Port Choice Determinants and the Port Selection Process:

Based on the perceptions of carriers and freight forwarders.

Advisor: Prof. Tae Young Choi

by

Andrey Tenpen

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by

Andrew Tennent

Approved by:

Chairman: Prof. Myung Shin Ha

Member: Prof. Soon Gwon Choi

Member: Prof. Tae Young Choi

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Abstract

In the modern age of world trade, ports have been forced to adopt new strategies to successfully compete for the ever-increasing amounts of trade flows. Ports are competing against each other for cargo and for attracting ships. In this environment it is so important for ports to understand the needs of their customers. It is even more important to understand how customers select a port.

This paper tries to gain a further understanding of the port selection process. It identified several of the main determinants of port selection form previous research. A model was developed to classify these determinants. With these determinants a survey was established to identify which determinants port customers placed the greatest importance levels on. Carriers and freight forwarders were chosen as respondents for this study as they are ports' major customers and they have very different business interests. These customers were also asked to evaluate certain statements about the port selection process.

The results show that carrier companies place most importance on a port's location followed by cargo throughput, range of services for shippers, and then port efficiency. Freight forwarders however ranked departure frequency as the most important determinant followed by port efficiency, port location, and then ease of delivery to and from the port. Costs and customer service determinants ranked with moderate importance levels in the port decision-making process.

It was also discovered that carriers have a more structured and formal port evaluation and selection process. They use information from various sources in this process. Freight forwarders use a less structured process based on the decision maker's own knowledge and experience. This is interesting for ports as they have to develop marketing and promotional strategies that understand the differences in port selection process.

The results of this paper have some implications for ports. Ports have to be centrally located and attract both ship visits and cargo throughput simultaneously. They have to increase efficiency, which is especially important, as customers are willing to pay more for better efficiency. There has to be a range of services for carrier companies, and freight forwarders like ports to have strong links with other transport modes. Customers agree that ports should offer online services.

This paper also identified some interesting matters that could be researched in the future.

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I. Introduction:

The era of globalization has affected many industries, non-more than ports. Ports though have been in the special position of being agents of globalization by moving people and cargo, which may explain why they have drastically changed in recent decades. Traditionally ports were 'instruments of state or colonial powers' used to control markets[1]. In these times, cost of transport was high, so port costs were insignificant in the total cost of shipping goods. Ports were chosen based solely on location, that is, which was the closest. This created little incentive for ports to compete and improve efficiency.

Times have changed greatly since then. New shipping technology has seen rapid improvements in ship sizes and efficiencies. "Ships quickly reached loading capacities and dimensions that required total restructuring of port facilities"[2]. Ports also transformed their cargo handling roles as ships changed from break-bulk to containers. This new efficient and cheaper ocean transport placed greater focus on port efficiency. The decreasing cost of shore transport (via trucks and trains) also emphasized the focus on ports. Ports were transformed from sea cargo loading and unloading stations to transport hubs with the integration of all transport methods.

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[1] World Bank Port Reform Kit, module 2, p.1.
[2] French Government publication: City & Port, Change & Restructuring, http://www.urbanisme.equipement.gouv.fr/cdu/accueil/bibliographies/villport/notegb2.htm

Ports became widely acknowledged as vital for economic development. This in part came from the huge economic successes of the city-states, Hong Kong and Singapore, based on their port operations. Other governments tried to replicate these successes by just increasing port infrastructure. Some succeeded while others turned into 'white elephants'.

The growth of international trade bought with it new problems for ports. These were congestion and service failure. Even the great ports of Singapore and Hong Kong were not immune to these. Ports also became magnets for industry to gather around. This created a need for ports to offer other services for their customers such as warehousing, and clearing centers.

Ports also were under other pressures. They were "being steadily transformed by the evolution of markets, services, technologies and regulatory forces"[3]. This has led to increasing competition among ports. Ports are increasingly acting like businesses, vying for greater cargo throughput, and increasing number of ship visits. This competition is coming not just from ports in other countries, but also other domestic ports.

To cope with this competition, ports try to improve their efficiency. Most ports have adopted the approach of restructuring as the first step towards increasing their efficiency. The most important part of this restructuring is universally accepted to be the process of privatization. Ports were State owned entities going

back since the Roman days. "Roman's managed with the concept of *res publicae*, this was the things common to everybody which were regarded as a property of the Roman people. Ports were within this category"[4]. Governments generally owned and ran ports as they were in the 'public interest'. The modern need for efficiency is turning ports into private businesses.

The process of reform and structural change is so important, that the World Bank has completed a Port Reform Tool Kit to assist and guide governments and ports through this reform process. This report identifies five key factors that will shape the competitive environment of ports in the future. These are: existing competitors, new competitors, global substitutes, bargaining power of port users, and bargaining power of port service providers. The Tool Kit though only offers assistance for port reform by addressing issues such as ownership structures, laws and regulations, labor reform, and implementation. It does not address what operational strategies ports should use to combat increasing competition. This has become the topic of an ever-increasing number of research papers.

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[3] Rezende, S. (1998) "Port Modernization: a pyramid of interrelated challenges". Economic Commission for Latin America and the Caribbean: (UN publication), p.5.
[4] Sabatino, P. (unknown) Legal Framework in the Context of Commercialization. www.sabatinop.com.

II. Previous Studies:

In recent times, there have been four main topics of research regarding ports. The first of these is the port reform process and its effect on efficiency (Paik & Bagchi, Carbone & De Martino, Sabatino, etc) [5]. The second topic is port competitiveness. Studies on this topic have focused on strategies ports use to compete such as co-opetition (Song), and competition models (Veldman & Buckmann). Tongzon (1995) used quantitative measures to compare competition performances. The third topic has been focused on ports' customers. Murphy has completed several papers on services ports offer to shippers. Murphy et al (Feb, 1991) noted that some ports are now using a goods distribution strategy by becoming "key intermediaries in global distribution". These services can influence the last topic, which is, port selection or the process of how shippers choose ports.

The last topic is interesting in that it focuses on port customers not the ports themselves. Port customers may be shippers (importers and exporters), freight forwarders, or even carriers. It is extremely important for ports to understand their customer's needs. Ports can develop strategies to keep existing customers and attract new customers if they can understand what their customers need and want.

Research into this topic has taken different forms such as discrete choice analysis or decision factor analysis. Murphy et al (1992) identifies four classifications for

[5] As a note, all papers on port restructuring have showed restructuring increases port efficiency.

studies of transport choice based on roles and decision. These are shown in table 1[6].

Table 1: Research classifications

	Single role	Multiple role
Single Decision	E.g.: port selection from shipper perspective	E.g.: Port selection from both shipper and port
Multiple Decision	E.g.: Shipper evaluating port selection and port elimination criteria	E.g.: Different port customers evaluating port selection and port elimination criteria

Bagchi (1989) used a hierarchical process to analyze non-quantifiable factors in the selection process. He hypothesized three levels, setting objectives, setting criteria, and carrier evaluation in the decision making process. From this he developed a relative importance matrix. Nir et al (2003) utilized this matrix and used a utility function and choice probability models for shippers to choose from ports within Taiwan. The analysis found that travel time, cost and port distance are important port choice determinants while routes and ship frequencies are not so important. These are however the only determinants he considers in the decision process.

The determinants of port choice are extremely important for ports to understand as these determinants shape the decision making process of port customers. Many

[6] Information in table 1 has is adapted from Murphy et al (1992). It has been changed from a

scholars have identified and analyzed these port choice determinants to gain a better understanding of the decision making process (Banch, 1986, Slack, 1985, Willingale, 1984). Many scholars have also tried to categorize these determinants. According to Tiwari et al (2003), all of the port choice determinants used in studies can be grouped into three categories. These are route factors (transit time, ship frequency, etc), cost factors (freight charges and other costs), and service factors (cargo damage, documentation, reliability, etc)[7].

Tiwari et al (2003) used a discrete choice model where shippers chose combinations from five ports and two shipping lines in China. The choices were based on port characteristics which they identified as ship calls, total TEU's handled, TEU's per berth, usage factor (volume per length of quay), number of routes, and port charges. The results were that shippers were risk-adverse choosing the most cost effective combinations. The paper also found that distance from port is an important determinant of port choice. "In fact, distance is so important in the overall decision process of shippers that many shippers have located closer to ports"[8]. As this study was only conducted in China, the results of cost being so important might be a reflection of the economic and cultural situation in China. Other studies have found cost is not so important.

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carrier selection setting to port selection.

[7] From Tiwari et al, as identified by several previous studies such as Glimour (1976), McGinnis (1979), Ogden & Rattray (1982), Brooks (1985), Wilson et al (1986), & Meyrick & D'Este (1989).

[8] Tiwari et al, (2003), "Containerized Cargo Shipper's Behavior in China: A discrete choice analysis". Maritime Economics & logistics, Vol 5, Iss 1, p.23.

Tongzon (2002) asked freight forwarders from Malaysia, Singapore and Thailand to rank seven port choice determinants. These determinants were: efficiency, shipping frequency, adequate infrastructure, location, port charges, quick response to port users' needs, and reputation for cargo damage. He found that port efficiency was by far the most important determinant. Shipping frequency, then adequate infrastructure, and location followed, but they had relatively close importance levels. Reputation for cargo damage was by far the least important determinant, while port costs only rated as fifth most important. Tongzon also compared differences in rankings between Malaysian respondents and Thai respondents. He found that the ranks were similar even though shippers in Thailand were more cost and location conscious.

Tongzon's paper (2002) asked respondents if they agreed with various statements about port choice. Twenty-five statements were given, and respondents had to select agree or disagree. Some statements had significant results and should be recognized here. Almost 83% of respondents agreed that if they were happy with their current port then they would not change port. About 75% said that shipping line was chosen before choosing a port. Over 82% agreed that a port with frequent shipping delays would be excluded from future consideration. Only about 57% agreed that cost was an important factor in port choice. All of the statement responses give more insight into the port choice process. Overall Tongzon's work was good, and makes a good basis for further study.

Bosch and Lobo (2002) studied the decision process for shipping lines by apple exporters from Tasmania. Respondents were asked to rate 29 determinants on a 5-

point Likert scale. These 29 determinants are specific and covered route factors, service factors and cost factors. The results show that exporters place strong importance on transit time, on time delivery, cargo damage, sailing frequency, and customer service matters such as fair dealings and understanding customer needs. This survey however only had 5 respondents but it could make be a good basis for a wider study.

