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Factors Affecting the Competitiveness of the Seaport: A Case Study in Ho Chi Minh City, Vietnam

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FACTORSAFFECTINGTHECOMPETITIVENESSOFTHESEAPORTACASESTUDYINHOCHIMINHCITYVIETNAM

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I. Introduction

A Seaport is a gateway for import and export activities, which is a transit point between sea routes and rail, road, and inland waterway networks. As a coastal country, Vietnam has nearly half of its provinces and cities with seas with a total coastline length of over 3,260 km running along the length of the country. It has a large sea area with many peninsulas, bays, and deep, sheltered bays that face the international maritime route between the Indian Ocean and the Pacific Ocean. From Vietnam's coastal ports on the East Sea, it is easy to go through the Malacca Strait to the Indian Ocean, the Middle East, Europe, Africa, etc., and through the Bashi Strait to the Pacific Ocean to ports in Japan, Russia, and America. However, the development and usage of seaport services have not been commensurate with their available potential and advantages; The seaport system is still scattered and fragmented; Transport infrastructure and industrial parks have not been developed in line with the seaport system; Its technology, equipment, and services are still outdated; Customs service quality is limited and customs clearance costs are high; Scattered investment and unreasonable structure are characterized by an excess of small ports and a lack of large ports and deep-water ports; The modernization of the seaport system is slow, so it is not qualified to receive the world's medium and large tonnage ships, etc. (Nguyen Duc Phu, 2023). This leads to the top issue for seaport development which is building their connectivity and improving their competitiveness. These are also challenges for researchers and seaport managers. This study focuses on (i) Determining the factors affecting its competitiveness; (ii) Building a quantitative model of the above relationship; and (iii) Implications for policies to improve Ho Chi Minh City seaport competitiveness. This study uses primary data from a survey of 370 observations (Seaport experts, port authority managers, managers of domestic shipping lines, and managers of foreign shipping lines) in Ho Chi Minh City to build a practical basis for modeling. Ho Chi Minh City is the economic center of Vietnam, which is adjacent to the sea with a rich river system and has the most developed seaport system in the country with 42 ports and port clusters covering a length of about 13km, which support logistics accounting for nearly 60% of the South Region. Ho Chi Minh City ranks 22nd and 26th among the 50 best container ports in two consecutive years 2020 and 2021, which was awarded by the World Shipping Council 2022, a member of the International Association of Ports and Harbors (IAPH) and ASEAN Port Association (APA). Ho Chi Minh City's seaport system has a significant growth, especially the amount of goods throughput has increased steadily over the years, with more than 93 million tons in 2015, it had increased to more than 163 million tons between 2020 and 2022 (of which container goods are 7.8 and 8.11 million TEUS), a number of goods through Ho Chi Minh City seaport system is forecast for steady growth in the years to come (Vietnam Maritime Administration, 2023).

II. Literature Review

1. *"Industrial Cluster" Theory:* According to Porter (1998), an industrial cluster is a group of companies and institutions that are geographically linked in a specific field and interconnected by their similarities and mutual support to improve their competitive advantage. The "industrial cluster" theory assumes that the inevitable requirement for enhancing the competitiveness of an economic cluster is to have industrial linkages within it. Today's seaports are not only considered a junction in the transportation chain but also a multi-industry economic cluster including post-port logistics areas (industrial parks, export processing zones, and logistics centers) and multi-modal transport (sea, railway, river, and air transport).

