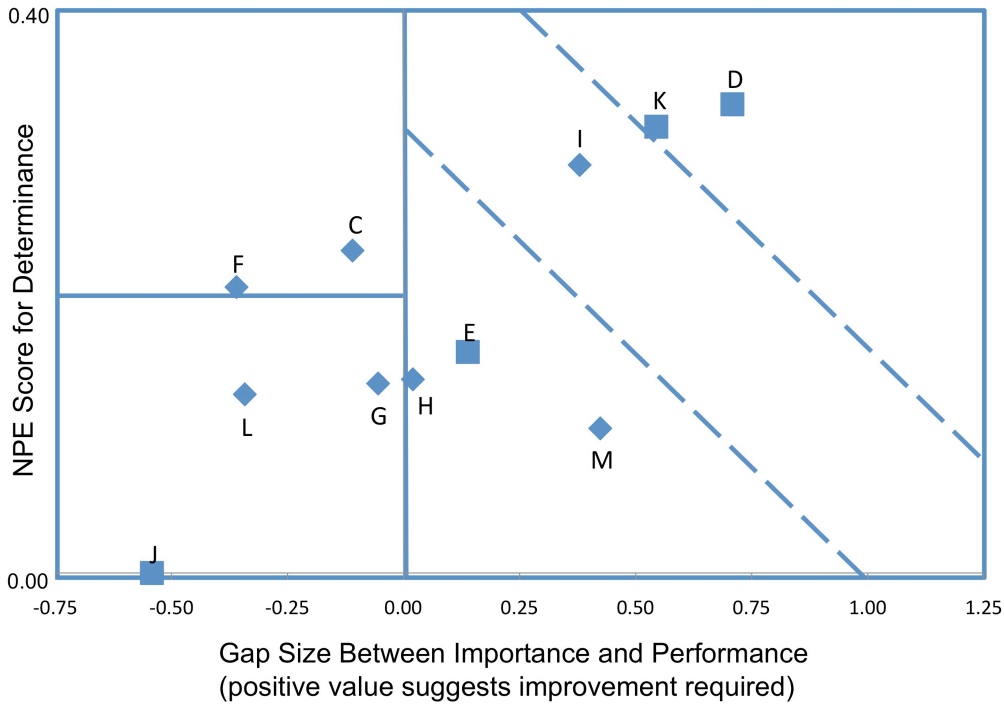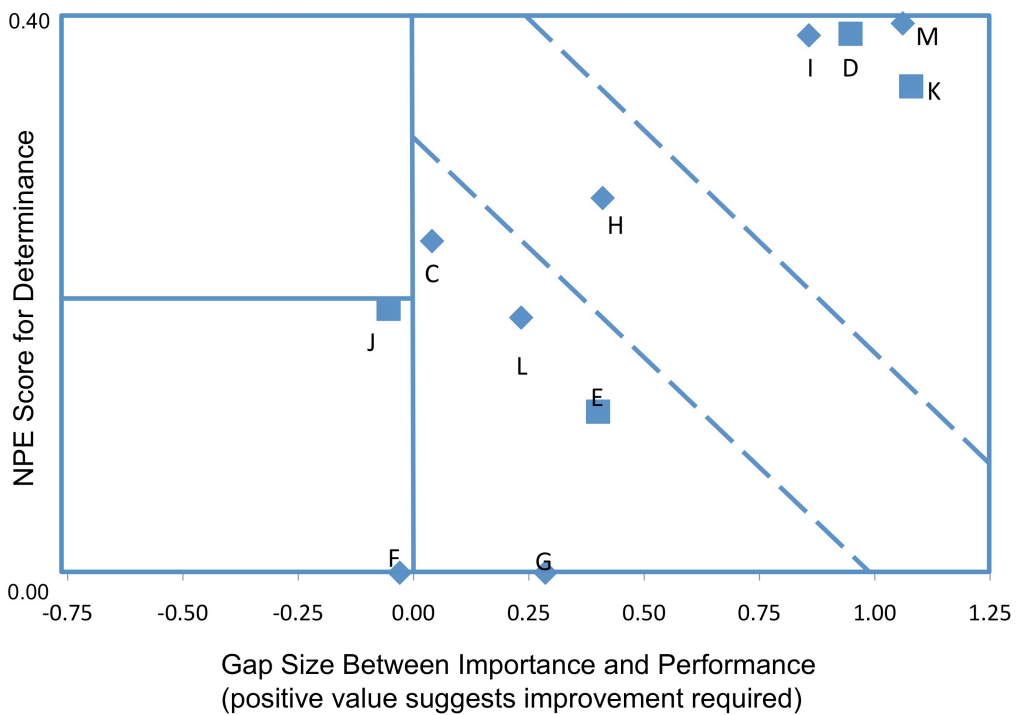Figure 2: Determinance I-P Gap Space for Cargo Owners