Murphy and Daley (1994) used nine factors of port choice together with a 5 point Likert scale. Their paper targeted purchasing managers (importing shippers) in the US. The result was shipment information and loss and damage performance were the most important factors while large volume shipments, and large and odd sized freight were the least important factors. They used the results from this study and compared them to previous work by Murphy and colleagues, concerning shippers and ports[9]. They found that shippers and purchasing managers have similar views, while ports have very different opinions. An example is shipment information, which was ranked first by purchasing managers and seventh by ports. "Previous research had indicated that a number of worldwide ports tailor their offerings to appeal to ocean carriers, such as emphasizing goods handling capabilities"[10]. This focus on carriers may explain the difference of thinking between ports and purchasing managers.

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[9] Purchasing managers are basically 'importers' while shippers are 'exporters'. Information from ports was the port's perception of what their customers deem as important.

[10] Murphy, P. & Daley, J. (1994), "Comparative Analysis of Port Selection Factors". Transportation Journal Vol 34, Iss 1, p.15.

It is important to note the fact that different customers will have different needs and therefore their decision-making processes will be different. "Burdg and Daley (1986) found that carriers and shippers have different perceptions toward their modal choice behavior and the differences in perceptions truly reflect marketing situations"[11].

Murphy et al (1992) showed that different customers evaluate port selection determinants differently. To do this they surveyed five groups being, international carriers, international freight forwarders, large US shippers, small US shippers, and the international ports themselves. The respondents were given nine port selection determinants to evaluate with a 5 point Likert scale. These nine were: allows for large volume shipments, low freight handling shipments, low frequency of loss or damage, available equipment, offers convenient pickup and delivery, provides information about shipments, offers assistance in claims, and offers flexibility in special requirements. They found that small and large shippers have similar views and that they place importance on a port's information handling ability. Ports viewed carriers as their primary customers and they are concerned with shipment handling ability. The results also showed that ports and freight forwarders have similar rankings on the selection determinants. From this they deduced that "shippers' needs in port selection are to some extent

[11] From Nir et al, (2003), "Port Choice Behavior-from the perspective of the shipper". Maritime policy Management Vol 11, Iss 2, p.165.

being ignored by two key participants in global commerce, namely, international freight forwarders and water ports"[12].

Burdg and Daley (1986) found significant differences between shippers and carriers in decision-making. Again a 5-point Likert scale was used for surveying. Carriers ranked the following determinants as the most important: low charges, loading and unloading facilities, and satisfaction of customer requirements. Shippers ranked customer satisfaction and low charges as the most important followed by large or odd sized freight handling ability.

As we can see from previous research, there are differences between customers' importance levels for port choice determinants. Results of previous studies also differ as to what port customers view as the most important factor in port choice. One explanation for this may be that different papers use different determinants. There might also be differences due to differences in respondent country cultures (for example, Asian customers may have different decision making processes from customers in Europe), or economic situations (developing countries may place greater emphasis on costs). These factors might be worth an investigation in future studies.

[12] Murphy et al, (1992), "Port Selection Criteria: An application of a Transportation". Logistics & Transportation Review Vol 28, Iss 3, p.237.

III. Research Focus:

In this new ear of competition among ports, ports must understand their customers in order to provide the services to satisfy customer requirements. This paper will try to evaluate the important determinants in the decision making process for the selection of ports. This paper will also try to gain more insight into the decision making process through this evaluation. The research in this paper could be classified according to Murphy's research classifications (table 1) as a 'single decision, multi role' analysis, as it will examine port selection from very different customers. This paper will be useful for ports so they can develop competitive marketing strategies to maintain current customers and attract new customers.

The target respondents for this paper will be freight forwarders and carrier companies. These two groups are a port's most important customers. The carriers provide the ocean going services, and the freight forwarders provide the cargo. The port acts as a service provider between these two parties. It also has to be noted that freight forwarders are also customers of carriers. These two therefore have different needs that ports must endeavor to satisfy. These needs will be reflected in the process undertaken in choosing a port, so by analyzing the importance placed on port choice determinants, we can understand the differences between the needs of carriers and of freight forwarders.

Because of the difference between these customers, any survey on the port selection process must understand that different customers may use a different

process, and that different determinants of port choice may apply. Previous studies that compared determinant choices across different customers failed to consider the differences between business practices therefore they may not show accurate comparisons. As mentioned earlier, previous studies have also used different determinants of port choice, so it is hard to compare the results between studies.

1) Determinants of port choice:

This study uses a combination of the most important port choice determinants based on work by Murphy et al, Murphy and Daley, and Tongzon. These determinants are discussed in more detail below.

Port Location

Port location is not important purely from a geographic perspective. In fact the main concern with location is cost of transportation to and from the port, in other words, inland transportation. As has been shown in some previous studies, port location can be an important factor in port choice, but it can also be an unimportant factor. Differences in results may be explained by different economic situations as this accounts for differences in transport infrastructure and therefore inland transport costs. As Tongzon explains, "significant improvements in domestic transportation systems appeared to have lessened the importance of close geographical proximity between ports and their customers in port choice decisions"[13].

[13] Tongzon, J. (2002), "Port Choice Determinants in a Competitive Environment". Economic Commission for Latin America and the Caribbean.

Port cargo damage performance

A port's reputation for cargo loss or damage can seriously affect a customer's choice for sending freight. No customer is going to ship their cargo through ports if there is a high risk of losing the cargo. Theft has been a big problem at ports, so much so that "some carriers shifted their port calls to satellite ports in response to unacceptable levels of loss at larger ports"[14]. A reputation may be worse than the real situation, so ports must be careful to avoid any freight loss or damage.

Port infrastructure

Infrastructure is a broad term defined by Webster dictionary as "the underlying foundation or basic framework (as of a system or organization)"[15]. In regard to ports this term can be used to describe such things as the number of cranes or berths, terminal areas, storage, or any other structures that assist in the supplying of services to customers. A port's infrastructure is important because this infrastructure helps avoid service problems. If cargo exceeds the infrastructures ability, then congestion or service delays can result.

Amount of cargo throughput

Cargo throughput can have two effects on port customers. First high cargo throughput can strain the infrastructure causing the problems listed earlier. Second, cargo can attract more ships thereby increasing a port's business.

[14] Murphy et al (Apr 1991), "Ocean carriers seek service". Logistics Today Vol 32, Iss 4, p.67.
[15] Merriam Webster online dictionary.

Therefore this may be an important determinant for carrier companies but not very important for a port's other customers.

Port efficiency

Port efficiency refers to matters such as speed and reliability, or more precisely, loading and unloading speed (often measured in TEU's per crane per hour). This affects shippers, as they need on time deliveries, and carriers through turnaround time. It can also be easily accepted that efficiency is related to port cost, as the longer time in port results in more costs to carriers, which is then in turn passed on to shippers. With this reasoning port efficiency should be a major determinant of port choice of both carriers and shippers. Tongzon (2002), and Murphy et al (1992) have showed this in previous research. They concluded that customers would pay higher for increased efficiency.

Ease of delivery to & from port

How easy it is to deliver goods to and from ports is very important for shippers as it can greatly effect transport cost, and time. Ease of delivery is greatly influenced by a port's links to inter-modal transport such as truck, train, or air. These links integrate ports into the domestic transport network. Generally the stronger the links to inter-modal transport, the quicker and cheaper freighting to and from a port should be. "An efficient and modern inter-modal system is crucial to any port's success. And the secret to this success is to make the transfer between ship, rail and truck as invisible or seamless as possible"[16].

[16] Taddeo, D. (1999), "The role of ports in intermodal transport". Logistics Quarterly Vol 5, Iss 3.

Port charges

Port charges are the costs involved in using a port. By going to any port website we can see the range of port charges. These charges fall under two categories, vessel related charges (paid by carriers) and cargo related charges (paid by shippers or forwarders). Charges may vary from port to port. Table 2 shows some examples of charges that ports may impose[17].

Table 2: Examples of port charges

Vessel Related Charges Normally calculated by a vessel's GRT (gross registered tonnage).	**Cargo Related Charges** Normally calculated on the volume of cargo, weight, or cost of cargo.
Port dues: fee for entering harbor	Storage charge: fee for keeping freight at port (either waiting for ships, or for transshipment)
Pilotage: charge for guidance or towing of a ship into and out of harbor.	Stevedoring charges: for actual loading or unloading of freight.
Berth hire: rental fee for being at terminal.	Freight documentation fees:
Wharfage: sundry charges that may include bunkers, water,	Sundry labor charges: for packing or unpacking, overtime charges, etc.
Other related charges.	Other related charges.

[17] Examples are taken from various port websites.

As mentioned earlier, some studies have found port charges to be an important determinant in port choice (Nir et al, Tiwari et al), while others have found this to be not so important (Tongzon, Murphy & Daley, Murphy et al).

Port's information services

Ports can offer a wide range of information services. This can be in the form of having a website for customer access, easy tracking of freight in port, easy documentation, easy to find information about the port such as charges, etc, or sundry information such as weather and tidal information. An excellent example of a port that offers information services is the Port of Singapore website: www.singaporemaritimeportal.com. Carriers should be more concerned with this availability of information than other port customers (except shippers concerning freight tracking and port dealings which will be addressed separately) as they need to know important information about the ports for voyage planning. Not much research has been done on port information systems, but Murphy et al (Apr, 1991) stated that ocean carriers "would like to see a stronger focus on *information* handling".

Ease of dealing with the port

Ease of dealing with a port could fall under information services, but it was decided that this should be looked at separately in regard to freight forwarders. Freight forwarders are agents for shippers and are therefore dealing with ports on a daily basis. To them being able to effectively contact ports may be important. Paperwork and documentation would also fall into this category as well as claims

for lost or damage cargo. If documentation procedures are difficult and complex, shippers may turn to other ports.

Availability of shipment information

Again this could be another sub category under port information services that may have particular importance to shippers and freight forwarders. Shippers and freight forwarders would like to know where exactly their freight is, and when it will be delivered. Having these details available allows for easier planning and better service to their customers. Some shippers may place importance on this as a determinate in port choice.

Ports' range of services for ships

In an effort to compete against other ports, major ports are transforming themselves into 'maritime centers' by offering carriers more than just a place to load and unload cargo. Increased range of other services is vital for attracting ships. Ships need to restock on supplies, so ports must offer chandlery (selling ship supplies) and bunkering (refueling) services. Other services that ports may offer in addition to regular services such as pilotage, could be availability of moorings, ship registry, ship inspections, ship cleaning, waste and pollution handling, navigational charts, etc. Of course ports also have distress and rescue services as well. The Ports of Hong Kong and Singapore also offer training centers. These centers offer many important courses such as onboard firefighting, or seaman certifications. Other services that ports have little control over might also attract carriers. These could include insurance or financing services. In the

process of port choice, a port's range of services should be an important selection criterion.

