PORT STRATEGIES FOR THE NEW ECONOMY: AN EMPIRICAL INVESTIGATION

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ABSTRACT

The proposed study is designed to measure primarily sea-based and secondarily land-based logistical links that support merchandise related trade in Asia & North America at a macro-level. The method and instrument development are based on macro-level published data. For further development, data will be collected using surveys, field observations, and interviews conducted in the United States, Korea, and China; and conceptual discourses within and beyond the research team will be used to develop conclusions. To our knowledge this is the first study to apply AHP to measure global port competitiveness along two dimensions: 'customer-facing' competitiveness as well as 'investment-attracting' competitiveness.

Keywords: AHP, Empirical, Port, Logistics

INTRODUCTION

From the time of the pioneer sailing on April 26, 1956 of Ideal-X, the first containership, from Newark, New Jersey, international trade and transport have been transformed through containerization. The result has been an alteration of the geography of production and distribution according to the 2007 Conference CFP "Globalization and Freight Transportation in a Containerized World", available at: http://www.gfptt.org/Entities/EventProfile.aspx?list=all&id=5621f7a8-eae8-4847-8e34-a1499c156391, accessed on March 1, 2007, with Asia becoming the global center for all types of manufacturing and service creation. Starting with Singapore, Hong Kong, and Busan, many Asian ports have taken full advantage of containerization and associated inter-modal transport methods to create some of the world's most efficient and competitive ports [22], [23].

In recent years, Asian merchandise trade has grown at a rate higher than the rate of growth of global trade in North America and Europe (see Table 1). Within Asia, of course, the main driver of merchandise trade is China where imports as well as export growth rates in recent years have hovered around 25 percent per year (see Table 1). While merchandise trade growth rates are high for Europe, trade among the European Union member states accounts for most of this growth. Asian trade, on the other hand, is directed significantly outside the region although intra-Asia trade is also growing. Table 2 further dramatizes the very high levels of North America and Europe-linked merchandise trade from China and Korea. In 2005, Asia's North America and Europe-linked trade was about $1.1 trillion dollars while North America's and Europe's combined Asia-linked trade was about $600 billion dollars.

TABLE 1

Share in Merchandise Trade by Global Regions or Countries

Region or Country	Exports				Imports			
	1990	**2000**	**2005**	**% Change 2000-5**	**1990**	**2000**	**2005**	**% Change 2000-5**
North America	16.6	19.5	14.5	4%	19.6	25.8	21.7	6%
Europe	49.6	42.0	43.0	11%	50.1	42.4	43.2	10%
Asia (Korea, China)	21.8	26.4	27.4	11%	20.3	22.9	24.7	12%
-China	1.8	4.0	7.5	25%	1.5	3.4	6.3	24%

Source: Based on WTO statistics, available at: http://www.wto.org/english/res_e/statis_e/its2006_e/its06_bysubject_e.htm , accessed on: September 10, 2007.

TABLE 2

Merchandise Trade among North America, Europe, Asia Regions

		Merchandise Trade with ($billions, 2005):		
		North America	***Europe***	***Asia***
Merchandise Trade from ($billions, 2005)	***North America***	824	238	270
	Europe	398	3201	332
	Asia	608	498	1424

Source: Based on WTO statistics, available at: http://www.wto.org/english/res_e/statis_e/its2006_e/its06_bysubject_e.htm , accessed on: September 10, 2007.

