

PORT SELECTION FACTORS AND ATTRACTIVENESS: THE SERVICE PROVIDERS' PERSPECTIVE

ABSTRACT

Through undertaking a likert-style questionnaire survey towards ports located in five Asian and Latin American countries, this paper studies the major attributes in determining port attractiveness from the perspective of service suppliers. By comparing the survey results with the results undertaken from an earlier survey on service users, i.e., shipping lines (Ng, 2006), special attention was paid on whether the perception from service suppliers and users were conflicting each other. It is believed that this paper has provided constructive insight on port attractiveness, as well as a springboard for further research on port competition.

KEYWORDS

Port attractiveness; port service suppliers; likert-style questionnaire; average significance score (ASS)

1. INTRODUCTION

Ports gain more economic relevance as they gradually become logistical nodal points of an increasingly globalized market, which can be seen at both local and national levels. Port facilities have always helped create job positions and attract industrial activities around them, boosting the growth of their surrounding economy. We may regard ports as hubs which agglomerate firms from different complementary activities, thus creating port ‘clusters’ (De Langen, 2004). In turn, this exercises an important dragging capacity on the other companies of the region. Since their individual evolution depends on the evolution of the cluster they form, from a micro-geographical perspective it is worth wondering which the factors that condition the development of the group, in general, and of the specific port behind it are, i.e., which factors leverage the port capacity to attract activities or traffic to its facilities.

On the other hand, there is a strong negative relationship between transport costs and trade volume, as well as between the cost level and the availability of infrastructure. Besides, it is known that, the lower the transport costs, the higher foreign investment and service export levels, and the better the chances of a country to have access to technology (Sanchez et al., 2003). Against this background, to have a good port infrastructure positively contributes to the economic development of a country with direct access to the sea, just like any hindrance to the smooth operation of ports imposes an additional cost, to the detriment of its economy competitiveness. From this macro-geographical perspective, it is worth wondering then which factors streamline the role of ports within the transport chain; i.e., which factors affect its quality of service and, consequently, boost its attractiveness.

The practicality of identifying these factors increases as inter-port competition is enhanced and inter-port competition becomes stronger when the demand for maritime transport of containers grows at a pace higher than goods production itself, as it has been the case throughout the last years (Baird, 2006). If the use of containers in maritime transport is the key to foster the sector, this is because it enables goods to be efficiently carried across different ports, encouraging competition among them. However, research studies published up to now are not enough and offer different results as for identifying the keys to port selection process, linking the attractiveness of a port to different variables. The complexity of the subject, the obstacles to access the statistic information necessary for assessment, and the fact that the outcomes of the papers, which studied the selection of the means of transport, extended to the problem of port selection, made this situation possible.

Nevertheless, there are relevant inputs in this connection. From a thorough review of the literature on port selection process, we intend to put pieces of puzzles within this field together so as to continue moving it forward in its study. With such understanding, this paper aims to fulfil three major objectives, including: (i) investigating the roles of qualitative factors in port choice; (ii) comparing the similarities and differences between port service suppliers and users; as well as (iii) providing appropriate platform for further research on port attractiveness and competitiveness. To that end, we start by assessing the nature of port service demand and selection in section 2, where we explain the need for digging in this subject from the port agents’ perspective. Sections 3 and 4 present the

methodology and empirical results respectively, while section 5 concludes the major findings.

2. PORT SERVICE DEMANDS AND PORT SELECTION

At the core of the port sector, competition arises among terminals within a same port, between different ports, whether belonging to the same domestic system or not, or between maritime and other alternate means of transport. Likewise, the transit of goods through port facilities triggers additional competition, intra-port competition, unleashed between agents operating in the same port and delivering similar services. All these competition processes occur at the same time, conditioning one another and intermingling, also, with local, regional and federal political-economic interests.