Frequency of ship departure

How often ships leave a port for various destinations may be important in port selection for shippers and freight forwarders. This will be mostly because of time constraints. Shippers and freight forwarders want cargo to arrive at the destination quickly so frequent ship departures means less time for the cargo to be waiting for a ship. This saving of time also represents a significant cost saving too, which may be important.

Preference for a particular shipping line

Some shippers or freight forwarders may place higher preference on a particular shipping line rather than a port. For these people, the decision making process will involve choosing a carrier and then choosing the port that carrier operates from. They may do this due to having a contract with a carrier or they have preference for a carrier that better satisfies their requirements. If this is an important determinant of port choice for shippers and freight forwarders, then ports may have to develop strategies to attract shipping lines.

Large and odd size freight handling ability

Shippers and freight forwarders are concerned about cargo. However as freight forwarders are dealing with many shippers, they often have the need to ship large or odd sized cargo. From this we can deduce immediately that freight forwarders will place a higher importance on this than shippers would. Murphy et al (1992)

identified that freight forwarders and ports placed a similar emphasis on determinants. This paper also identified that ports placed importance on freight handling abilities including odd sized freight.

Classification of determinants

As mentioned in the background research, many studies have tried to classify the determinants of port choice. Bardi (1973) classified determinants into eight categories: reliability, security, user satisfaction, availability capability, transit time, business practice, and transport costs. This work was consolidated and as Tiwari et al (2003) noted determinants could be grouped into three categories being, route factors, service factors, and cost factors. D'Este and Meyrick first identified these categories in 1989 and grouped the determinants as per table 3.

Table 3: Three categories of classifying determinants.

Route Factors	Cost Factors	Service Factors
Frequency	Freight rate	Delays
Capacity	Other costs	Reliability
Convenience		Damage Avoidance
Directness		Loss & Theft
Flexibility		Fast response to problems
		Co-operation
		Tracing ability

Pederson and Gray (1998) reviewed all previous classification work and identified that selection of transport includes timing factors, price factors, security factors and service factors. However security factors could be argued to be a sub-category of service factors. Timing factors may also be regarded as a service factor or route factors.

Both Brooks (1990), and Bagchi (1989), have identified a big problem with these models of classifying determinants. These models "emphasize the tangible benefits of carrier choice criteria, such as cost of service to shipper"[18]. They do not involve "non-quantifiable factors such as future financial stability, or responsiveness" [19], or other intangible benefits such as relationships. The consequence of this is that any future model classifying determinants must be able to consider both tangible and non-tangible criteria.

Another problem of these classification models is that it can be argued that some of the determinants may apply to all of the classifications. The previous research does not reach consensus over categorizing determinants because of this important problem. McGinnis (1989) noted, "It is important to emphasize that many of them are interrelated"[20].

[18] Brooks, M. (1990). "Ocean carrier selection criteria in a new environment", Logistics & Transportation Review, Iss 26, Vol 4, p.339.
[19] Bagchi, P. (1989). "Carrier selection: The analytic hierarchy process", Logistics and Transportation Review, Iss25, Vol 1, p.63.
[20] Pedersen, E. & Gray, R. (1998). "The transport selection criteria of Norwegian exporters". International Journal of Physical Distribution & logistics, Vol 28, Iss 2. p.108.

To examine this problem in more detail, first we should define cost. The traditional definition of cost factor only regards freight rate or port charges. However the cost of shipping a good through a port exceeds this amount. This can be because of additional fees and charges, or the most important factor 'time'. British university professor Ian Walker has just proved the cost of time, by using a mathematical formula[21]. Therefore the term 'cost' should be split into two groups, nominal cost, and real (or actual) cost[22]. The nominal cost will be the freight rate or port charges, while the real cost will account for time saving, and any other potential costs. The importance of this real cost is shown by the "growth in awareness of logistics trade-offs while the perceived importance of direct transport costs has diminished"[23].

The modern concept of Just In Time (JIT) shows this logistics trade off. The goal of JIT delivery is to reduce 'buffer stocks' or the cost of carrying inventory. With this in mind, transit time is an important part of the JIT concept. The lower the transport time, the lower the cost of inventory in transport. Transport time has several determinants in itself. These can include route factors such as frequency and directness, and it can include service factors such as efficiency and delays. It should be noted that Bagchi et al. (1987) found that high frequency transport service increases transport costs but reduces the cost of inventory[24].

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[21] CNN news report, *Times is money, professor proves.*
[22] Based on economic terms of 'nominal' and 'real'.
[23] Pedersen, E. & Gray, R. (1998). "The transport selection criteria of Norwegian exporters". International Journal of physical Distribution & logistics, Vol 28, Iss 2, p.108.

Cargo damage and loss is regarded as a service factor, but it also has an obvious cost implication. This cost implication is the cost associated with the cargo, and also the loss of the sale of the cargo. Other service factors also have cost implications as well. Pedersen and Gray sum up this cost issue saying that "the service level increases with increased expenditure on transport, resulting in a reduction in the cost of lost sales and therefore leading to a reduction in the total logistics costs"[25]

Route factors and service factors are not just interrelated with costs, but also with each other. Shipping frequency, regarded as a route factor, also could be classified as a service factor. Directness, flexibility and capacity could also fall into both categories.

With this new meaning of cost, the importance of time and actual cost needs to be reflected into the categorizing of port choice determinants. Service factors and route factors must have a cost implication. Also service factors and route factors may also be the same. Knowing this, one might assume that all determinants are related to each other, and therefore would fall into one category, but this would be a mistake. A determinant may or may not fall into different categories, depending on the customer's (the person or company making the port selection decision) perception of that determinant. This could mean that for one customer a determinant might be regarded as a cost factor while another customer sees it as a

[24] Bagchi, P. Raghunathan, T. & Bardi, E. (1987), "The implications of just in time inventory policies on carrier selection". logistics and Transportation Review, Vol 23, Iss 4, p.63.

service factor. The implication of this is that selection determinants will be categorized differently from customer to customer according to their reasoning of the underlying importance of the determinant.

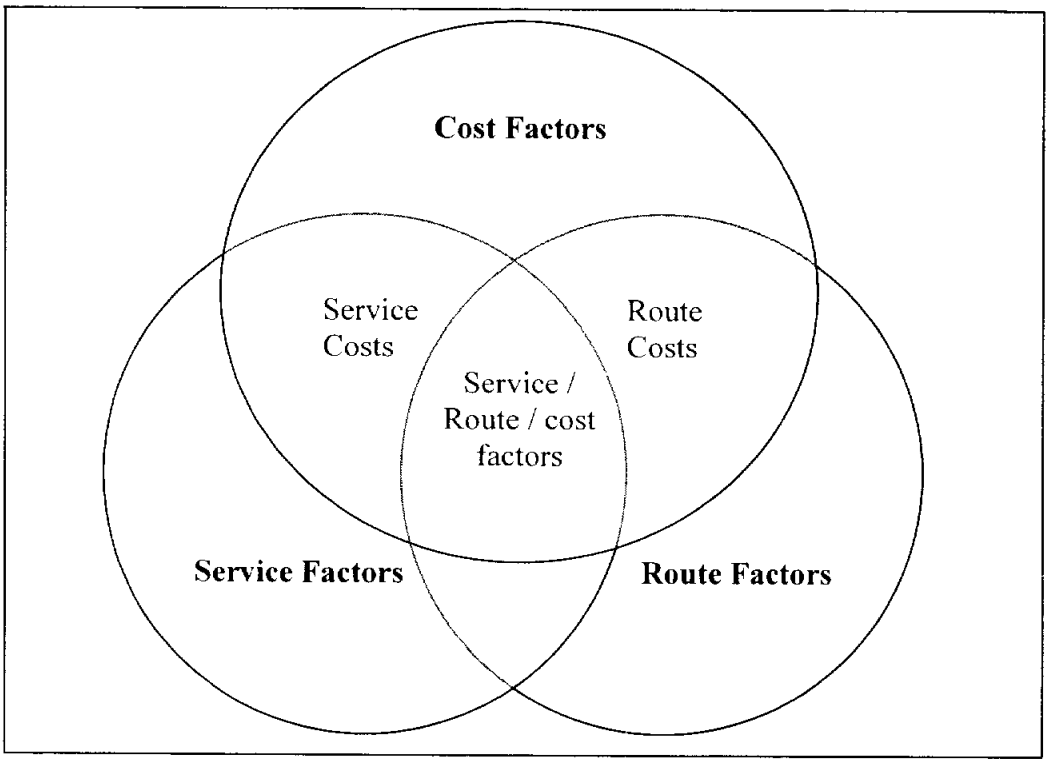
If classifications of port selection determinants are different from customer to customer, and each determinant can be classified under different categories, then it is necessary to attempt to correctly classify port choice determinants. Figure 1 shows a possible solution to the problem of classifying port choice determinants. This model shows that cost factors, service factors and route factors are related and overlap. This model can be used to show the importance levels customers place on each port choice determinant. A customer's perception of a determinant would be represented by the size of the area in the different parts of the model. The model should be able to be used to classify both tangible and intangible benefits associated with the choice of port because the model shows only the customer's rationale for using the determinant in the selection process.

Frequency of ship departure can be used as an example of how the model works. Shipping schedule is a route factor, but it also can be classified as a service factor as it allows quicker delivery of goods. It also has a cost implication by reducing transport time. To apply this to the model, the customer's perception of shipping frequency must be known (that is, how shipping frequency is important). If a customer considers frequency of ship departure as an important determinant because it represents speedier delivery, it may appear in the service, route section

[25] Pedersen, E. & Gray, R. (1998). "The transport selection criteria of Norwegian exporters".

of the model by that part of the model having a larger area. If however the customer's reason for speedier delivery is greater cost saving, then it will appear in the route, cost section of the model.

Figure 1: Model of Selection Determinants



International Journal of physical Distribution & logistics, Vol 28, Iss 2, p.108.

2) Research goal

In the modern world of port competition, ports are aggressively trying to develop strategies to attract a share of the ever-increasing volume of international cargo shipment. In order to develop effective strategies, a port must first understand what their customers deem as important and try to gain an insight into how their customers select which ports to use. With this in mind, this paper will try to gain an increased understanding of the process of port selection from a port's customers' point of view.