Asia's merchandise trade with North America and Europe is increasing faster than the planned capacity expansion for ports located in those regions. This means that the probability of supply chain interruptions due to port capacity constraints is also heightened. To mitigate these emerging imbalances and potential interruptions, several initiatives have been undertaken, or are being contemplated [7], [8], [9], [10]:

- Extreme pressure on the Long Beach port in California is spawning initiatives to enhance East Coast and Gulf ports in USA, and to increase volumes to Canadian ports, with surface transport of some of the goods to USA.
- China's development push in its own western region has shifted container volume to inland Yangtze ports - with Shanghai as a hub. This is necessary since 90% of China's international trade is handled through marine transport.
- The intense transshipment competition between major East Asian ports such as Busan and Shanghai has led to major investments in port capacities.
- Middle East ports such as Dubai Jebel Ali, Jeddah, are making continuing efforts and Aqaba to upgrade and to become transshipment centers not just for Middle East/Africa but also for South Asia – capturing some of the expected growth through Busan and China.
- China has launched aggressive plans to upgrade the infrastructure of its remote western regions by building a major highway link from its western provinces to the Pakistan port of Gwadar.
- Busan has consistently increased its berth capacity among its five member ports to discourage competition and maintain competitive service levels.
- The European Union, with the support of agencies such as Geneva-based International Road Transport Union (IRU), is making concerted efforts to improve transportation infrastructure by developing regular road-rail, inter-modal links, via northern and southern routes, to western China.
- To mitigate the increased costs and decreased service levels at some US ports, the Panama Canal widening project has prompted private firms to invest in increasing capacities on the US Gulf and East Coast ports such as Houston, Savannah and Charleston.

These initiatives are designed to mitigate the anticipated capacity imbalances that could potentially interrupt important supply chains, harm trade, and weaken national economies. This leads to the first research question:

> *Will the existing actions by ports improve their competitive positions? Will the improved competitiveness result in the expected outcome of mitigating supply chain disruptions and attracting new container volume?*

The underlying general research question is the following:

> *What are the factors on which ports compete? How can ports manage their congestion and growth so as to become and remain competitive?*

LITERATURE REVIEW

The literature on how ports compete has primarily addressed port competition from the viewpoint of the customer (customer-facing) within a country or region [10]. Other studies either do not specify the context for their findings (i.e., whether the findings apply within a specific region or on a global scale) or they address only a few of the competitive factors (e.g., [3], [12], [13],[14], [17]. Collectively, these studies identified five major factors affecting port competition from the viewpoint of a customer. These include port location, cargo volume, service level, port facility, and port expenses (lowest cost or price). In the [10] model, the authors expressly exclude port expenses because the accounting practices in the Chinese ports they studied were heterogeneous – making meaningful comparisons difficult. In this study, the variable 'port expenses' were included as a subjective factor so that Port Competition can be measured in a more robust manner. Based on these studies, we adapted general definitions for each of the five competitive factors. Greater levels of each of the following factors are considered to make a port more competitive:

(1) Actual Cargo Volume (not capacity): Carriers and port users view major ports that handle large volumes of containers as preferable. Total volume combining import, export, and transshipment cargo appears to be more important than any single category of volume.

(2) Port Facility Capacity: Port facilities are defined as all tangible assets that are used to service water-borne cargo. Capacities of these assets are of particular importance to liners and carriers since ports operate during peak and off-peak periods. They include infrastructure, superstructure, and labor assets.

(3) Port Location: Location factors include geographical distance from production facilities, ease of port and berth entry, potential for expansion, and quality of inter-modal access.

(4) Service Level: The percentage of cargo that will be off-loaded/loaded within the port management's promised time period (variance of time promised), as well as the average off-load/load time. This includes operation during peak periods and in adverse weather conditions.

(5) Cost Competition: The cost to the liner per TEU for load/off-load service as well as applicable port duties. From the viewpoint of a liner/user, Cost is a surrogate for port efficiency – so efficiency will not be measured separately [10].