Indeed, intensified port competition is a generally-accepted phenomenon nowadays, and port managers should address it bearing in mind that port is dynamic (Hoyle and Charlier, 1995), i.e., depending on how factors that condition its attractiveness relatively evolve against other ports. Lacking knowledge about these factors may result in, if not failure, wastage of resources, for instance, the competitive strategies developed lead to excess installed capacity. This risk is taken because, contrary to the expectations from a higher mobility of goods, increased inter-port competition is fostering traffic concentration. Progressive increase of vessel size for the exploitation of scale economies makes service quality maintenance, in terms of travel frequency, only possible by reducing the number of berthing ports. Therefore, and not only to leverage port attractiveness but also to prevent congestion of facilities, the managers, supported by local authorities, try to encourage traffic growth by expanding and improving infrastructure (Haralambides, 2002; Malchow and Kanafani, 2004). This is due to two main reasons: the perception of port managers on factors determining the port capacity to attract traffic, and their lack of capacities to act on some other ones that, regardless of their significance, are beyond their control. In the former, factors include port infrastructure improvement, modernization of equipment, granting of terminal use to large shipping lines, identification and development of alternative routes, setting of competitive fees or fostering efficiency in service delivery, and so forth. In the latter, factors would include, for instance, location and accessibility.

However, which of these conditions are relevant to favour port selection? The interests in unveiling the conditioning factors of port attractiveness are, indeed, not something new¹. Pioneer studies in addressing this subject empirically can be traced back to the 1970s. For example, Foster (1977) highlighted geographical proximity to the port and the characteristics of the services delivered in its facilities as determining factors for port selection. However, in 1978, the same author suggested that the key was actually transport cost. In this respect, the significance of both works lied in that they were pioneers attempting to find out what attracted users to ports, though at the same time they also stated how difficult it would be: two studies; two opposed results. As Slack (1985) commented later, these works addressed the issue at a high level - from the perspective of decision-makers. Disparity of conclusions might have been attributed to low survey responses and that the survey was aimed at a very heterogeneous group of companies without taking into account the export destinations.

¹ For a comprehensive review on port research, see Pallis et al. (2010).

More recent studies attempted to overcome Foster's contradictions by boiling down the problem of port selection and analyzed more specific scenarios. For example, Slack (1985) carried out a study to unveil the behaviour of North American exporters who then traded in the European Economic Community (EEC) using containers. He concluded that for port users what matters were cost and the services offered by transport companies, both inland and maritime (not port's characteristics). On the contrary, and almost at the same time, Branch (1986) suggested that port selection broadly depended on the characteristics of port facilities and fees. Indeed, further works, whose outcomes continued to differentiate from one another, confirmed the complexity of the subject concerned and the need for further research. For example, Bird and Bland (1988) concluded that a decisive factor in port selection was service frequency of maritime transport offered by ports, while D'Este and Meyrick (1992) highlighted the significance of port proximity to the shipper; Murphy and Daley (1994) suggested that cargo safety was highly decisive; Tongzon (2002) believed that the efficiency of service delivery was the key factor; and Garcia-Alonso and Sanchez-Soriano (2009) revived the idea that port location was the most key port selection factor.

Most of these factors had been the variables considered in the studies conducted to assess the port selection process ever since. Most of them were related to the common objective of the port users: efficient transport of the considered cargo, which depended upon transit cost and time. Malchow and Kanafani (2004) distinguished four key factors in each one of these two aspects. Regarding cost, overland distance from place of origin to port, port fees, maritime distance from port to cargo destination and average size of vessel; regarding transit time associated to each port, distance from place of origin to port, time needed to transfer cargo from land to vessel, time needed for berthing of vessel in transit ports, and maritime distance to destination port. Finally, Lim et al. (2004) summarized five effective conditioning factors of port traffic: (i) handling cost of containers'; (ii) proximity to main navigation routes; (iii) proximity to import/export areas; (iv) basic infrastructure condition; and (v) existing feeder network.

Nevertheless, even until now, researchers cannot generally agree on the decisive factors from the port user perspective, as knowledge on the keys to inter-port competition is broadening, certain consensus has been reached around monetary costs, and specifically, port fees, have a lower impact on the initially assumed port selection. As Preston (2004) argued, due to the very nature of decision-making of the human mind, the more structural and 'humanistic' aspects could not be ignored when researchers attempted to understand this issue. Hence, factors which are not closely related to maritime transport service cost (*qualitative factors*) are being acknowledged to the detriment of the significance initially assigned to those factors more related to monetary cost itself (*quantitative factors*). However, its inclusion in the empirical models was rather complex. Moreover, some aspects of these multiple goals might conflict against each other, and this required decision-makers to include the interaction of several standards, whose relative weight varies as the circumstances around the decision do (Guy and Urli, 2006).