Previous research by Murphy and others has identified four important customers for ports. These are carriers, freight forwarders, importing shippers (consignees), and exporting shippers (consignors). The target respondents for this paper will be freight forwarders and carrier companies. These two groups are a port's most important customers. The carriers provide the ocean going services, and the freight forwarders provide the cargo. Freight forwarders were chosen instead of shippers, as freight forwarders are agents for both importers and exporters and should make decisions in the shippers' best interests. Brooks (1990) has also noted that "larger proportion of companies delegate their choice of carrier to a freight forwarder"[26]. This shows the importance of freight forwarders in the supply chain is increasing making them a valuable customer of ports.

The ports act as a service provider between carriers and freight forwarders. It also has to be noted that freight forwarders are also customers of carriers. These two

[26] Brooks, M. (1990). "Ocean carrier selection criteria in a new environment". Logistics & Transportation Review, Iss 26, Vol 4, p.339.

parties therefore have different needs that ports must endeavor to satisfy. These needs will be reflected in the process undertaken in choosing a port, so by analyzing the importance placed on port choice determinants, we can understand the differences between the needs of carriers and of freight forwarders.

This paper will test hypotheses about port selection determinants for carriers and freight forwarders. Ports will be able to use the results from this paper to gain insight into how their customers select ports, enabling them to understand how to satisfy their customers. They will be able to use this information to assist with their restructuring processes, marketing, or the development of effective competitive strategies that will lead their port into the future.

3) Decision making processes:

To understand the processes that carriers and freight forwarders go through in their port selection, one must first know the basics of decision making. Carriers and freight forwarders are both customers of ports and they choose the port that best satisfies their needs. It would also not be unreasonable to say that carriers and freight forwarders are 'consumers' of a port's services. This should mean then that a 'consumer decision making model' could be applied to the port selection process.

There are many models of for consumer decision-making. Wilkie (1994) proposed a four-step process starting with problem recognition, followed by search and evaluation, then decision and purchase, and finally consumption and

evaluation. Most models follow similar stages. Newman et al (2000), show an eight-step process that may be more relevant to port selection.

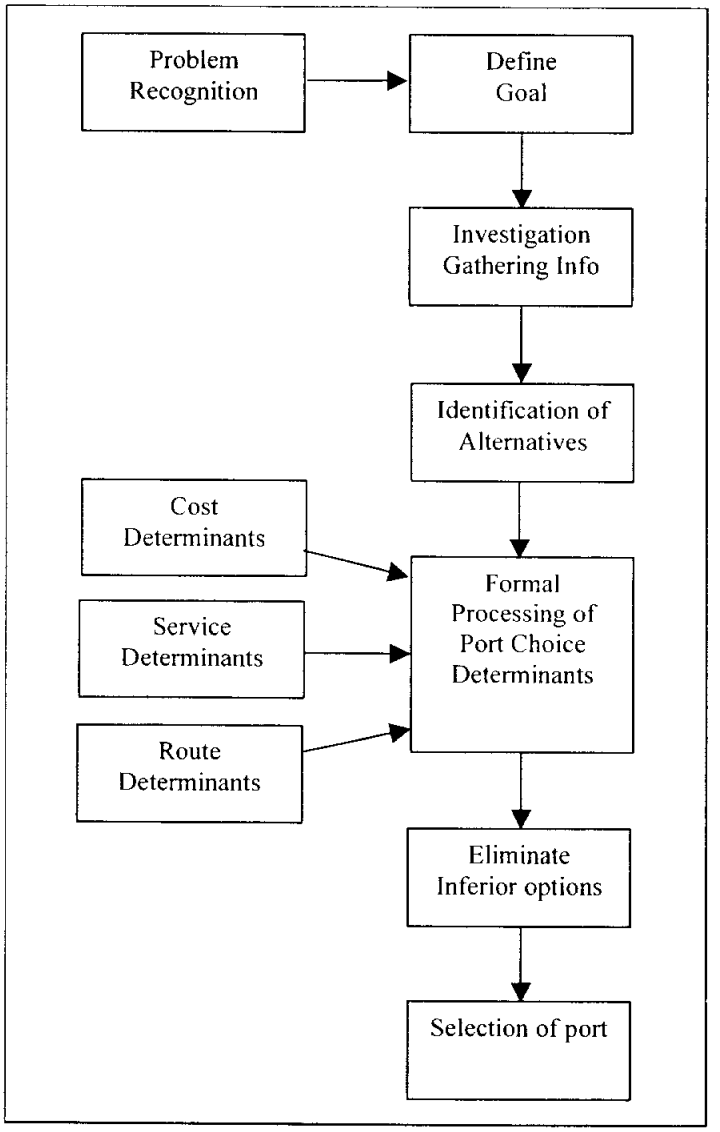
1) Recognition of problem- understanding that there is a decision to make.
2) Define a goal- in other words, what is to be achieved.
3) Assemble of relevant data- search for information.
4) Identification of alternatives- what decision choices can be made?
5) Selection of criterion for judging alternatives- choice determinants.
6) Modeling the interrelationship- applying determinants to alternatives.
7) Predictions of outcomes or alternatives- expected result from alternatives.
8) Choosing the best alternative- selection.

These steps for decision-making could be applied to carrier companies but they will need modification to be applied to freight forwarders. Freight forwarders have a different decision making process partly identified by Tongzon (2002). Freight forwarders deal with ports on a daily basis, so their port selection process is guided by knowledge and experience rather than a formal evaluation process. Tongzon confirmed this in a survey of freight forwarders in 2000. Also freight forwarders do not just choose a port; they also have to choose a shipping line, and land modes of transport. These other decisions can have an impact on the port selection process.

The difference of business activities between carriers and freight forwarders shows that there may be differences in their decision-making processes. Carriers should have a more formal port selection process than freight forwarders, and

they should be more willing to use and gather information for use in the selection process. Figure 2 shows how the port selection process may be for carriers.

Figure 2: Carrier companies' port selection process.



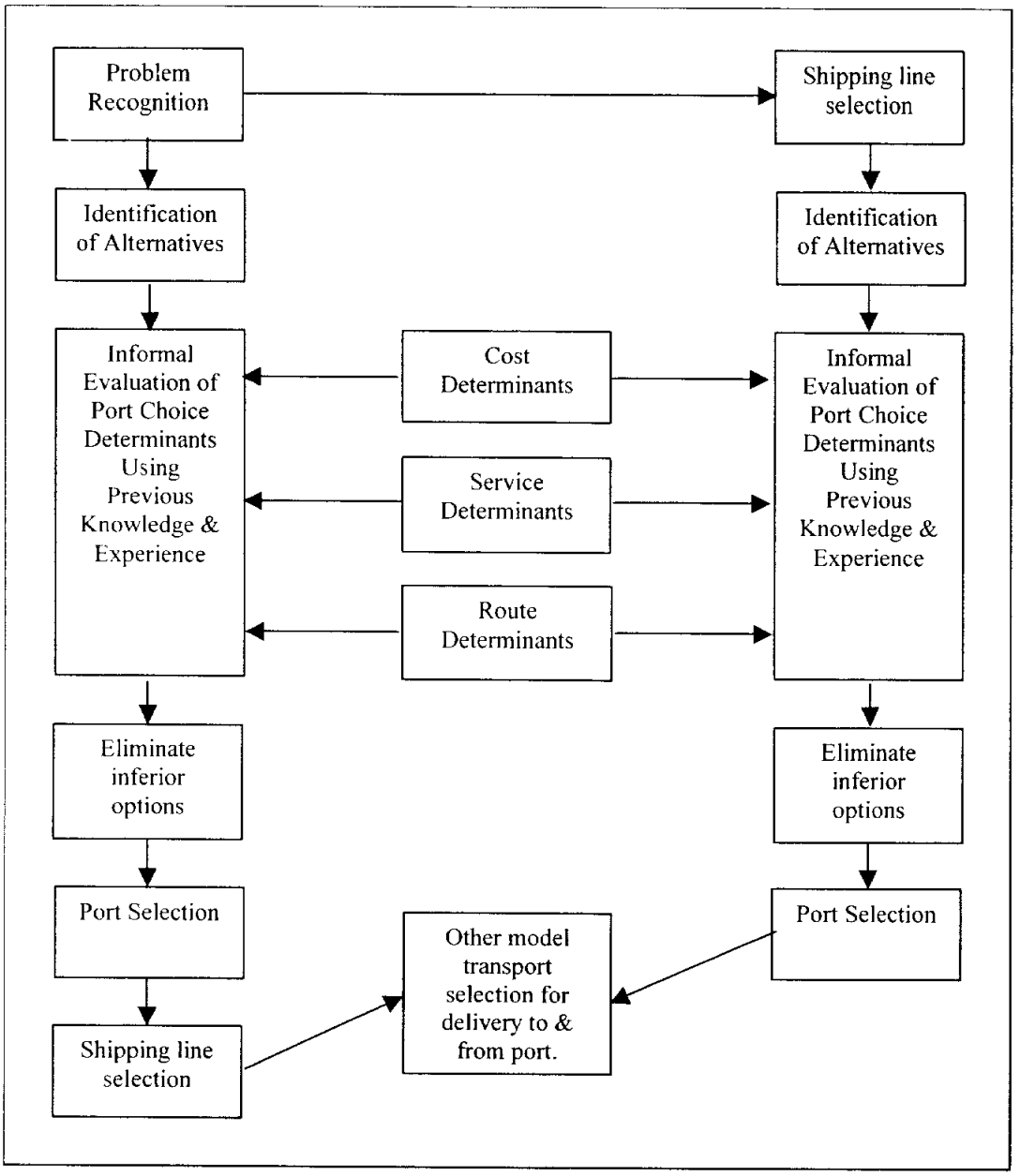
This model shows that the first step in the decision making process is to identify what decision has to be made, that is, what they need to do. Next carrier companies have to define their goal, or what they want to achieve. They then gather the necessary information to help them in the decision making process. Next, they identify possible ports that they need to decide from. After identifying the alternatives, carrier companies must select the port choice determinants they will use. These determinants will come from the classification presented in figure 1 (page17). Next these port selection determinants are processed and applied to the alternatives. This processing step would involve identifying the importance levels placed on determinants. The importance levels of determinants will then be applied to the gathered information for the comparison of ports. In the next step, ports that do not meet the required determinant importance levels would be eliminated. Finally the port that best satisfies the determinant importance levels will be selected.

The freight forwarder selection process is a little different however. As mentioned previously, freight forwarders do not just select a port; they also select a carrier to transport the goods. The freight forwarder port selection process is less formal and involves the use of the decision maker's own knowledge and experience. The possible decision making process for freight forwarders is shown in figure 3 (page22).