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2. *Stakeholder Theory:* According to Freeman and Reed (1983), stakeholder theory refers to any group or individual that can influence or be affected by the achievement of an organization's goals. Different stakeholders have different interests, perceptions, and ideas on competitive advantages (Castro and Nielson, 2003), they find their interests without appreciating what is significant to others. Therefore, the interests of stakeholders create diverse sets of expectations, needs, and values (Harrison and John, 1994). This diversity of interests poses a potential problem where a failure to satisfy a particular stakeholder may disadvantage others due to resource scarcity and management skills (Freeman, 1984; Mahoney and Pandian, 1992). To balance the interests of different stakeholders, this theory suggests that managers should make decisions by taking into account the interests of their stakeholders (Sternberg, 2000). It recommends that modern companies must satisfy multiple stakeholders to survive in a volatile and uncertain environment (Foley, 2005). The importance of stakeholder orientation comes from several fields, with several studies showing that stakeholder orientation has a positive impact on outcomes (Clarkson, 1995; Greenley and Foxall, 1997). Stakeholder orientation is a condition for achieving the highest goals because stakeholders are not isolated from each other, the success of one stakeholder depends on the others (Polonsky, 1995). Stakeholder theory implies that all parties that are involved in the port system should be taken into account when determining seaport connectivity.
3. *Institutional Theory:* The institutions are sets of formal, and informal rules, regulations and norms, culture-based perceptions, and strategies of actors in an economic environment(North, 1991; DiMaggio, 1998; Scott, 2001; Strambach, 2010). Organizations can impose constraints on shared participation, limiting the degree of autonomy in decision-making and management control of other organizations (Greif, 2005; Saka-Helmhout and Geppert, 2011). Conversely, institutions also enable actors to choose how to act by removing existing barriers and facilitating access to material resources and relationships (Carney and Child, 2013). With their role in establishing ownership rights, institutions determine several aspects related to how competition between companies is shaped, thereby regulating their missions, fields, functions, and territories (Thorelli, 1986; Fligstein and Freeland, 1995). Institutions with different geographical locations have different procedures and outcomes, which emphasizes the relevance of geography in such analysis (Van der Lugt *et al*., 2014). With consideration to seaports, their authorities can be highly institutionalized organizations (Child *et al.,* 2012; Notteboom *et al*., 2013), which are bound by national rules and policies as well as local structures and values that influence both their behavior and outcomes (Hall, 2003; Ng, *et al*., 2013; Debrie *et al*., 2013). Consequently, port authorities themselves can be institutions for other actors, if they are authorized by governments to design regulations and standards for actors within the port's jurisdiction. They can potentially facilitate or hinder strategic options for developing connectivity in a port system. Because institutions are not always consistent, they can facilitate and hinder the strategies of actors (Rodrigues, 2013). From an organizational perspective, port authorities are territorial-bound institutions, in which distance, local agreements and costs committed to infrastructure are interconnected in determining the local institutional logic, including market participants (Notteboom *et al*., 2013). Some studies consider organizational connectivity as a factor that promotes innovation and new habits (Hall and Jacobs, 2010). As port operating companies acting as part of supply and transportation chains have a natural incentive to integrate networks (Carbone and De Martino, 2003; Notteboom, 2007; Song and Panayides, 2008; Veenstra *et al.*, 2012), changes in port management with greater autonomy and governance rights are provided for port authorities. Similarly, it brings about opportunities to expand their role in shaping port products by expanding into the hinterland (Notteboom *et al*., 2013). Therefore, the organizational linkage between port authorities and port operators, which naturally exists in port areas, then expands into the hinterland. In this regard, the port authorities do not disrupt existing development paths but develop new capacities and operations through a process of institutional expansion. According to Wilmsmeier *et al*.(2014), port authorities invest in transshipment centers in the hinterland, which arise beyond their traditional jurisdiction, and the particular importance of informal networks is noted.
4. *Port Geography Theory:* Weigend (1956) believes that port geography includes key parts such as ports, aircraft carriers, cargo, inland, hinterland, land, and maritime spaces (Wiegmans *et al.,*2008). It is, therefore, necessary to study ports in the context of a network, rather than as an independent entity. Among them, geography has the most prominent meaning. An ideal port is that it has enough space for its operations and attributes of easy access, deep water, a small tidal range, and an unobstructed climate condition for the whole year. It should pay special attention to the origin and destination of goods, both incoming and outgoing goods. A port that is only a destination for incoming goods has a much narrower function and