Gap Size Between Importance and Performance
(positive value suggests improvement required)

Figure 3: Determinance I-P Gap Space for Cargo Agents

Gap Size Between Importance and Performance
(positive value suggests improvement required)

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FINDINGS AND DISCUSSION

The three methods of determining evaluative criteria relevance and where companies should focus when targeting specific segments have all been used in the past. We see here that they both reinforce each other and identify unique evaluative criteria that might merit special attention when focused on specific segments. The comparison of means found only one difference significant at the $p < 0.10$ level. The results suggest that Cargo Owners see the overall cost of using the port as more important. The same criterion was found to have a larger I-P Gap and have greater determinance for Cargo Owners using the remaining two approaches as well ($p < 0.10$).

The I-P Gap comparison found two differences significant at the $p < 0.05$ and three more at the $p < 0.10$ levels. Finding five differences out of thirteen suggests the two segments are quite different in terms of where attention needs to be focused in order to improve the overall service performance ratings. The results suggest that cost factors are more critical to Cargo Owners, while for Cargo Agents the terminal operator responsiveness to special requests, and the provision of adequate, on-time information, and the incidence of cargo damage are indicated to need port attention. The NPE analysis uses the perception and performance data to derive empirically a measure of determinance and is distinctive from the other two measures. This analysis identified four criteria that differentially influence overall performance ratings, three of which were identified in the I-P Gap analysis as well. Cargo Owners appear to be more influenced by their perceptions of the cost of rail / truck / warehousing and the overall cost of using the port while Cargo Agents are more influenced by their perceptions of the terminal operator responsiveness to special requests. Unique to the NPE analysis, Cargo Owners appear to be more influenced by their perceptions of port performance on port security when assessing overall service performance.

In total, six out of 13 criteria were found to potentially differ in terms of the need for attention between the two segments using the three approaches. The two cost criteria are clearly more relevant to Cargo Owners along with port security while for Cargo Agents the focus is more on criteria related to customer relationships such as the terminal operator responsiveness to special requests, and the provision of adequate, on-time information. Cargo damage is also more relevant to this segment.

The study finds negligible differences in stated requirements of ports between Cargo Owners and Cargo Agents (as indicated by importance scores) but significant differences between the two segments in the influence that the individual criterion has on the performance scores ports receive and on the size and nature of performance gaps. I-P Gap analysis provides slightly different guidance than does Determinance analysis, indicating that there is a need for both approaches, which can be reconciled using the Schellinck and Brooks (2013) Determinance I-P Gap Space approach.

Attribute placement in the Determinance I-P Gap Space differed for seven of the eleven criteria graphed and most importantly two more criteria were identified that were located in the 'invest to improve' area for the Cargo Agents than for Cargo Owners while two criteria

were located in the 'marketing for awareness' area for Cargo Owners only. This lends further support for evaluation of these two segments separately when conducting this analysis.

IMPLICATIONS FOR RESEARCH AND POLICY

This paper adds to the scholarly knowledge beyond that initially provided by the Brooks et al. (2011a) assessment of Canadian port users, and the Brooks et al. (2011b) assessment of Canadian and U.S. port users on the East Coast of North America. By narrowing the focus to effectiveness issues specifically for beneficial cargo owners, and specifically for container cargoes, the research has drilled deeper to explore whether these large users groups can be further segmented, and what the particular influencers are in their assessment of port performance.

The paper focuses on the determinants of users' evaluation scores based on a five-year research program by the Port Performance Research Network of ports in Canada and the U.S. and what these findings mean for strategic decisions made by port managers. Participating ports all reported that the Determinance/Importance-Performance Gap Space provided a framework on which they could hang improvement initiatives, one that would likely be readily understood by their partners and staff, and best to repeat in about two years. Most important of all, by pooling the market research function under an independent third-party, each port does not face the problem noted by Whittle (2012) of having its own results without deep understanding of its results relative to those of its competitors the joint research effort by ports identifies best practice benchmarks and each port can see its performance in a context consisting of those it competes against.

Finally, this research validates the use of the Determinance–IP Gap Space for analyzing users' perspectives in the port industry (Schellinck and Brooks, 2013); it was found to be a readily understandable technique for practicing managers, securing its use for fields beyond transport services to many other service operations.

To conclude, we have used the findings of this research to refine the research instrument, SEAPORT (Service Effectiveness Assessment for PORT managers), for use in future port service evaluation studies.

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