Again the first step for freight forwarders is to identify what they need to do. For freight forwarders this would normally be to move cargo from point A to point B.

Next freight forwarders have the option to select a carrier company first. Some forwarders have strong preference for a particular shipping line so they would then have to select a port, from which the carrier company operates. This step will be determined by the identification of alternatives. Next freight forwarders select the port choice determinants based on the categories in figure 1 (page 17), quickly using their knowledge and experience. They will then process the determinants and apply them to the alternatives. This processing is again informal and is probably done quickly in the decision maker's head. Next they would eliminate the ports that don't fill their needs, and select a port. If they haven't done so earlier, they would select a shipping line. Finally freight forwarders would select other modes of transport for delivery items to or from the port.

Figure 3: Freight forwarder port selection process.



4) Hypotheses

The following hypotheses will be tested in this study.

Hypothesis 1: *Location will be an important determinant in the port selection process for both carriers and freight forwarders.*

Tiwari et al (2004) using a discrete choice model showed that location of port is by far the most important determinant in port selection. Nir et al (2003) used a utility function and showed mathematically that location held great importance in port selection. Tongzon (2002) obtained the result that location was the fourth most important port determinant. This paper will test these findings to confirm whether distance to a port is important in port selection.

Hypothesis 2: *For carrier companies, cargo throughput is a major determinant of choosing a port for operating to or from.*

This should be an obvious conclusion, as ships will be attracted to cargo. However other studies have not included this determinant. Other studies have been mainly focused on determinants applicable to shippers and freight forwarders. Due to the differences in business activities between port customers, any survey must address each customer differently. This paper will be one of the first to address the issue of cargo throughput as a determinant for carrier companies.

Hypothesis 3: *For freight forwarders, frequency of ship departures will be a major determinant in the port choice process.*

Tongzon (2002) found that frequency of ship departure was the second most important determinant for freight forwarders, only behind port efficiency. Frequency of departure may be closely related to efficiency as it means faster cargo movement. This hypothesis was included to confirm Tongzon's result and to show a paradox situation with hypothesis 2. This means that if ships are attracted to cargo and cargo is attracted to ships, there is a serious implication for ports. This relationship has also never been shown in any previous papers.

Hypothesis 4: *Port efficiency will have a high importance level for both carriers and freight forwarders.*

Many studies have found port efficiency to be important in the port selection process. Tongzon (2002) found that port efficiency was by far the most important determinant in the port selection process for freight forwarders. Bosch and Lobo (2002) also found efficiency to be important for shippers. Murphy in his many papers has also mentioned the importance of efficiency. This hypothesis is being tested to confirm previous study findings of efficiency being important for freight forwarders. This hypothesis also tests whether carriers place importance on a port's efficiency levels.

Hypothesis 5: *Carriers will place strong important on a port's range of services as a selection determinant.*

Many papers have addressed the issue of carriers wanting better service. Murphy has published many papers showing that carrier companies want other services. Richardson (1989) also showed that ports were increasing their range of services in order to attract more vessels. This hypothesis is included to prove carriers place strong importance on extra services for them.

Hypothesis 6: *Availability of inter-modal transport (or ease of delivery to and from a port) will have a strong importance level for freight forwarders.*

As mentioned previously, freight forwarders not only select a port, they select a carrier and other transport modes. Freight forwarders should select ports that will allow for ease of their other decisions. A port that has good inter-modal transport links and is easy to deliver to and from should be preferred. A port's inter-modal links has not really been addressed in other studies; therefore it is included in this study to set precedence.

IV. Research Method:

Several methods of surveying were identified as potentials to use in this study. These included a phone survey, mail survey, email survey, and online survey. A phone survey would ensure a higher response rate and accuracy of responses due to the ability of respondents to clarify questions and discuss their answers. Drawbacks of the phone survey, are time, and cost, especially if respondents are in other countries. Mail surveys would have a lower response rate, as they are

more time consuming for respondents because the respondent has to fill out the form and then post it back. Email surveys also have a low response rate. First they have the problem of being read by the targeted people. This can be difficult as emails might be treated as spam. Next it can also be time consuming for the respondent have to fill out the survey and then email it back. Online surveys are quicker and should have a higher response rate than email surveys, but they have the problem of attracting the respondents to the survey site.

This study used an online survey option offered through www.questionpro.com. This website was chosen as it offers many features such as ease of designing a survey, analyzing survey responses, email list management, and respondent tracking. Possible respondents were sent an automatic email explaining what the survey is about and asking them to click on a link to be taken to the survey website. The time required for taking the survey was estimated to be about three minutes.

The survey was designed to be as simple as possible. Once respondents clicked on the link they were taken to a welcome page that explained the survey in more detail, and assured them their information would be kept confidential. To be taken to the survey they had to click the continue button. Upon clicking continue respondents were taken to the question page[27].

[27] See appendix A & B for a copy of question pages.

The question page was slightly different for carriers and freight forwarders. Small differences in questions was necessary in order to reflect the differences in their business needs, but questions also had to be similar for ease of comparison. Carriers were first asked to select their company size by choosing the number of vessels they operated. Both sets of respondents were asked to select their location (based on continents).

In the next question respondents had to rank various port choice determinants from most important to the least important. The ranking system was used to clearly differentiate between the levels of importance. If a Likert scale was used different determinants could be given the same value. Table 4 shows which determinants were applied to each of the respondent groups.

Table 4: Port choice determinants applied to customers

Carriers	Freight Forwarders
Port location	Port location
Amount of cargo throughput	Frequency of ship departure
Port efficiency (speed & reliability)	Port efficiency (speed & reliability)
Port's range of services for shippers	Ease of delivery to & from port (intermodal transport options)
Port cargo damage & loss performance	Port cargo damage & loss performance
Port infrastructure (# of berths, cranes, etc)	Port infrastructure (# of berths, cranes, etc)
Ease of dealing with port (contact, paperwork, etc)	Ease of dealing with port (paperwork, contact, etc)
Port charges (costs)	Port charges (costs)
Port information services	Availability of shipment information
	Preference for particular shipping line
	Large & odd size freight handling ability

The next part of the survey asked the respondents to rate various statements on a 5-point Likert scale from strongly agree to strongly disagree. These statements offer more information about the nature of the port selection process. They also gain the opinions that customers have about some services ports could offer. The following is a list of the statements for evaluation.

a) Choice of port is made without any formal evaluation process.
b) Choice of port is made quickly using my knowledge and experience.
c) Decision making process is conducted by eliminating inferior options.
d) Price is the most important consideration.
e) I tend to avoid ports that are difficult to deal and communicate with.
f) It is important for ports to offer online services to customers.
g) It is important for ports to be well connected with other transportation modes.
h) Preserving my company's reputation and satisfying customers are important.
i) I am willing to pay higher for better service and quicker delivery. (Only for freight forwarders to evaluate)
j) Preference for a shipping line is more important than preference of port. (Only for freight forwarders to evaluate)
k) I am wiliing to pay higher for better service and quicker turn around. (Only for carriers to evaluate)
l) Turn around time is an important factor in port choice. (Only for carriers to evaluate)

After completing the survey, respondents had to click 'continue' so that the results could be logged, and a thank you message displayed. It also should be noted that the surveys were not held concurrently. Carrier companies were surveyed first over three weeks, followed by freight forwarders who also had three weeks to log responses.

Email addresses for potential respondents were gathered from various websites that contained company directories. Some of these websites were freight link sites while others were national freight organizations (such as national freight forwarder associations). Companies from predominately English speaking countries were the priority. The main countries targeted for response were, Australia, Canada, Denmark, Hong Kong, New Zealand, United Kingdom, and the United States, but some companies in other countries were also asked to respond. The survey email was finally sent to almost 400 addresses of carriers, and over 2000 freight forwarder email addresses.

V. Results:

1. Response rate analysis

Response rates to the survey were very low. This was in large part due to a high rate of returned emails particularly for freight forwarders. These returned emails were all invalid email addresses in some form. The following table shows the view and completion rates for the survey.

Table 5: response rates

	Carriers	Freight forwarders
Sent emails	391	2128
Returned emails*	65 (16.6%)	700 (32.9%)
Viewed	70 (21.5% of valid addresses)	90 (6.3% of valid addresses)
Started	53 (75.7% of viewed)	74 (82.2% of viewed)
Completed	33 (62.3% of started)	31 (40.5% of started)

* Figures for returned emails are approximated values

In regard to carriers, table 5 shows a relatively low rate of invalid email addresses (only 16.6%). It also shows over 21% of valid carrier email addresses viewed the survey, with 75% of those starting it. The final number of completed surveys from carriers totaled 33, which was about 62% of those that started the survey or 10% of valid email addresses. Some reply emails were received from email recipients advising that the survey would not be applicable for them. These emails were from carrier companies that are dedicated to a customer or charter their vessels. This meant that the carrier company is not involved in port selection as their customers decide where the vessel is sent. Dedicated or charter vessel companies were not separated from the email list as they are hard to identify from a carrier directory. This fact would create a lower response rate to the survey. Overall the response rates for carriers are satisfactory given the method and timeframe of the survey.

The information in table 5 for freight forwarders shows a different story. First it is noticeable to see a very high rate of invalid email addresses being 33%. It was also noticeable when looking for email addresses that many websites for freight forwarding companies had closed. From this it may be proposed that the highly competitive nature of freight forwarding results in many business closures. Table 5 also shows that an extremely low percentage (6.3%) of valid email addresses viewed the survey. The total number of survey responses from freight forwarders was only 31, which was 40% of those who started the survey and only 2.2% of valid email addresses. As with the carrier companies, a few reply emails were

received from freight forwarders who do not undergo a port selection process. These freight forwarders were often dedicated to airfreight, or road freight. As these types of freight forwarders are hard to identify from a directory, they were not separated from the email list and therefore they would contribute to a lower response rate.

A conclusion could be drawn from these response rates that could be a topic for further research. Consider this question. If a potential business email were sent instead of the survey email, would the difference in response rates between carriers and freight forwarders still be so large? The response to a new potential customer's email would show the level of service a company offers. It can be assumed that if the level of service were low then the company would lose business, especially in a highly competitive industry, and therefore the business would close. Is it a coincidence that freight forwarders have a high rate of invalid emails and a very low rate of survey response, while carriers have a much lower rate of invalid emails and a much higher rate of response? Or does low response rates reflect lower levels of customer service among an industry, which results in higher rates of company closures? Further research should be undertaken with regard to this matter.