Perhaps the most important issue with Asia-linked trade today entails the second factor listed above – Port Facility Capacity – because the existing 10,000, 14,000, and planned 18,000 TEU post-Panamax vessels require 16-21 meter, deep draft, multi-berth container ports [21, Module 2, Pg. 41, Box-12]. Currently, neither the US nor Busan (Korea) or China ports can handle all of these vessels when fully loaded [5]. From the viewpoint of a customer/user, this could be especially problematic for developing countries because their fast growth and steady shift to world-class manufacturing will rely on developing reliable and efficient supply chains. These efficiencies will necessarily involve accommodating the larger vessels. Supply chain interruptions – caused by inadequate scale and efficiency of ports – would severely hamper developing countries competitiveness. Other well-known Asian-port rivalries (e.g., Busan-Shanghai, Singapore-Dubai) are motivating these mega-ports to improve their competitiveness for transshipment business by planning to build the capacity to handle the larger vessels. Berths at Busan's new port are currently being planned to accommodate larger ships.

In addition to the factors considered important to a customer (customer-facing competitiveness), the literature identifies factors affecting port competitiveness for resources (e.g. FDI and/or governmental funding). We group these factors under the label of "investment competitiveness". These competitive factors are heavily influenced by public policy and could be used to shape public policy [21]. These factors are:

(1) Legal Framework: This entails the degree of autonomy of port management, including its own judiciary, to work outside of political arenas (similar to US Administrative courts) and the specific agreement between central and local governments describing the powers of port officials.

(2) Institutional Structure: The management structure should be conducive to investment (Private Sector ports), with proper autonomy and have a cooperative relationship with labor. The labor force should be sufficient and well trained. Table 3 demonstrates the four major port management structures and spells out how they differ with respect to the control over port assets and activities. They are Public Service Ports, Tool Ports, Landlord Ports, and Private Sector Ports. Table 4 describes each management structure – including its strengths and weaknesses. At the extremes, Public Service ports are operated as not-for-profit entities whose primary goal is public service; while Private Sector ports operate solely in the interest of the investors – with the government abdicating its rights for any public good.

(3) Financial Resources: Autonomy to use port revenue for maintenance and expansion, maintain healthy cash flows, and the capacity to raise funds when needed.

(4) Port Reputation: The use of a mechanism, such as a port sector regulator, to ensure fair competition among the various entities that compete in ports. This involves preventing anti-competitive practices that often take place with port monopolies.

(5) Price: The price that ports charge for basic services including container handling, premiums for peak periods, and storage fees.

The literature suggests that the public policy factors are key factors for a port's competitiveness for investment income. Investment sources include local private, foreign direct investment (FDI), local governmental, central governmental or federal, and international agencies or intergovernmental.

TABLE 3

Port Management and Operations by Port Type

Port Management or Operations Aspect	***Port Type***			
	Public Service Port	***Tool Port***	***Landlord Port***	***Private Sector Port***
Administration	Public	Public	Public	Private
Nautical Management	Public	Public	Public	Private
Infrastructure – Nautical	Public	Public	Public	Private
Infrastructure – Port	Public	Public	Public	Private
Superstructure – Equipment	Public	Public	Private	Private
Superstructure – Buildings	Public	Public	Private	Private
Cargo Handling	Public	Private	Private	Private
Pilots	Mixed	Mixed	Mixed	Mixed
Towing	Mixed	Mixed	Mixed	Private
Mooring	Mixed	Mixed	Mixed	Private
Dredging	Mixed	Mixed	Mixed	Mixed
Inter-modal Connections	Mixed	Mixed	Mixed	Mixed

Note : Mixed – A combination of Public and Private
Source: [21, Module 1, Pg. 9, Box-5)

TABLE 4

Port Types, Missions and Orientations (available on request from authors)
Source: Adapted from World Bank Report, 2007

The results of the literature review answers the first research question:

What are the factors on which ports compete? How can ports manage their congestion and growth so as to become and remain competitive?

This study finds that there are ten factors measuring two dimensions of port competitiveness. Included in these ten factors are variables measuring a port's ability to attract new investments. New investments in port infrastructure lead to reduced congestion and provides resources to manage growth.