Such difficulty partially explained why they were not considered even researchers as Veldman and Buckmann (2003) acknowledged their relevance. Thus, inputs made by various researchers applying various technical tools, e.g., Veldman and Buckmann (2003) (multinomial logit model), Lirn et al. (2004) (AHP), Chang et al. (2008), Kolanovic et al. (2008) (both factor analysis), Wu et al. (2009), etc., to the assessment of selection criteria

became utmost importance. In addition, there is no final conclusion on which is/are the key factor(s) in port selection, which is the next step we should take towards unveiling the origin of port attractiveness. This is vital because it is known that the relative importance of different factors does not only vary according to the circumstances in which they are considered, but also to the concepts that appraise them². Besides, port agents rarely take their decisions based on a single factor, and each decision in particular has many goals. In this respect, a serious problem exists, where existing literature largely concentrates on the demand side (like shipping lines and freight forwarders, see Ng (2006) and Tongzon (2009) respectively), while the perspective from service suppliers is rather lacking. Such a deficiency implies that there is currently a scarcity of studies investigating whether the perception of port service suppliers and users are matching each other.

3. METHODOLOGY

In accordance to the methodology proposed by Ng in his paper published in 2006 (cf. Ng, 2006), who also served as a co-author of this paper, the relevant factors for port selection in this study were collected from the port service suppliers' perspective. Specifically, we had analyzed the information collected through a survey conducted to a group of port stakeholders located in Chile, China³, Colombia, India and Uruguay. Ng analyzed the factors determining the attractiveness of ports by means of surveys addressed to directors and agents of the main shipping lines operating in Northern Europe. To conduct the said survey, Ng considered 20 attributes gathered in table 1 which was ranked by survey respondents using a likert-style questionnaire, with scores ranging from 0 to 5⁴. These scores were calculated to form an average significance score (ASS) for each factor. In this study, similar attributes and ranking scale have been considered to know the opinion of port service providers, and to compare it in later papers with Ng's research outcomes, i.e., to be able to compare it with the service demand side, where respondents were requested to give scores reflecting the significance of 20 factors affecting port attractiveness. As noted by Ng (2006), these factors were identified with reference to existing literature, as well as in-depth discussions with various stakeholders within the port and shipping industries. In other words, this study also serves as an extension of the project by Ng (2006) investigating the nature and development of port attractiveness.

Table 1. Factors considered in this study

Factor code	Factor
C1	Monetary cost (terminal handling charge and port dues)
C2	Time efficiency
C3	Geographical location
C4	Cases of delays in loading/unloading containers
C5	Record of damage during container-handling
C6	Custom procedures (e.g., inspection, documentary, etc)
C7	Port authority policy and regulations
C8	Accessibility of the port

² See for example Hanelt and Smith (1987), Lirn et al. (2004) or Murphy et al. (1997). To overcome this limitation, researchers such as Malchow and Kanafani (2004), Tiwari et al (2003) or Veldman and Buckmann (2003) used discrete selection models to assess the combined and careful selection of the shipping line, the port and the overland transport mode.

³ Hong Kong, Macau and Taiwan were excluded from this exercise.

⁴ The interpretation of the attribute ranking as to its contribution to port attractiveness is as follows: 0, not significant; 1, very little significant; 2, little significant; 3, significant; 4, quite significant; and 5, very significant.

C9	Quality of port infrastructure in container-handling
C10	Quality of port superstructure in container-handling
C11	IT and advanced technology
C12	Dedicated terminals and facilities for transshipment
C13	Supporting industries (e.g., warehousing, insurance, etc.)
C14	Quality of other services (like pilotage, towing and mooring)
C15	Availability of professional personnel in port
C16	Preference of shipping lines' clients/shippers
C17	Relations between port operator and shipping lines
C18	Efforts of marketing on the port by port authority
C19	Reputation of port within the region
C20	Speed in responding to liner's new demands and requests