2. Location of respondents

Table 6 shows the breakdown of the origins of respondents.

Table 6: Location of respondents

	Carriers		Freight forwarders	
Asia	6	18%	7	23%
Australasia	2	6%	11	35%
Europe	16	49%	3	10%
America's	8	24%	10	32%
Other	1	3%	0	0%

Originally this study was going to try to identify differences in the port selection process between the different continental regions. If differences could be found then they might offer an explanation as to why some previous papers had discrepancies in their findings. However, due to the low number of survey respondents, there is not enough information in this survey to make any accurate analysis of differences in port decision making by region.

3. Carrier company size

Size of carrier companies was recorded to try to identify if there are any differences in the port selection process between different size companies. Table 7, on the following page, shows the breakdown of company sizes for carrier company respondents. Unfortunately, the low number of carrier company responses makes it difficult to have an accurate analysis of differences in the port selection process based on company size.

Table 7: Carrier company size

Number of vessels operated	Number	Percentage
Less than 10	9	27%
Between 10 and 25	11	33%
Between 25 and 50	7	21%
Between 50 and 100	3	9%
More than 100	3	9%

4. Port choice determinants analysis

Carrier companies

Carrier companies were asked to rank nine determinants from one to nine, in order from the most important to the least important. Number one was the most important determinant and number nine was the least important determinant. Table 8 shows the rank order analysis for responses from carrier companies.

Table 8: Carrier rank analysis

	Minimum	Maximum	Mean	Std. Deviation
Port Location	1	9	3.42	3.11
Amount of cargo throughput	1	9	4.42	3.16
Port's range of shipper services	1	9	4.42	2.72
Port efficiency (speed & reliability)	2	9	4.67	2.46
Port charges	2	9	4.96	2.12
Port infrastructure	3	8	5.13	1.39
Port's information services	1	9	5.71	2.61
Ease of dealing with port	1	9	6.08	2.21
Port cargo damage performance	3	9	6.21	2.17

The first thing to notice from the results in table 8 is that port location is considered to be by far the most important consideration of carrier port selection. This result is a little surprising considering none of the previous studies found that port location was this important to carrier companies. This result does however partly confirm hypothesis 1 about the importance of location in port selection. The implication for this is that carriers choose to send their ships to ports that are centrally located. One possible reason for this is fuel cost and voyage time is greater for ports that are more remote. Also remote ports may have less cargo which means it is not cost effective for carriers to travel there.

Amount of cargo throughput is equally important to a port's range of shipper services, with both determinants having mean scores of 4.42. Both of these determinants were ranked second and are quite important considerations in the port selection process. This result proves hypothesis 2 and hypothesis 5 are correct. Large amounts of cargo throughput attract the ships required to carry it. Volume of cargo throughput being an important determinant is an expected result. The result of a port's range of shipper services being an important port selection factor supports articles published by Murphy et al in 1991[28]. It also supports the findings that carriers are seeking greater ranges of services from ports.

The fourth ranked determinant was port efficiency, which may be a little surprising to some. Carriers companies are seen to be concerned with loading and unloading speeds (turnaround time). The result of efficiency being placed fourth may not mean it is not important (this issue will be addressed later in the paper), it just means other determinants may have more importance. What is also interesting is that port efficiency was one out of four determinates that did not receive a number 1 ranking. This result partly confirms hypothesis 4.

Port charges were ranked as the fifth most important determinant. It too did not receive a number 1 ranking in the responses, meaning that none of the respondents ranked cost as the most important factor in port selection. This result was expected though based on previous research findings.

[28] Murphy et al (Feb 1991), "Some ports lack shipper focus". Logistics Today Vol32, Iss 2, p.43.

Port infrastructure was shown to be the next most important factor in port choice. It is interesting to note that none of the respondents ranked infrastructure as the least important factor, and none ranked it as the most or even the second most important factor. Infrastructure helps to avoid service problems so it does have some importance but efficiency might be a better sign of port service problems, hence its higher ranking.

The next two rankings were port's information services followed by ease of dealing with the port. Both of these determinants received number 1 rankings, so some carriers place high importance on them. Overall though, carriers don't place a high importance level on them. A port's information services may not be so important because ships can gain this sort of information from other sources, or they might have the information already. Also ease of dealing with ports may not be so important as carriers may not deal with the same port on a daily basis.

The determinant ranked least important was a port's reputation for cargo damage. This is also not surprising given the fact that ships are only carriers for cargo that belongs to someone else and so they may not place great importance on controlling cargo damage. However carriers wanting to preserve their reputations and maintain customers would be concerned about cargo damage. It is interesting to note though that no respondents ranked reputation for cargo damage as the most or the second most important determinant.

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and Murphy et al (Apr 1991), "Ocean carriers seek service". Logistics Today Vol 32, Iss 4, p.67.

Looking at the table 8 we can also immediately see fairly large standard deviations. An explanation can be seen from the minimum and maximum rank values being very diverse. Five of the determinants had minimum ranks of one (most important) and maximum ranks of nine (least important). The determinant with the lowest ranking spread, port infrastructure (ranked between three and eight) was also the determinant with the lowest standard deviation. It is also interesting to note that the determinants with the highest standard deviations were overall the highest ranked determinants.

Freight forwarders

Freight forwarders had to rank 11 port choice determinants in order of importance from one (being most important) to 11 (being least important). The results appear in table 9.

As can be seen from table 9, frequency of ship departure was ranked as the most important determinant in port selection. Hypothesis 3 suggested that frequency of ship departure would be an important determinant, as it wasn't expected to be the most important determinant. This result however shows that freight forwarders place great importance on frequency of ship departure in the port selection process, thereby confirming hypothesis 3.

Table 9: Freight forwarder rank analysis

	Minimum	Maximum	Mean	Std. Deviation
Frequency of ship departure	1	10	3.84	2.98
Port efficiency	1	10	3.88	2.45
Port location	1	11	4.08	3.98
Ease of delivery to & from the port	1	10	4.56	2.50
Port charges	1	11	6.04	2.21
Ease of dealing with port	4	11	6.52	2.06
Preference for a particular shipping line	1	11	6.80	3.04
Availability of shipment information	2	11	6.92	2.41
Port's cargo damage performance	2	11	7.52	2.92
Port infrastructure	3	11	7.60	2.77
Large & odd size freight ability	1	11	8.24	3.09

Port efficiency ranked as the second most important determinant, only just behind frequency of ship departure. The difference in the mean scores was only 0.04, which shows that they are almost equally important determinants. Port efficiency is therefore a very important determinant of port choice for freight forwarders. It must also be noted that no respondents ranked departure frequency or port efficiency as the least important choice determinant (number 11 rank). This result shows the importance of efficiency confirming hypothesis 4.

The third most important determinant was port location, confirming hypothesis 1. The traditional decision to ship via the nearest port is slowly being pressured to

change by other factors. Although location still may have importance for some freight forwarders, the importance of time factors (such as departure frequency and efficiency) is forcing forwarders to search for the quickest freight methods.

Ease of delivery to and from the port ranked as the fourth most important determinant. A port's inter-modal transport links are also an efficiency type factor allowing for quicker, easier, and therefore less costly movement of goods. This similarity to efficiency makes it no surprise that ease of delivery to and from a port is ranked quite high. This shows that hypothesis 6 is true. It also should be noted that as with efficiency, ease of delivery did not receive any least important rankings.

Port charges were ranked quite far behind ease of delivery (which had a mean score of 4.56), to be the fifth most important determinant with a mean score of 6.04. This was an expected result as customers focus more on service costs and time costs. Actual cost (cost associated with payment), still have a reasonable importance level, but 'real cost' seems to have a much higher importance level.

The next most important determinant is ease of dealing with port. It must be noted that the highest rank this determinant received was only '4' but it was ranked sixth overall. This helps to explain why the standard deviation of 2.06 was the lowest of any of the freight forwarder determinants. Ease of dealing with a port is therefore not thought of by any freight forwarders to be of high importance, but it still has a reasonable importance level.

Preference for shipping line was placed seventh. This determinant received ranking scores from 1 to 11, having a mean of 6.80. For some forwarders, this preference of shipping line is most important, but generally there is not a great importance level placed on it. The situation of shipping line preference in the port selection process will be addressed in more detail in the statement analysis section.

The availability of shipment information was eighth most important, while a port's cargo damage performance was placed ninth. Both of these determinants never received a most important ranking. These two determinants being placed so low shows a pattern that freight forwarders do not place great importance on cargo. Murphy et al (1994) found that these two determinants were the most important factors for shippers, who freight forwarders are agents for. This shows that there may be misalignment of thinking between freight forwarders and shippers.

Port infrastructure was ranked as the second least important determinant in the port selection process showing that ports are not so concerned with what a port has, but they are concerned about how they use what they have (that is, port efficiency). This is shown by port infrastructure did not receiving a number '1' or '2' rating, while port efficiency was rated as number '2' overall.

The determinant that was rated as the least important was large and odd sized freight ability of a port. However, it also received a most important rating by some respondents. These respondents maybe specialized freight forwarders who

have specialized transport needs therefore they would place high importance level on large freight ability. This study though shows that most freight forwarders don't place much emphasis on the large and odd sized freight ability of ports.

Comparison and summary

- Both freight forwarders and carriers place strong importance on port location. Carriers rated location as most important, while freight forwarders rated location as the third most important determinant. This result shows that hypothesis 1 is true.
- Hypothesis 2 has been proven true, as carriers are attracted to the amount of cargo volume going through a port.
- Hypothesis 3 has been proven as freight forwarders place strong importance on frequency of ship departure.
- The proving of hypotheses 2 and 3 show an interesting situation where to attract ships, ports need the cargo volume, but to attract cargo volume, ports need the ships.
- Efficiency is an important determinant for both carriers and freight forwarders, therefore we can accept hypothesis 4.
- It is interesting to notice the importance levels of efficiency. Efficiency has a very high level of importance placed on it by freight forwarders. This differs to carriers' ranking of efficiency recalling that no carrier ranked efficiency as the most important factor.
- Hypothesis 5 has been proven as carrier companies ranked a port's range of services for shippers as the third most important determinant.