METHODOLOGY

The Analytic Hierarchy Process (AHP) is one methodology used in decision-making. Its strength is its ability to utilize both quantitative and qualitative criteria in the same analysis. Saaty [16] developed the concept of AHP, defining it as "…combining both subjective and objective assessments or perceptions into an integrative framework…" based on ratio scales from pair-wise comparisons. Wedley [20] described the techniques associated with AHP in the following three steps:

(a) Structure a network hierarchy
(b) Making pair-wise comparisons to yield priorities
(c) Synthesizing the priorities into composite measures of the decision alternatives or options.

According to [10, pg. 11] "…due to its applicability in business decision-making, resource allocation, priority rating, and performance evaluation problems, AHP has been used in a variety of studies. AHP application example can be found in [2], [4], [15], [18]." A useful feature of AHP is its applicability to measuring intangible and tangible criteria through ratio scales . In addition, by breaking problems into separate elements and relating them in a hierarchical, logical manner beginning with a single high-level decision – descending in a step-wise manner to lower-level criteria on which the decision will be made. A decision-maker is able to relate the higher-level to the lower-level criteria through a series of pair-wise comparisons [19].

Several studies have applied AHP to maritime decision-making [10]. For example, Frankel [10] applied it to shipping policies, and [11] to shipping liner competition. These studies, however, are limited in that they only utilize the methods analytical and conceptual elements. Haralambides [5] applied an advanced version of AHP, called fuzzy set logic, to model shipper choice in international shipping. This pilot study applies AHP to an empirical investigation of port competitiveness. The data were collected from expert academics, port directors and managers, shippers, carriers, and public officials. Next, a description of the application of the AHP stages to container port competition among Asia, Europe, and the United States is made to measure perceived competitiveness using upper and mid-level objectives.

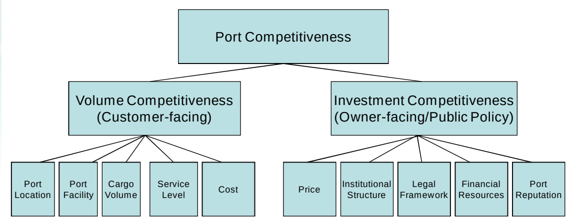
Step 1: The Decision Hierarchy

The first step required for AHP analysis is to establish a network structure. This can be done by:

(a) Identifying the ultimate goal or decision on the top of the hierarchy
(b) Establishing one or more mid/lower-level objectives that are the criteria to evaluate the goal
(c) Link the criteria to specific variables on which the criteria are measured
(d) Finally, listing identified alternatives on the bottom, which are linked with the higher level variables, criteria and the ultimate goal of the decision

The ultimate goal of this study is 'Port Competitiveness', which is positioned at the top of the hierarchy. Next, mid-level goals are 'Volume Competitiveness' and 'Investment Competitiveness'. The third level involves the variables and attributes of port competitiveness, which will be identified using empirical techniques and the literature. These are listed in the middle of the network structure. Finally, specific container ports in countries such as India, Asia, Europe, and the U.S. – the port alternatives – are listed at the bottom of the network. Figure 1 illustrates the conceptual framework for port competitiveness derived from the AHP method as described above.

FIGURE 1



AHP Structure for Port Competitiveness

Step 2: Determining weights on criteria and alternatives

In this stage, pairwise comparisons are used to determine the relative weights that represent the importance of one criterion over another. The greater the relative weight, the higher the importance of the factor to the decision. The computational procedures are based on [16].

Step 3: Ranking Alternatives

The final step involves summing the multiplied weight values of each criterion to develop scores. Higher scores represent greater port competitiveness.

Survey Instrument

The survey instrument used to collect data was heavily adapted from the [10] scales. In this study, however, it is combined with additional variables to develop a more robust measure using macro-level criteria and three levels of hierarchy to assess competitiveness along two dimensions rather than the single dimension of [10].

The items measuring volume competitiveness were adapted directly from [10], except for the items measuring 'port costs', which were excluded from their study. However, as reliable objective cost data were still unavailable for all ports, the items in this study were subjective. While the variables comprising 'investment competitiveness' were developed by [21], the items measuring the variables had to be developed from scratch; however to maintain consistency, the structure of these items and responses are consistent with those of 'volume competitiveness'.