Two surveys towards Latin American port service suppliers had been conducted in Bogota (Colombia) and Santiago (Chile)⁵, with 40 relevant responses being received⁶. Likewise, a similar survey was conducted to the Chinese and Indian port stakeholders, with 21 relevant responses being received. During the survey period, all respondents were key decision-makers in respective ports concerned. As the information gathered came from different groups, also located in different countries, the goal of the statistical analysis conducted by means of this paper is to identify whether there is a consensus on the attributes considered relevant for port selection by port service suppliers. To achieve this objective, the discrepancies found in the answers have been analyzed considering the country of origin, as well as the group of respondents. Finally, port service suppliers (hereinafter called 'port stakeholders') can be divided into: (i) national port authority (APN); (ii) local port authority (APL); (iii) port/terminal operator (OP); and (iv) public institution (PI). In all cases, both Latin America and Asia, port authorities can be defined as landlord or moving towards the direction of landlord port governance system.

4. EMPIRICAL ANALYSIS

4.1. Preliminary analysis

Based on ASS, responses were processed and ranked, as illustrated in table 2 (Uruguayan and Chinese cases were not included here due to their small sample sizes). Results indicate that the countries and the port stakeholders concerned share similar perception pattern regarding port selection factors in deciding port attractiveness. For countries, time efficiency (C2), case of delays (C4) and port accessibility (C8) serve as the core factors in deciding port attractiveness, while quality of port infrastructure (C9), port superstructure (C10) and speed in responding liner's new demands and requests (C20) have middle ranks, indicating that these attributes should also not be ignored. For stakeholders, time efficiency (C2), case of delays (C4), port accessibility (C8), quality of port infrastructure and superstructures (C9 and C10 respectively) serve as the core factors in deciding port attractiveness, while the speed in responding liner's new demands and requests (C20) is another significant factor. A major difference is that national port authorities do not seem to regard monetary costs (C1) as an important factor, although they regard port authority

⁵ All the respondents had similar rank to those previously surveyed by Ng (2006), within the shippers group. In the case of ports, surveys were answered by major public national and local authorities, managers and directors of port companies, and people responsible for government services, such as Custom's and Health Control).

⁶ Six forms were later sent by e-mail.

policy and regulations (C7) as something which cannot be overlooked. Their perception, however, does not seem to be shared by other port stakeholders.

Table 2. Ranking of port selection factors by countries and stakeholders

Factor code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
Countries	7	1	9	2	14	15	15	4	5	6	3	10	15	19	11	11	18	20	13	8
Colombia	18	1	8	2	16	16	8	4	7	6	3	12	10	14	15	12	19	20	11	5
Chile	4	1	14	2	10	9	19	5	3	6	7	18	11	14	17	13	11	20	14	8
India	2	3	7	6	12	17	18	4	8	9	1	4	19	20	10	11	14	15	15	12
Stakeholders	7	1	9	2	14	16	15	4	5	6	3	6	16	19	11	12	18	20	12	8
National port Authority	17	1	10	2	16	17	8	2	6	7	2	13	12	14	10	15	18	19	9	5
Local port Authority	3	1	7	5	15	16	18	4	6	8	2	10	19	16	12	11	13	20	14	9
Port operators	3	1	13	2	9	13	18	5	7	5	4	7	11	20	17	11	13	18	13	9
Public institution	2	2	7	5	7	7	13	5	1	2	7	11	16	13	16	18	13	20	18	11

To confirm this objectively, analysis of variance (ANOVA) was applied to the survey results, as illustrated in table 3. Results indicate that, at a significance level of 0.05, the null hypotheses (H_0) can be rejected for all factors except C3 (geographical location), C11 (IT and advanced technology), C12 (dedicated terminals and facilities) and C18 (efforts of marketing on the port by port authority).

Table 3. Statistical testing (ANOVA): port selection factors vs. countries

ANOVA	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
F-value	4.06	32.1	2.9	17.92	8.25	14.79	26.7	5.47	10.34	14.28
Prob.	0.0217	0	0.0621	0	0.0006	0	0	0.0063	0.0001	0
ANOVA	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
F-value	2.14	0.79	49.79	30.76	4.31	8.92	6.84	0.62	10.42	18.3
Prob.	0.1256	0.4593	0	0	0.0174	0.0004	0.002	0.5404	0.0001	0

ANOVA was applied again in comparing against the similarities found in the responses gathered in groups: national port authorities (APN), local port authorities (APL), terminal operators (OP) and other authorities/institutions (P), as illustrated in table 4. Results indicate that, at a significance level of 0.05, H_0 can be rejected for all factors except for monetary cost (C1) and marketing efforts in the port by port authorities (C18).