opportunity for expansion and development than a port through which cargoes are shipped to and from. Additionally, the connectivity of the port and hinterland will be strengthened in case of their reduced distance, close relationship, and effective spatial planning. Weigend (1956) emphasizes that the effective planning and use of land have a strong influence on both port growth and function as well as that the maritime spatial planning and the growth of a port play an important role in the development of hinterland and maritime networks. The theory of port geography has been adopted by many scientists around the world to build models related to seaports (Kenyon, 1970; Hayuth, 1981; Hoyle, 2010; Ducruet, 2020).

5. *Theory of Competitiveness:* Porter (1990) introduced the Diamond model with new concepts and explanations about competitive advantage. Instead of focusing on cost minimization in closed economies, today's competition is dynamic and is based on innovation and the search for strategic differentiation as countries are opening up their economies. Porter argues that four interconnected factors represent the significant competitive advantages of countries in specific industries, which include conditional factors of market demand, related supporting industries, strategy, and structure along with business competition. It can be seen that, when applying the theory of competitive advantage to the seaport, the conditional factor is related to seaport facilities. The diamond model emphasizes the possible impact of a port's fundamental strengths and weaknesses on its competitive advantage, which also highlights the potential for competition and cooperation between port users and port service providers (Porter, 2000). In this case, the diamond model is a good solution for reflecting the real conditions because it realizes that port service providers can cooperate with each other and get mutual benefits while minimizing their destructive competition, thus changing the overall competitive structure of the port (Ng, 2006). However, the diamond model does not take into account the characteristics of international and multinational activities (Cartwright, 1993). Rugman and D'cruz (1993) introduced the double diamond model to demonstrate the nature of international competition in the port market. To getan international competitive advantage, the dual diamond model recommends that port managers and decision-makers establish their own national and international diamond mechanisms. This is consistent with the concept of supply and logistics chain because the weakness of any link in the chain will directly affect the performance of other links (Moon *et al*., 1998). To include inter-nationality as a fundamental concept of port competitiveness, Rugman and Verbeke (1993) developed a model based on the Porter diamond model which builds local, regional, foreign, and global inventories for each corner of the diamond model. They argue that some have local competitive levels while others havean international level. The inclusion of these inventories in Porter's model formed the expanded diamond model, making it relevant to the global economy. Although Porter's model emphasizes the host country as the main factor of competitive advantage, Dunning (1997) stated that countries other than the host country could influence the competitive advantage of a company in a particular market.

The above arguments relate to this research in explaining the nature of the seaport competitiveness.

a) Seaport Connectivity and its Competitiveness

1. *Seaport connectivity:* Indriastiwi *et al.* (2020) state that seaport connectivity is the linkage of maritime, inland, and ports. Therefore, the concept of seaport connectivity should be studied from the perspective of the entire freight transport chain and the assessment of hinterland connections (inland ports and trade) and maritime connections (Zhang *et al*., 2018).
2. *Hinterland Connectivity:* Is mainly determined by inter-modal networks from the port to the hinterland (Wang *et al.,* 2016; Parola *et al*., 2017). If the smoothness of seaport-inland connections is not consistent with the maritime network, it will affect the port's competitiveness because the increasing size of ships, especially the associated emergence of distribution centers and satellite port networks, will only aggravate the bottlenecks related to port hinterland connectivity (Merk and Notteboom, 2015;Abbes, 2015).
3. *Maritime Connectivity:* Is the link between ports and shipping lines as well as the link between ports (Arvis *et al*., 2018). Among them, the link with shipping lines is the most important aspect of maritime connectivity. It is the result of the shipping line's selection of ports. It demonstrates a port's ability to handle ships of different sizes and capacities. The depth of the port, its mooring system, and its facilities play an important role in this connection. While the sea connectivity of the port is its connection to the main sea network, it needs to have efficient sea transport services. This ensures the global movement of goods between this port and other ports. For good sea connectivity, the port needs to have a good link with shipping lines.