The initial questions measuring 'port cost' and 'investment competitiveness' were given to 11 managers and academics with familiarity of port strategies to evaluate the readability, clarity, and appropriateness for measuring the variables of interest. As a result, minor changes to wording and the instructions were incorporated and reevaluated by the same set of managers and academics until consensus was reached on the appropriateness and readability of all items. This method is consistent with a four-step procedure suggested by Dillman, which involves pretesting and pilot testing survey instruments to ensure reliability prior to administration to a full sample.

To pretest the instrument, it was administered to a convenience sample of experts and port administrators through an organization called the Global University – 8 (GU8). The GU8 is a consortium of eleven international universities located on ocean ports. The purpose of the organization is to encourage global research on issues related to international trade. Member institutes include The University of Rhode Island (US), Inha University (Korea), LeHarve University (France), Xiamen University (China), Washington University (Seattle, Washington, US), University of Hawaii (US), The Royal Melbourne Institute of Technology (RMIT-Australia), Hull University (GB), Haifa University (Israel), and Meiji University (Japan).

While invitations were sent to ten GU8 members, 28 experts and managers, representing eight ports, agreed to participate. They are Busan Port (Korea), the port of Los Angeles/Long Beach (US), port of LeHarve (France), Port of Incheon (Korea), Port of Chennai (India), Port of Mayaguez (Puerto Rico), Port of Melbourne (Australia), Port of New York/New Jersey (US).

RESULTS

The following tables report the results of the AHP analysis and the respondent profiles. The Continuity Index (CI), which measures the logical consistency of the results, was .8, which is less than the critical value of 1.0. Any CI exceeding 1.0 is considered logically inconsistent [10].

TABLE 5

Port Affiliation & Position

	Port Director	Elected Official	Port Senior Manager	Researcher	Shipper	Carrier
Busan (Landlord Port)	2	2	1	3		1
LA/LB (Landlord Port)	1	1	1		2	1
NY/NJ (Landlord Port)	1				1	
Melbourne (Tool Port)				1		
Chennai (Landlord Port)					1	
Incheon (Landlord Port)	1		1			
Mayaguez (Landlord Port)	1			2		
LeHarve (Tool Port)				2		
No Specific Port Affiliation				2		

TABLE 6

Volume Competitiveness - Pair-wise Comparison matrix, weights, & priority

	Cargo Volume	Port Facility	Port Location	Service Level	Port Cost	Weight	Priority
Cargo Volume	1	3.33	.445	.95	.885	.087	5
Port Facility		1	.848	2.544	2.14	.171	4
Port Location			1	3.269	2.889	.282	1
Service Level				1	3.056	.276	2
Port Cost					1	.184	3

TABLE 7

Investment Competitiveness - Pair-wise Comparison matrix, weights, & priority

	Price	Institutional Structure	Legal Structure	Financial Resources	Port Reputation	Weight	Priority
Price	1	1.245	1.49	1.43	1.434	.163	4

Institutional Structure		1	2.158	2.178	2.184	.246	1
Legal Structure			1	1.768	1.595	.153	5
Financial Resources				1	2.10	.243	2
Port Reputation					1	.195	3

TABLE 8

Overall Values of Volume Competitiveness

	Cargo Volume (.087)	Port Facility (.171)	Port Location (.282)	Service Level (.276)	Port Cost (.184)	Overall Values	Ranking
Busan	0.5011	0.3750	0.3099	0.2062	0.1773	0.1570	1
LA/Long Beach	0.1415	0.1610	0.2856	0.2014	0.1930	0.0983	2
LeHarve	0.1313	0.1240	0.1112	0.1488	0.0743	0.0610	5
Incheon	0.0900	0.1508	0.0937	0.1921	0.2075	0.0834	3
NY/NJ	0.0332	0.1467	0.0520	0.1781	0.2130	0.0735	4
Chennai	0.0272	0.0202	0.0307	0.0500	0.1123	0.0281	6
Melbourne	0.0321	0.0104	0.0455	0.0103	0.0125	0.0133	8
Mayaguez	0.0435	0.0120	0.0714	0.0138	0.0104	0.0160	7