Table 4. Statistical testing (ANOVA): port selection factors vs. port stakeholders

ANOVA	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
F-value	2.24	8.82	2.52	10.18	9.94	8.36	14.69	5.62	6.47	8.29
Prob.	0.0742	0	0.049	0	0	0	0	0.0006	0.0002	0
ANOVA	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
F-value	4.44	3.64	20.77	11.85	3.77	2.92	3.17	1.28	5.57	4.44
Prob.	0.003	0.0097	0	0	0.008	0.0276	0.019	0.2855	0.0006	0.003

Although agglomerate results provide indications on the major factors in deciding port attractiveness, different port stakeholders have diversified opinions in their perception of the most important factors. Moreover, different countries may also have different opinions due to the geographical variations, the existence of diversified background and political culture (Ng and Pallis, 2007). Hence, in the following sub-sections, analysis will focus on diversified opinions between different countries and port stakeholders.

4.2. Country-based analysis

The correlation between the appraisal of attributes considered in port selection and the nationality of the respondents was analyzed per country pairs. Tables 5, 6 and 7 (Chile *vs.* Colombia; Chile *vs.* India; and Colombia *vs.* India) show the results obtained with a 5% level of significance for those attributes where it is possible to reject H_0 . Two-sample *t*-tests with unequal variance were conducted to evaluate differences among the means of Chilean and Colombian respondents on the factors of port attractiveness, and the results of test are report at table 5. There have a significant differences among the means of Chile and Colombia respondents with alpha = 0.05 for the factors of monetary costs (C1, $p = 0.0096$), and port authority policy regulations (C7, $p = 0.0311$). Such results indicate that there are no significant differences between the two groups of respondents in their answers. Generally speaking, Chilean respondents regard monetary costs (C1) as more important, while Colombian respondents believe that port authority policy and regulations (C7) are more significant in deciding port attractiveness (see table 2). Apart from that, however, there are no significant differences between them in terms of their perception of the factors in deciding port attractiveness.

Table 5. Chile vs. Colombia (*t*-test unequal variance)

Factor code	Factor	diff < 0	diff = 0	diff > 0
C1	Monetary cost (terminal handling charge and port dues)	0.9952	0.0096	0.0048
C7	Port authority policy and regulations	0.0156	0.0311	0.9844

Two-sample *t*-tests with unequal variance were conducted to evaluate differences among the means of Chilean and Indian respondents on the factors of port attractiveness, and the results of test are report at table 6. Results indicate that the priorities between Chilean and Indian respondents are quite similar who regard monetary cost (C1), time efficiency (C2), case of delays (C4) and port accessibility (C8) as core factors in deciding port attractiveness (table 2). Their major difference lies on custom procedures (C6) and supporting industries (C13), where Chilean respondents regard it as more significant than their Indian counterparts, and *vice versa* for availability for professional personnel in port (C15).

Table 6. Chile vs. India (*t*-test unequal variance)

Factor code	Factor	diff < 0	diff = 0	diff > 0
C1	Monetary cost (terminal handling charge and port dues)	0.9836	0.0327	0.0164
C2	Time efficiency	1	0	0
C4	Cases of delays in loading/unloading containers	1	0	0
C5	Record of damage during container-handling	0.9998	0.0004	0.0002
C6	Custom procedures (e.g., inspection, documentary, etc)	1	0	0
C7	Port authority policy and regulations	1	0	0
C8	Accessibility of the port	0.9984	0.0032	0.0016
C9	Quality of port infrastructure in container-handling	1	0	0
C10	Quality of port superstructure in container-handling	1	0	0
C13	Supporting industries (e.g., warehousing, insurance, etc)	1	0	0
C14	Quality of other services (e.g., pilotage, towing, mooring, etc.)	1	0	0
C15	Availability of professional personnel in port	0.9884	0.0233	0.0116
C16	Preference of shipping lines' clients/shippers	0.9997	0.0005	0.0003
C17	Relations between port operator and shipping lines	0.9997	0.0006	0.0003
C19	Reputation of port within the region	0.9995	0.0011	0.0005