Research by Zhang (2006) showed hinterland connectivity can affect the competitiveness of a port in an environment with many competing ports in China. Hinterland connectivity is characterized by transport

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corridors dedicated to seaport cargoes, such as designated railway lines connecting to ports or inland roads used by both freight trucks and local commuter cars. With research on OECD seaport cities, Olaf and Theo (2015) believes that hinterland connectivity is one of the most important factors affecting seaport competitiveness. With research on the Valencia seaport, Scaramelli (2010) states that hinterland connectivity affects seaport competitiveness. On the other hand, Hayuth (1981) believes that shipping lines are increasingly trying to control costs and coordinate their activities throughout the entire transport chain. They are seeking to lease and operate their container terminals as a priority. Ports that can meet the specific requirements of individual shipping lines and provide them with dedicated terminals will have a competitive advantage. A study of the Port of Rijeka in Croatia by Tijan *et al*. (2022) states that one of the important factors affecting port competitiveness is hinterland connectivity and maritime connectivity. Research on the seaport system in India, Saha (2022) stated that hinterland port development affects the improvement of seaport competitiveness. Nguyen and Woo (2022) studied the connectivity of the 10 largest container ports in Southeast Asia and found that their connectivity is confirmed to be one of the factors helping Singapore become the most competitive container port in the region. Seaport connectivity is also an important factor that helps Canadian ports promote their competitiveness (Beatriz and Alan, 2015). Seaport connectivity has a positive impact on improving competitiveness (Song and Yeo, 2004;Yeo *et al*., 2007; Low *et al*., 2009; Meersman *et al.,* 2010; Da Cruz, 2012; Wang *et al*., 2016; Parola *et al.,* 2017; Pietrzak *et al*., 2020; Oliwia *et al*., 2020). Based on empirical studies, we propose the following hypothesis:

H1: Seaport connectivity has a positive impact on its competitiveness.

b) Other Factors Affect a Seaport's Competitiveness

Geographical Location: Plays an important role in the operations of ports. Although distance is not an absolute barrier to trade, to overcome such limitations, building an efficient multi-modal network is indispensable. Each port has a hinterland to serve. However, these hinterlands may vary subject to their distance, cost, and topography. Because freight costs are proportional to distance, a favorable geographical location will boost a port's hinterland connectivity (Pallis and Rodrigue, 2022). With research on seaport competition in Southeast Asia, Yeo (2007) shows that geographical location has a strong impact on a seaport's competitiveness. Research on Valencia port in Spain by Scaramelli (2010) shows that geographical location has a positive impact on a seaport's competitiveness. Similar results were found from the research on the global competitiveness of seaports by Kaliszewski *et al.* (2020), the research on carriers' selection of seaports in Turkey by Baştuğ *et al.* (2022), and the research on Rijeka seaport in Croatia by Tijan *et al.* (2022). With the above studies, we propose the following hypothesis:

H2: Geographical location has a positive impact on a seaport's competitiveness.

Seaport Facilities: Also known as seaport utilities, are container terminals, handling equipment, trailers, container yards, information systems, multi-modal systems, and governance systems (Tongzon and Heng, 2005). In addition, they include container cranes over the length of wharves and deep-water wharves (Wang and Cullinane, 2006). With the emergence of global value chains, it is not surprising that policymakers and port managers around the world are developing strong and competitive port facilities to enhance their hinterland connectivity (Wang *et al*., 2016; Mohamed-Chérif and Ducruet, 2016; Calatayud *et al*., 2017). Rajasekar and Rengamani (2019) believe that seaport facilities are one of the extremely significant factors for hinterland connectivity. Especially, several domestic customers during the decision-making process consider adequate port facilities more important than quick response time to the needs of port users (Ugboma *et al*., 2006). Research on seaports in Spain by Da Cruz (2012) shows that facilities are a factor affecting a seaport's competitiveness. Comparing the competitive advantage of Karachi port with the ones of neighboring emerging countries in the Persian Gulf and Indian Ocean, Liaqait *et al.* (2020) discover that facilities are a decisive factor affecting a seaport's competitiveness. Similar results were found from the study of container ports in Northeast China by Wan *et al.* (2022) and the port systems along the "belt and road" by Liu*et al.* (2020), carriers' selection of seaport in Turkey by Baştuğ *et al.* (2022) and Rijeka seaport in Croatia by Tijan *et al.* (2022). Researching the port system in Vietnam, Ha Minh Hieu (2021) shows that infrastructure affects seaport competitiveness. With the above studies, we propose the following hypothesis:

H3: Seaport facilities have a positive impact on a seaport's competitiveness.

An Information System: Is a combination of human resources, materials, and software to collect, formalize, store, browse, link, and disseminate information within the same organization (O'Brien and Marakas, 2011). Information technology plays an essential supporting role in setting up and deploying information systems and is a catalyst for internal and external integration. According to Sweeny and Evangelista (2005), different types of Information-Communication Technologies enable a degree of external (port community) and external integration as well as the integration of internal and external port processes. Hsu and Lalwani (2010) see the deployment of information and communication technology as a tool to support international transport, with an emphasis on seaports as a focal point of a transport chain.

Reviewing the competitiveness of Agadir port in Morocco, Jouad and Hamri (2020) find that information technology is the decisive factor affecting its competitiveness. Similar results were found from the studies of regional port systems in China by Yi *et al.* (2021), port chain in Sub-Saharan Africa by Adabere *et al.* (2021), and Rijeka seaport in Croatia by Tijan *et al.* (2022). With the above studies, we propose the following hypothesis:

H4: Information technology has a positive impact on a seaport's competitiveness.

Port Authorities: Have become more autonomous and proactively expanded and redeveloped port infrastructure. Port authority activities can be classified into four main categories: traffic management, customer management, regional management, and stakeholder management. More active engagement of port authorities means their active coordination within the transport chain and cluster and more coordination can lead to more efficient supply chains and more competitive ports. Therefore, they have an incentive to improve their coordination within port clusters and supply chains. The active involvement of port authorities is especially suitable for inland transport, as this is quickly becoming the main bottleneck in the international door-to-door transport chain. Port authorities can contribute to effective hinterland access by investing in infrastructure and terminals within the port area, perhaps also outside the port area. They can improve hinterland access by incorporating infrastructure access rules and developing a system of port communities (De Langen, 2009). According to Van den Berg *et al.* (2012), port authorities recognize the importance of multi-modal transport to serve the development of seaport hinterlands and suggest policies to involve ports in multi-modal connections. Port authorities play an important role in hinterland connectivity to increase traffic flow to their ports. The port authorities also develop new inland routes to their ports. Their engagement in infrastructure investment will increase reliability and attract port users to their ports. Research on seaport connectivity in Southeast Asia by Yeo (2008) shows that port authorities are the decisive factor for a seaport's competitiveness. Research on regional port systems in China by Yi *et al.* (2021) discovers a positive relationship between a port authority and its port competitiveness. Similar results from the studies of Valencia seaport in Spain by Scaramelli (2010) and seaports in Indonesia by Wahyuni *et al.* (2019),performance of the port in Sub-Saharan Africa by Adabere *et al.* (2021), carriers' selection of seaports in Turkey by Baştuğ *et al.* (2022); Rijeka seaport in Croatia by Tijan *et al.* (2022) and Chittagong seaport in Bangladesh show that port authorities are the decisive factor for a seaport's competitiveness (Munim *et al*., 2022).With the above studies, we propose the following hypothesis:

H5: Port authorities have a positive impact on a seaport's competitiveness.