TABLE 9

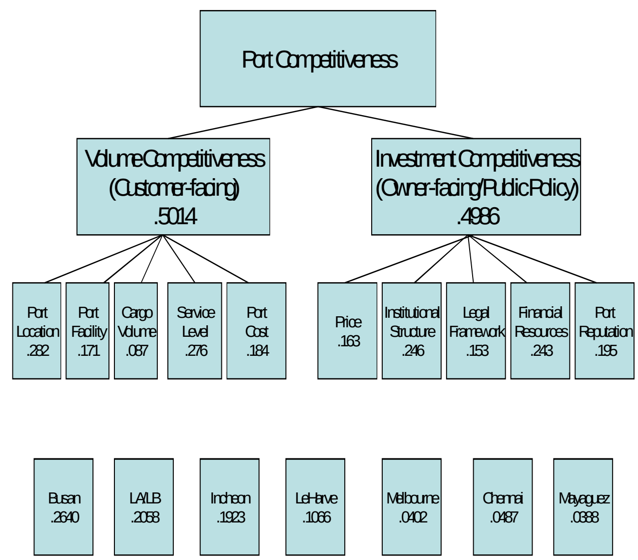
Overall Values of Investment Competitiveness

	Price (.163)	Institutional Structure (.246)	Legal Framework (.153)	Financial Resources (.243)	Port Reputation (.195)	Overall Values	Ranking
Busan	0.2002	0.2229	0.1776	0.2430	0.2271	0.1070	3
LA/Long Beach	0.1670	0.1994	0.1742	0.2740	0.2602	0.1075	2
LeHarve	0.1114	0.0542	0.0976	0.0912	0.1017	0.0456	5
Incheon	0.1779	0.2311	0.2710	0.2610	0.1451	0.1089	1
NY/NJ	0.1776	0.1517	0.1235	0.0703	0.0909	0.0614	4
Chennai	0.0622	0.0135	0.0321	0.0122	0.0843	0.0206	8
Melbourne	0.0557	0.0271	0.0638	0.0383	0.0800	0.0269	6
Mayaguez	0.0479	0.1006	0.0604	0.0100	0.0100	0.0228	7

DISCUSSION

The weights and overall values reported in Tables 5 to 9 are summarized in Figure 2.

FIGURE 2



AHP with weights and overall values

Volume Competitiveness

Based on the results in Table 6, Port Location (.282) is the most important criteria in the competitiveness of global ports. Service Level (.276) is a close second, followed at a distance by Port Cost, Port Facility, and Cargo Volume. This means that 58.5% of a shipper's, or 3PL carrier's decision to select a port is based on where the port is located, relative to the destination of the cargo, and whether or not a port can off-load or load the cargo within the promised time period. This finding is important because it suggests that ports are not selected primarily based on port costs, meaning that shippers do not view them as commodities in the supply chain, but as value-added assets. However, since ports can't be physically relocated to improve the Port Location variable, the finding that it is important does not help administrators at existing ports to make better decisions. It does mean that port directors should focus resources on reducing the time it takes to off-load and load containers in order to improve service levels. This does not mean that port costs can be ignored, accounting for 18.4% of shipper's decision, costs must still be in line with other similar ports. This variable increases in importance in areas where viable alternatives exist, such as Korea, China, and Puerto Rico, and less important where viable alternatives do not exist, such as LeHarve, and Melbourne. Using these criteria on the eight selected ports, Busan is the most competitive port in the world for improving volume, followed by LA/LB and Incheon. This finding is supported historically as Busan has increased annual container volume at a rate that has kept it ranked as one of the top five ports in the world, second only to Chinese ports, which were not represented in this study.