- Ease of delivery to and from the port was the fourth most important determinant for freight forwarders. This result confirms hypothesis 6 and shows that freight forwarders place high importance on a port's inter-modal transport links.
- Carriers and freight forwarders both rated port charges as the fifth most important determinant in port selection.
- Freight forwarders place much higher importance level on ease of dealing with ports. Carriers placed this as the second least important while freight forwarders placed it as the sixth most important. Freight forwarders having daily contact with ports would explain this.
- Port infrastructure is a less important consideration for freight forwarders who ranked it the second least important. It is interesting that for both carriers and freight forwarders, number '3' rank was the highest, so no freight forwarder or carrier ranked port infrastructure as the most or second most important determinant.
- For both carrier and freight forwarders, a port's reputation for cargo damage was not very important. Carriers rated this least important, while freight forwarders rated it as third least important.

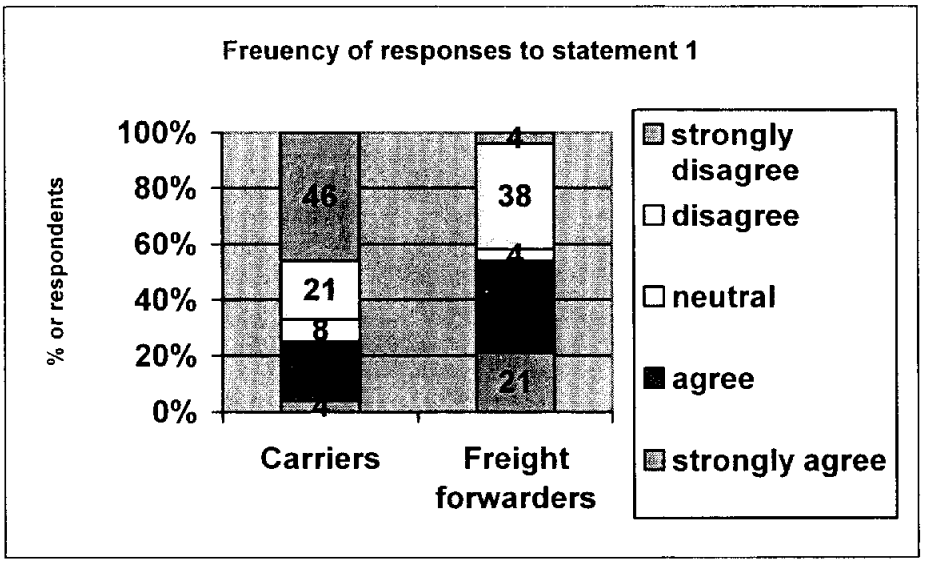
Statement analysis

Respondents ranked the statements using a 5-point Likert scale from strongly agree to strongly disagree. For analysis purposes, strongly agree is 1 and strongly disagree is 5. This means the higher the score (range 1 to 5) the stronger the disagreement. A score of 3 means a neutral standing. The results for each

statement are shown in the following tables. Statements that have interesting frequencies of response show the response frequency graph.

1. Choice of port is made without any formal evaluation process.

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	3.83	1.34	1.80	43.3%
Forwarders	2.71	1.30	1.69	65.8%

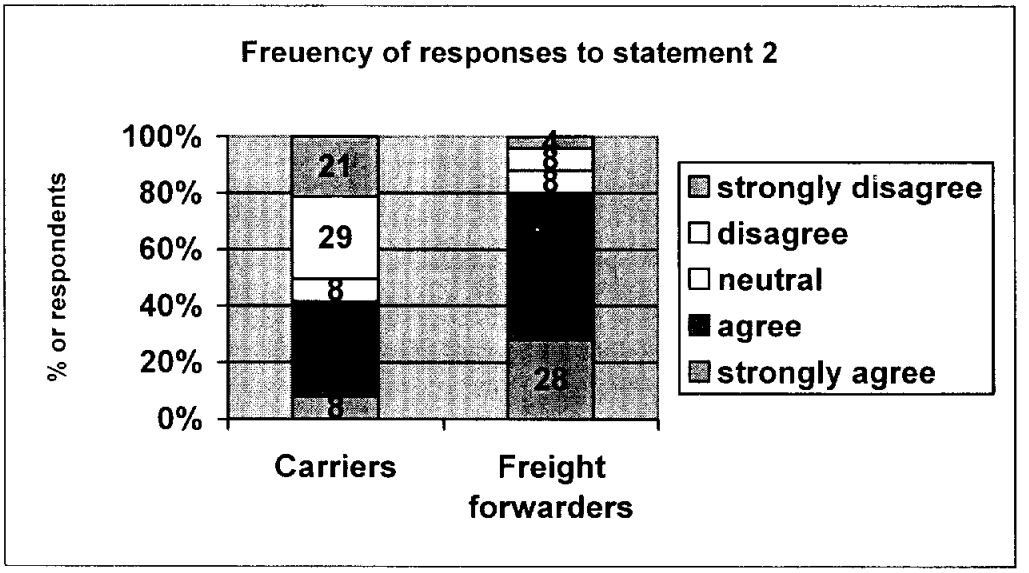


This information clearly tells us that carriers have a more formal decision making process in regard to selecting a port, than freight forwarders. Carriers tend to disagree that there is no formal evaluation process, while freight forwarders are more neutral. It is interesting to look at the frequency distribution for the

responses to this statement. It shows that 46% of carrier responded as strongly disagree, compared to only 4% of freight forwarders. This too confirms that the carriers' decision-making process is much more formal.

2. *Choice of port is made quickly using my knowledge and experience.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	3.21	1.35	1.82	55.8%
Forwarders	2.08	1.04	1.08	78.4%



Freight forwarders tend to agree that they use their own experience and knowledge when selecting a port. Carriers however are more neutral or tend to slightly disagree. It can be seen from the frequency of responses that about 70%

of freight forwarders agreed or strongly agreed with this statement compared to 41% of carriers. About 50% of carriers disagreed or strongly disagreed compared to 12% of freight forwarders. This may mean that the carrier selection process is more open to new ideas and is based on more informational sources compared with freight forwarders.

3. *Decision making process is conducted by eliminating inferior options.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	2.61	0.84	0.70	67.8%
Forwarders	2.64	0.99	0.99	67.2%

Both carriers and freight forwarders tend to slightly agree that the selection process involves eliminating bad options. The frequency of responses is not shown, as there are no significant differences between the responses from carriers and the responses from freight forwarders. This means that in this regard the decision making process is similar for both carriers and freight forwarders.

4. *Price is the most important consideration.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	3.13	1.12	1.24	57.5%
Forwarders	3.12	1.13	1.28	57.6%

Again we see alignment in thinking between carriers and freight forwarders. They both slightly disagree that price is the most important consideration. The close to neutral overall result though shows that price does have a moderate importance level. This is also confirmed by the ranking analysis where both carriers and freight forwarders ranked port charges as the fifth most important determinant in port selection.

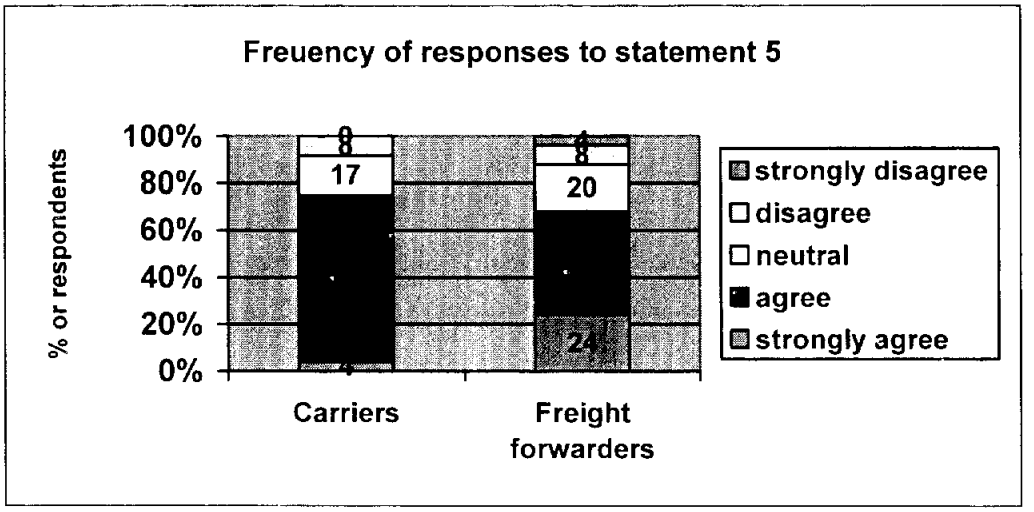
5. *A) I am willing to pay more for better service and quicker turnaround time.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	2.29	0.69	0.48	74.2%

B) I am willing to pay more for better service and quicker delivery.

	Mean	Standard dev.	Variance	Mean Percentile
Forwarders	2.24	1.05	1.11	75.2%

This question was phrased slightly differently for carriers and freight forwarders in order to recognize the differences in their respective businesses. However the question is asking if they would pay more money for better service and quicker speed. We can see that both carriers and freight forwarders agree that they would pay more for better efficiency. Both groups had similar responses with over 75% of carriers and freight forwarders agreeing or strongly agreeing with these statements. It is interesting to note though that 8% of carriers and 12% of freight forwarders either disagreed or strongly disagreed with these statements.



6. Turnaround time is an important factor in port choice.

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	1.63	0.58	0.33	87.5%

This statement was targeted purely at the carrier companies in order to access whether turnaround time should be a determinant in port choice. The result shows that carriers either agree or strongly agree that turnaround time is important in selecting a port. It is interesting to note that only one carrier had a neutral stance. All other respondents either agreed or disagreed.

7. *Preference for a shipping line is more important than preference of port.*

	Mean	Standard dev.	Variance	Mean Percentile
Forwarders	2.68	0.95	0.89	66.4%

This statement was only given to freight forwarders, as it did not apply to carrier companies. Freight forwarders agree that the choice of a particular shipping line is more important than the choice of the port. This means that the port selection process for freight forwarders would start with choosing a shipping line, and then the best port is chosen from the ones that the shipping line operates from. This result confirms the decision-making model for freight forwarders suggested earlier.

8. *I tend to avoid ports that are difficult to deal with.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	2.46	0.98	0.95	70.8%
Forwarders	2.60	0.96	0.92	68.0%

Again there was similar thinking between carriers and freight forwarders with no large differences in statistical information. Generally both carriers and freight forwarders tend to agree or have a neutral opinion that they avoid ports that are difficult to deal with. Carriers overall lean more towards to agree side than freight forwarders. This is a little surprising given the results from the port determinant

rankings, where freight forwarders placed a much higher importance level on ease of dealing with a port than carriers.