Corporate Reputation: Can be defined by several attributes that shape buyers' perceptions of whether a company is known, good or bad, trustworthy, reputable, or not (Levitt, 1965). The reputation of a company refers to how people perceive it based on any information (or misinformation) they have about its activities, work environment, and performance in terms of past and future (Fombrun *et al.*, 2000). The reputation of seaports (as measured by the Fortune Reputation Index) influences shippers' expectations of close relationships with specific ports and acts as a moderator of the customer's trust in suppliers. It also constitutes a moderator of the effects of trust on commitment and investments, and the adaptation of business systems to specific relationships. In addition, it is characterized by the fact that the supplier always adjusts its behavior to adapt to new customer requirements, and it affects seaport competitiveness (Bennett and Gabriel, 2001). Research on the port of Valencia, Spain by Scaramelli (2010) shows that the port's reputation is the decisive factor for its competitiveness. A study of container port systems in West Africa by Meersman *et al.* (2010) discovered a positive relationship between port reputation and its competitiveness. Similar results were found from the studies of seaports in Zachodniopomorskie Voivodeship, Poland by Pietrzak *et al.* (2020) and Rijeka seaport in Croatia by Tijan *et al.* (2022). Thus, a port's reputation affects its attractiveness to customers and is closely linked to the extent to which a mechanism ensures fair competition between different entities in ports (Bennett and Gabriel, 2001). Therefore, it is related to preventing anti-competitive practices that often takes much time in exclusive ports. The environmentally friendly operations of a port and its reputation have become more and more important for its competitiveness (Lam and Notteboom 2014; Lun, 2011). With the above studies, we propose the following hypothesis:

H6: The reputation of a seaport has a positive impact on its competitiveness.

III. Research Model

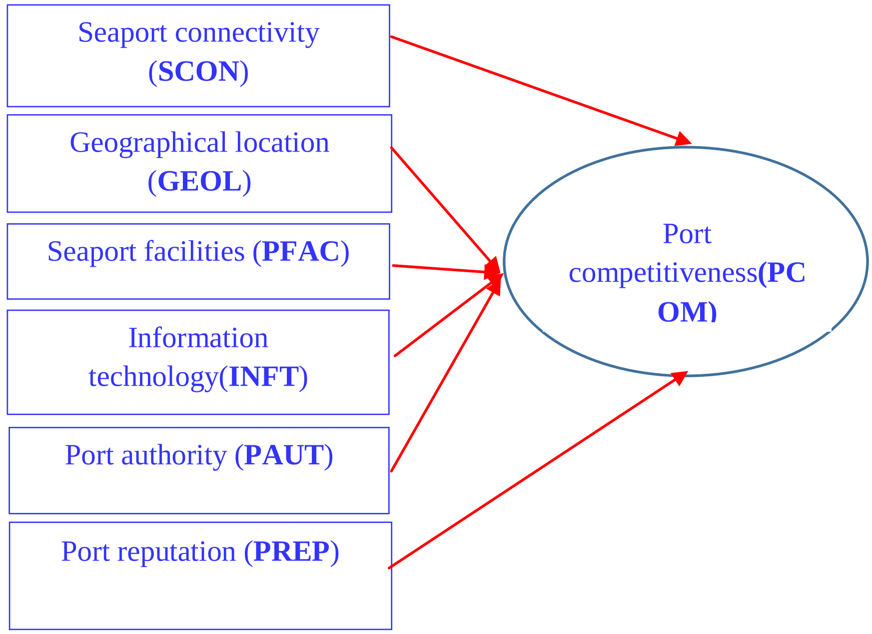

Figure 1: Theoretical Modeling

It is required to have a theoretical assessment and empirical study for further research to expand this theory and provide more empirical evidence and policy implications related to improving seaport competitiveness. Previous studies highlighted the factors that impact seaport connectivity with qualitative analysis or measurement of relationships using quantitative models such as statistical testing, or separate regression models, but did not provide a complete basis for a comprehensive analytical frame-work on seaport competitiveness. Therefore, the purpose of this study is to extend the findings from previous ones and integrate analysis of their correlation into an exploratory factor analysis and linear regression modeling. The research teams selected a case to study seaport competitiveness in Ho Chi Minh City Port as shown in Figure 1.