C20	Speed in responding to liner's new demands and requests	1	0	0
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Two-sample *t*-tests with unequal variance were conducted to evaluate differences among the means of Colombian and Indian respondents on the factors of port attractiveness, and the results of test are report at table 7. Results indicate that there have a significant difference with $\alpha = 0.05$ between the means of countries on all factors except monetary cost (C1, $p = 0.2782$), IT and advanced technology (C11, $p = 0.0897$), dedicated terminal and facilities for transshipment (C12, $p = 0.4812$) and efforts on marketing on the port by port authority (C18, $p = 0.4787$). Generally speaking, the priorities between Colombian and Indian respondents are quite similar, of which they both sets of respondents regard time efficiency (C2), case of delays (C4), port accessibility (C8), port accessibility (C11) as core factors in deciding port attractiveness (see table 2). Their major differences lie on supporting industries (C13) and the speed of ports in responding to liner's new demands and requests (C20), where Colombian respondents regard them as more significant than their Indian counterparts. Colombian respondents also perceive port authority policy and regulations (C7) as important factors in deciding port attractiveness.

Table 7. Colombia vs. India (*t*-test unequal variance)

Factor code	Factor	diff < 0	diff = 0	diff > 0
C2	Time efficiency	1	0	0
C3	Geographical location	0.9989	0.0021	0.0011
C4	Cases of delays in loading/unloading containers	0.9998	0.0004	0.0002
C5	Record of damage during container-handling	0.9998	0.0005	0.0002
C6	Custom procedures (e.g., inspection, documentary, etc)	1	0	0
C7	Port authority policy and regulations	1	0	0
C8	Accessibility of the port	0.9976	0.0049	0.0024
C9	Quality of port infrastructure in container-handling	0.9994	0.0011	0.0006
C10	Quality of port superstructure in container-handling	1	0	0
C13	Supporting industries (e.g. warehousing, insurance, etc)	1	0	0
C14	Quality of other services (like pilotage, towing and mooring)	1	0	0
C15	Availability of professional personnel in port	0.9983	0.0035	0.0017
C16	Preference of shipping lines' clients/shippers	0.9999	0.0002	0.0001
C17	Relations between port operator and shipping lines	0.9964	0.0072	0.0036
C19	Reputation of port within the region	1	0	0
C20	Speed in responding to liner's new demands and requests	1	0	0

Results seem to confirm that, despite existing differences of opinions, there are no significant variations among the studied countries regarding the major factors that determine port attractiveness. Respondents from all nationalities regard time efficiency, case of delays and accessibility of ports are the core factors. An interesting difference can be observed here, though, since Latin American respondents seems to regard factors directly related to the public administrations, notably custom procedures and port authority policy and regulations as significantly more important than their Indian counterparts. Since all the cases are developing countries located in Asia and Latin America, the findings from this paper should be very useful for countries at similar level of development.

Nevertheless, geographical variations should be carefully studied in further research; those could be explained because of their diverse backgrounds and political cultures, their

histories as port authorities and / or related to the different experiences of port devolution processes.

4.3. Port stakeholder-based analysis

The *t*-test was applied to analyze possible correlations between the appraisal of factors relevant to port selection and the category each surveyed port agent belongs to, comparing 2 to 2. Table 8 shows the attributes for which it is possible to reject H_0 with a significance level of 5%. These attributes are those whose different appraisal between port agents cannot be explained at random.

Table 8. Attributes for which the null hypothesis can be rejected

Factor code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
APN vs. APL		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
APL vs. OP		X		X	X	X				X		X	X							
APL vs. PI	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	
APN vs. OP							X							X	X					X
APN vs. PI	X				X	X			X											
OP vs. PI			X		X	X			X	X				X						

Analysis on the similarities and differences between stakeholders are given below:

- i) **APN vs. APL:** there are significant differences with $\alpha = 0.05$ on all factors expect monetary cost (C1, $p = 0.789$). The priorities between both sets of respondents are highly similar, of which they both regard time efficiency (C2), case of delays (C4), accessibility of port (C8), IT and advanced technology (C11) and speed in responding to liner's new demands and requests (C20) as core factors in deciding port attractiveness. There are very few differences between these two groups of respondents except, ironically, port authority policy and regulations (C7), of which national port authorities regard this attribute as much more important than their local counterparts.
- ii) **APL vs. OP:** there are significant differences with $\alpha = 0.05$ on the factors report of damage (C5, $p = 0.0026$), customers procedures (C6, $p = 0.0063$), and dedicated terminals and facilities for transshipment (C12, $p = 0.0153$). There also have a significant differences on the means of the factors time efficiency (C2, $p < 0.0001$), case of delays (C4, $p = 0.0003$), and quality of port superstructure (C10, $p = 0.0029$). Both of respondents think that these factors are important in deciding port attractiveness, while custom procedures (C6, $p = 0.0063$) is a not-so-important issue. A major difference lies in supporting industries (C13, $p = 0.0018$), of which local port authority does not regard it as an important factor in deciding port attractiveness.
- iii) **APL vs. PI:** there are significant differences with $\alpha = 0.05$ on all the factors expect preference of shipping line's clients/shippers (C16, $p = 0.1548$) and speed in responding to the liner's new demands and requests (C20, $p = 0.0791$). Both set of respondents regard monetary cost (C1), time efficiency (C2), case of delays (C4) and accessibility of the port (C8) as highly important factors in deciding port attractiveness. On the other hand, their major differences seem to lie in record of damages (C5) and custom procedures (C6), of which public institutions other than the port authority see these factors as significantly more important than local port authorities.
- iv) **APN vs. OP:** there are significant differences on port authority policy and regulations (C7, $p = 0.0017$), quality of other services (C14, $p = 0.0042$), and availability of professional personnel (C15, $p = 0.0282$). Furthermore, there has a significant

difference on speed in responding to liner's new demands and request (C20, $p = 0.0399$) among two group with a high rank indicates that both of respondents regard C20 as an important factor in deciding port attractiveness. The major difference seems to lie on port authority policy and regulations (C7) and availability of professional personnel in port (C15), where national port authorities regard it as a much more significant attribute than port/terminal operators.

- v) **APN vs. PI:** there have no significant differences on the factors of port attractiveness among two groups of respondents except C1, C5, C6, and C9. We draw out that the means and the ranks of national port authority are higher than customs on factors monetary cost (C1, $p = 0.0092$) and port infrastructure (C9, $p = 0.0309$) indicate that public institutions other than port authorize regard C1 and C9 as highly important factors deciding port attractiveness, of which such perception is not shared by national port authorities. Furthermore, there have a significant differences exists on the mean for record of damage (C5, $p = 0.02899$) and custom procedures (C6, $p = 0.0309$) among two sets of respondents
- vi) **OP vs. PI:** there have a significant difference at level at $\alpha = 0.05$ on factors geographical location (C3, $p = 0.0298$), record of damage (C5, $p = 0.0415$), as well as quality of other service (C14, $p = 0.0375$). Besides, there also has a significance level at $\alpha = 0.05$ difference between the means of terminal operator and customs on quality of superstructure (C10, $p = 0.0407$) with a high rank indicates both of respondents place a great emphasis on the quality superstructure, while certain differences exist between custom procedures (C6, $p = 0.072$) and quality of port infrastructure (C9, $p = 0.0032$).

To summarize, port stakeholders generally agree that the attractiveness of ports is mainly decided by the time efficiency, case of delays and accessibility offered by respective ports. At the same time, monetary cost, quality of infra- and superstructures and the speed in responding to client's changing demand are also factors which should not be ignored. While diversified opinions exist, one should not ignore the considerable number of factors of which H_0 cannot be rejected. This implies that port stakeholders provide coherent responses and thus their concern and perception on port attractiveness are, in fact, very similar.

4.4. Supply-demand analysis

Finally, the similarities found in the identification of the determining aspects of port selection allow for furthering its analysis. The surveyed port service suppliers widely agree on their appraisals, regardless of their origin or responsibility for providing these services. It is worth wondering then if such appraisals match those made by service users (i.e., the demand side - shipping lines). To find this out, we compared the results against those previously prepared by Ng (2006). Table 9 depicts the ASS, both for the former paper and for this one. Such comparison may also illustrate about matches between visions.