9. *It is important for ports to offer online services for customers.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	2.33	0.82	0.67	73.3%
Forwarders	2.04	0.93	0.87	79.2%

Freight forwarders and carriers both agree that ports should offer online services for customers, with forwarders having a little stronger agreement. This may be because the freight forwarders deal with the ports on a daily basis, so they want an easier contact system. The stronger agreement result from freight forwarders would be expected considering freight forwarders placed ease of dealing with the port as the sixth most important while carriers placed it as second last.

10. *It is important for ports to be well connected to other transport modes.*

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	1.58	0.58	0.34	88.3%
Forwarders	1.72	0.94	0.88	85.6%

Carriers generally strongly agree that ports should be connected with other transport modes, while freight forwarders have a slightly weaker agreement. This is a little surprising as carriers act as agents for sea transporting leg of freight

moving, while forwarders are involved with getting the goods form A to B so they deal with all the transport legs such as road and rail. One possible reason for the very strong agreement by carriers is that carriers want a port to have high cargo throughput and they see that strong inter-modal links will give a higher cargo throughput.

11. Preserving my company's reputation and satisfying my customers is important in port choice.

	Mean	Standard dev.	Variance	Mean Percentile
Carriers	1.17	0.38	0.14	96.7
Forwarders	1.28	0.84	0.71	94.4%

Both carriers and freight forwarders strongly agree that they choose the best port to satisfy their customers and protect their company image. Carriers have a slightly stronger agreement than freight forwarders do, and with a lot less variance. This could show that carriers have a higher customer service focus than the freight forwarders do. The result here also gives further evidence to the argument presented in the response rate analysis about low response rates from forwarders, and possibility of lower customer service levels.

VI. Conclusion:

1) Summary and Conclusions

This survey identified the levels of importance that port customers placed on various determinants in the port selection process. From the results some useful information can be gained for use by ports in developing strategies to meet customer requirements.

The first main implication for a port concerns hypotheses 2 and 3. Carrier companies choose ports with a large importance placed on cargo throughput. Shippers and freight forwarders supply the cargo to ports thereby determining the amount of cargo throughput. Freight forwarders place most importance on frequency of ship departures. Carrier companies determine the frequency of departure. The implication for ports then is if a port wants to attract new business, it must attract both cargo and ships at the same time. A port therefore must adopt strategies targeting, carriers, freight forwarders and shippers simultaneously. These strategies must focus on the customer needs in order to offer better customer service and satisfaction.

Carriers place great importance levels on a port's location. Location is also shown to be an important determinant for freight forwarders. A port's location has to be centrally positioned which gives easier access for freight volume and other modes of transport. The importance of location is shown by the emergence of 'hub ports'. The major hub ports all have central locations near countries that have high trade volumes.

In addition to having a good location, a port must also offer a complete range of services for carrier companies if it wants to attract carrier companies. The strong importance level placed on the extra services shows that carriers are not just selecting a port for loading and unloading. They are in fact selecting maritime centers where they can conduct other business that is important to their operation. It might be useful for a thorough study to be conducted into what other services carriers want.

This study also has shown that ports must be well linked to other forms of transport ensuring easier delivery to and from the port. Freight forwarders placed high importance on ease of delivery (ranked fourth highest), and both freight forwarders and carrier companies agreed or strongly agreed that ports should have strong inter-modal links. Ports have to be a strong link in the transportation network. Transforming themselves from a port into a transport hub is vital. They must be integrated with rail and road transport systems, and possibly even the airfreight system.

Port charges have moderate importance levels placed them by both carriers and freight forwarders. These customers are also neutral on the stance that price is the most important factor in port choice, which shows that price has a moderate importance level in the decision making process. The implication for ports here is that they have to have competitive charges that are not too high. However both carriers and freight forwarders agree that they would pay higher prices for better service and quicker speed.

Better service and quicker speed is a quite broad topic. To carriers, speed is turnaround time, which carriers agreed was an important factor in port selection. To freight forwarders speed is movement time through port, and speed of delivery. The way to measure better service and speed is in fact efficiency. Efficiency was ranked as the second most important determinant by freight forwarders, and carriers ranked it as the fourth most important determinant. From these results we can assume that port customers will pay higher for higher efficiency. Ports must therefore adapt strategies of reform to increase their operational efficiency.

Ports also have to offer online services for their customers. Both carriers and freight forwarders agree that ports should offer these services. Because freight forwarders deal with ports on a daily basis, they are particularly interested in ease of dealing with a port. Online services may fall under this category. Both carriers and freight forwarders tended to slightly agree that they avoid ports that are difficult to deal with. As well as offering these online services, ports should have strong customer focus and adopt documentation systems, and communication systems that make it easy for customers to work with the port.

The final implication for ports from this study comes from the port decision-making process itself. The results from this study show that carrier companies have a more structured and formal approach to the decision making process. The people making the decision use less of their own knowledge and experience. This means that the people making the port selection choice for carrier companies are more open to new ideas and changes in circumstances. An implication here is that

carrier companies may be have an increased chance of changing operational ports. Ports could use marketing and promotional strategies to target carrier companies in the hope of attracting more business.

On the other hand freight forwarders tend to not have a formal evaluation process for port selection. The people making the port selection decision normally use their own knowledge and experience. This creates a challenge for ports to inform freight forwarders about changes in port operations. Freight forwarders will also be less likely to change ports based on new information.

This paper has helped gain a further insight into the port selection process of carriers and freight forwarders. It has shown that there is a difference between carriers and freight forwarders when it comes to the port selection process. This paper also has shown that carriers and freight forwarders evaluate port determinants differently and that they have different needs that ports must endeavor to satisfy. This paper has also clearly shown that ports must attract both carrier and freight forwarders simultaneously if they want to increase their business.

2) Limitations:

There are several limitations to this study. The first is in regard to respondents. Respondent numbers were enough to analyze the differences in the port selection process of freight forwarders and carriers. However the numbers were not high enough to make comparisons between different continent areas, and company

sizes. The low response rate also means that this survey could be open to non-response bias. No test can be done to check to see if there would be statistical differences in the port selection process between respondents and non-respondents.

Survey emails were sent to mostly English speaking countries, but also some non-native English speakers also completed the survey. There could have been some confusing or misunderstanding of the questions for those with lower English proficiency. To avoid this problem, the survey could have been translated into other languages.

Another limitation of the survey is the ranking system. Although it does have some merits it does not show importance, only relative importance levels. This could mean that the least important item still could have some high level of importance. Also the ranking system is open to bias where the first items could be ranked higher than the last items only because of the order they appear.

The Likert scale questions can also be open to 'yeasaying bias', which is where the respondent agrees with all the statements. Luckily this study did not have any respondents who gave the same rating to every statement. However the statements may have been appraised without full understanding, or answers selected randomly.

3) Future research

The research and analysis in this paper has also bought up many new ideas for future research. The first thing for future study is an extension of this paper to see if differences exist in port selection between different cultures, or different levels of country economic development. This would have to be done over a longer period of time, combining several survey methods in order to gain enough responses to make proper comparisons.

The survey could also expand the number of determinants based on the work started by Bosch and lobo[29]. This will give a more accurate understanding of port selection, but will have survey problems due to higher complexity. Other customers such as shippers and the ports themselves could also be used in future surveys[30].

Another possible research opportunity exists in regard to finding out about freight forwarders service levels. This paper presented a possible explanation for low response rates from freight forwarders, being that freight forwarders may not offer high quality service to their customers, and hence there is a high business closure rate. It would be interesting to survey freight forwarder customers to understand their perceptions of the service level offered by freight forwarders.

The last topic that this paper raises for further study concerns the proposed model. This model needs to be tested to determine whether this is an appropriate model.

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[29] Bosch & Lobo used 29 determinants of port choice.
[30] Murphy et al surveyed 5 customer groups of ports.

To test this will be an in-depth study, identifying the reasoning (or thinking) of customers in regard to their judgments in the port selection process.

This paper has tried to gain further insight into the port selection process. Results from this paper should help ports gain an understanding of their customers' needs, in order to develop competitive strategies for the future. The research identified the main determinants of port choice from work done in previous studies. A model has been proposed for classifying these port determinants. The results of analysis clearly show a difference in the decision-making process between carriers and freight forwarders. This paper also raised some important issues for further research.

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Appendix A

Determinants of Port Choice

Port Customer Survey: Carrier Companies

1) Please select your location:

Asia North America Europe Australia

2) Approximately how many vessels do you operate? (Highlight correct group)

<10 10-20 20-50 >50

3) Please rank the following port choice factors in order of importance when undertaking the decision of which ports to use.

Port's location
Amount of cargo throughput
Port efficiency (speed & reliability)
Ports cargo damage performance
Port infrastructure (number of berths, cranes, terminal area)
Ease of dealing with port (paperwork, contact, etc)
Port Charges (cost)
Port's information services
Port's range of services for shippers

4) Please evaluate the following statements about the decision making process by marking the appropriate number (1 is strongly agree, 5 is strongly disagree).

a) Choice of port is made without any formal evaluation process
b) Choice of port is made quickly using my knowledge & experience.
c) Decision making process is conducted by eliminating inferior options
d) Price is the most important consideration.
e) I am willing to pay higher to ensure better service & quicker turn around.
f) Turn around time is an important factor in port choice.
g) I tend to avoid ports that are difficult to deal & communicate with.
h) It is important for ports to offer online services to customers.
i) It is important for ports to be well connected with other transport modes.
j) Preserving my company's reputation and satisfying my customers are important.

Appendix B

Determinants of Port Choice

Port Customer Survey: Freight Forwarders

1) Please select your location:

Asia North America Europe Australia

2) Please rank the following port choice factors in order of importance when undertaking the decision of which port to use for shipping.

Port's location
Frequency of ship departure
Ease of delivery to or from port (rail, truck, air, & ship feeder services)
Port efficiency (speed & reliability)
Ports cargo damage performance
Port infrastructure (number of berths, cranes, terminal area)
Ease of dealing with port (paperwork, contact, etc)
Port Charges (cost)
Preference for specific shipping line
Shipment information
Large & odd size freight ability

2) Please evaluate the following statements about the decision making process by marking the appropriate number (1 is strongly agree, 5 is strongly disagree).

a) Choice of port is made without any formal evaluation process
b) Choice of port is made quickly using my knowledge & experience.
c) Decision making process is conducted by eliminating inferior options
d) Price is the most important consideration.
e) I am willing to pay higher to ensure better service & on time delivery.
f) Choice of shipping line is more important than choice of port.
g) I tend to avoid ports that are difficult to deal & communicate with.
h) It is important for ports to offer online services to customers.
i) It is important for ports to be well connected with other transport modes.
j) Preserving my company's reputation and satisfying my customers are important.