Investment Competitiveness

Based on the results reported in Table 7, Institutional Structure (.246) is the most important factor for potential investors, followed closely by Financial Resources (.243). Together they explain 48.9% of an investor's decision. However, the minor differences in weights of .003 suggest both factors are of practically equal importance to an investor. Port Reputation (.195), Price (.163), and Legal Structure (.153), while less important, collectively account for 51% of an investor's preference of port investment. This suggests that potential investors prefer ports that are strong in all five factors of Investment Competitiveness, rather than a few dominant variables.

In relative investment competitiveness values, reported in Table 9, Incheon (.1089), LA/LB (.1075), and Busan (.1073) are equally attractive for investors. This is because all three ports have strong weights on all five factors. NY/NJ (.614) and LeHarve (.456) are third and fourth, with Chennai, Mayaguez, and Melbourne practically tied for the least attractive for investors. This suggests that the last three ports must make significant changes in their ability to reinvest funds in port infrastructure, improve practices that increase competition for services to capture new investment funds, and develop legal systems to efficiently and quickly resolve disputes between stakeholders.

Investment Competitiveness vs. Volume Competitiveness

In evaluating the overall scores for investment versus volume competitiveness, volume competitiveness was found to be slightly more important representing 50.14% of overall competitiveness. However, the two factors are practically of equal importance, which is logically consistent in that the most competitive ports are attractive to both shippers and investors. This may explain why Busan and LA/LB have demands on their ports that consistently exceed capacity and why Incheon has achieved strong growth in a relatively few years of operation. These results address first research question.

Will the existing actions by ports improve their competitive positions?

The results show that the activities of Busan, LA/LB, and Incheon are improving their competitive positions. However, the remaining ports must make substantial improvements in Service Levels and all five factors of investment competitiveness to become competitive with the larger ports.

Will the improved competitiveness result in the expected outcome of mitigating supply chain disruptions and attracting new container volume?

Strong volume competitiveness suggests that investments in infrastructure have a high probability of attracting new revenue and the associated returns. Increased investment in infrastructure leads to increased port capacity and decreases the probability of disruptions. Increased capacity also leads to higher service levels – resulting in greater volume.

The finding that Port Location is the most important factor in volume competitiveness is consistent with previous research, e.g. [10] that tested similar variables in a Chinese context. However, it differs with some US-based research, e.g. Grigalunas [5], that found that Cost was the most important factor. These differences could be contextual since there are container port alternatives in the Northeast US and China that may encourage Cost competition, whereas regions with few alternatives may consider Port Location the most important factor. The finding that Service Level is the second most important variable differs from previous research, e.g. [10], that found

Port Facility was second, along with other factors, e.g. [5]. Also, the difference between the first and second priorities is less in this study than [10] or [5]. This suggests that a balance in all five factors increases competitiveness greater than dominance of one or two factors. The reason for these conflicts could be due to the difference in sampling frames, i.e. [10] measured Chinese ports exclusively. These studies tend to compare ports within a single country or geographical region. In contrast, this study examines port competitiveness on five continents – a more diverse sample. Therefore, the way ports compete within a geographical region could be different than when competing on a global basis. This may explain why a greater balance in port capabilities is important to improve competitiveness. Another possible explanation is the small sample size used in this study. This suggests that the observed differences are due to random chance rather than a true difference in samples. A third possible explanation for the differences is that this study is the first to simultaneously test investment competitiveness and volume competitiveness. This suggests that investment competitiveness accounted for some of the variance previously accounted for by volume competitiveness.

LIMITATIONS

This study is severely limited due to its small sample size; however, since the primary purpose is to develop and pilot test a new measurement instrument, the sample size is appropriate. The final sample will be 200 ports worldwide. While the results are not fully consistent with previous research, major findings, such as Port Location being a top priority, suggest that the instrument is valid and reliable. While several blocking variables were measured, such as port type, the small sample size restricted testing these factors.

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