Table 9. Average significance scores of port selection factors between port users and service suppliers

Factor code	Factor	Demand side*	Supply side		
			Colombia	Chile	India
C8	Accessibility	4.47	4.38	4.29	3.08
C2	Time efficiency	4.42	4.92	4.43	3.15
C4	Cases of delays	4.42	4.46	4.57	2.77
C1	Monetary cost	4.26	3.29	3.86	3.38

C20	Speed in responding	4.05	4.33	4.29	2.15
C3	Geographical location	4.00	3.79	3.43	2.85
C9	Quality of port infrastructure	3.89	4.13	4.29	2.69
C15	Professional personnel in port	3.89	3.63	3.71	2.31
C11	IT and advanced technology	3.74	4.46	4.00	3.46
C12	Dedicated terminals	3.53	3.54	3.00	3.00
C10	Quality of port superstructure	3.42	4.17	3.86	2.46
C17	Relations port operator-shipping lines	3.37	3.29	3.86	1.92
C6	Custom procedures	3.26	3.33	3.14	2.15
C16	Preference shipping lines' clients	3.21	3.63	3.71	2.23
C19	Reputation of port	3.11	3.83	3.86	1.85
C7	Port authority policy	3.05	4.04	2.57	2.00
C14	Quality of other services	2.95	3.67	3.14	1.77
C5	Record of damage	2.89	3.54	2.57	2.08
C18	Efforts of marketing	2.79	2.50	2.00	1.77
C13	Supporting industries	2.74	3.71	3.14	1.77

* According to Ng (2006)

Results indicate that there are disparities of visions as there are only two attributes, i.e., C2 and C8, with important consideration from both service demand and supply sides. Also, one can observe a large dispersion among the attributes most valued by port service suppliers with respect to the views expressed by users regarding port attractiveness. The assessment of their relevance varies between groups. For users, port accessibility is the most valued, while for port authorities there is a diversity of views. Among this group, it is also possible to differentiate between the perceptions of Latin American and Asian stakeholders. The first match with users identifying as key features the following: port accessibility (C8), time efficiency (C2) and delays (C4), although in both cases, accessibility would be the third variable in importance, almost the same level of consideration as speed in responding (C20). Also, this group believes that monetary costs (C1) and geographic location (C3) issues are less important than the quality of the port infrastructure (C9) or IT and advanced technology (C11); that are aspects less valued by the users. As regards the Asian suppliers of port services, they have shown different views related to the variables determining port attractiveness. On the one hand, the variables identified as most relevant, are: IT and advanced technology (C11) and monetary costs (C1); on the other hand, it is noticeable the low valuation of the rest of attributes, compared with other groups. This leads to believe that there is another set of variables of which they consider as important, in addition to the features considered in the current survey.

5. CONCLUSIONS

It is a well-known fact that contemporary liner shipping is characterized by increasing ship size, high geographical coverage and frequent restructuring of shipping network. Such development has intensified inter-port competition, thus highlighting the importance for ports to sustain and improve service quality, and thus attractiveness, to port service users. While the major attributes in deciding port attractiveness from the perspectives of users, notably shipping lines and shippers, have been widely studied, the perspective from service suppliers, i.e., port operators and authorities themselves, has been, so far, largely overlooked.

Through a likert-style questionnaire survey targeted towards major ports within five major Asian and Latin American countries, this paper studies and identifies the major attributes in deciding port attractiveness from the perspective of service suppliers. Results indicate that, given the highly coherent responses between different countries and port stakeholders, a ‘general view’ exists in terms of the major attributes in deciding port attractiveness, where time efficiency, case of delays and the accessibility of ports seem to be perceived as the core factors in affecting port attractiveness. However, noticeable perception differences between what port authorities classify as relevant to port selection by shipping companies and what the shipping companies themselves believe can also be identified, especially in monetary cost, geographical location and, perhaps most importantly, the speed of ports in responding to the new demands of shipping lines (service users).

Said results are particularly important to, besides highlighting the significance of authorities in port development and in contributing to the countries’ economies, point out the need to go deeper in the knowledge of maritime business and the way they - clients - make decisions about their port service providers. Indeed, this paper is one of the few series of studies where the same author (as a co-author in this paper) employs a similar, thus comparable, methodology and reviews the attributes affecting port attractiveness, and so the survey and analytical results here should be able to provide an invaluable comparative references between port service users and suppliers. Last but not least, we believe that this paper can provide constructive insight on port attractiveness, as well as a springboard for further research on port competition.

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