IV. Methodology

Measurement: All scales are modified from previous studies to fit the research context in Vietnam. We designed a three-step process for the survey. First, we carried out a survey using the expertise method of discussing with 10 port experts with at least five years of experience working at agencies related to the port industry. They are leaders of departments and agencies in Ho Chinh Minh to refer to measuring scales and observation variables that are suitable for the Port Logistics industry. Second, a pilot survey with 10 managers of import and export companies and 10 managers of shipping lines in Ho Chi Minh City to verify if there were any errors in the questionnaire. The sample was selected based on the respondents' willingness to participate in this study. Third, a complete survey was conducted for seaport researchers (20 people), port authority managers (30 people), managers (225 people) of domestic shipping lines, and managers (225 people) of foreign shipping lines whose ships docked at Ho Chi Minh City port. They all had experience in handling cargoes in Ho Chi Minh City seaport. A general of four hundred respondents stuffed out the questionnaire.

A five-point Likert scales starting from "strongly disagree" to "strongly agree" were used to measure all observation variables. To measure the "Seaport connectivity" scale, 4 observation variables were included in the questionnaire. This scale is mainly based on research on the performance of the ports in Barcelona, Marseilles Egypt, and Morocco by Arvis *et al.* (2018), and research on seaports in Portugal by Da Cruz (2012). For "Geography", 4 observation variables were included in the questionnaire. It was mainly based on research on the performance of the ports in Vietnam by Ha Minh Hieu (2020). For "Seaport facilities", 4 observation variables are included in the questionnaire. It is mainly based on research on the ability to attract customers at Chittagong Port, Bangladesh by Munim *et al.* (2022). For "Information Technology", 4 observation variables were included in the questionnaire. It was mainly based on research on the port system in Chennai, India by Rajasekar and Rengamani (2019). For "Port Authority", 4 observation variables were included in the questionnaire. It was mainly based on research on port networks by De Langen and Sharapova (2013) and it was adjusted to suit the Vietnamese situation and had several new observation variables built by the authors from the expertise discussion results such as "Port authority can actively participate in investment projects for highway and barge terminals outside their port area"; "Port authority builds a port community information system to allow an effective communication between companies, contributing to the coordination of the transport chain. "For "Seaport reputation", 4 observation variables were included. It was mainly based on research on the Chittagong port network in Korea by Yeo *et al.* (2015), and it changed into adjusted to fit the Vietnamese situations and had numerous new commentary variables constructed via way of means of the authors from the effects of professional discussions such as "The port we are using has very good relationships with famous ports in the world"; "The port we are always using emphasizes responsibility for the environment and attracting tourists to Ho Chi Minh City." For "competitiveness", 4 observations were included in the questionnaire. It was mainly based on research on port connectivity and competition by Da Cruz (2012) and had several new observation variables built by the authors from the results of expert discussions such as "Annual share growth of the port against the adjacent region/country"; "Dynamic changes of cooperation policies based on economic fluctuations around the world and increasing revenue." Details of the scales are in the Appendix (Table A).

Data Collection and Processing: We launched a survey in Ho Chinh Minh City with 400 questionnaires. This survey lasted from February to May 2023. After data processing, 370 reliable observations were used for data analysis.

According to Fontaine (2005), the exploratory factor analysis modeling was performed in 4 steps: Reliability test of scale; Exploratory Factor Analysis (EFA); Confirmatory Factor Analysis (CFA), and Multiple variable regression. Data analysis was performed on SPSS and AMOS software version 21.0.

V. Results

a) *Descriptions of Survey Subjects*

Table 1 showed the details of the questionnaire. Results showed that 80% were men. The ages were distributed across three groups: under 30, 31-45, 46–55, and over 55 with 20%, 55%, 16%, and 9%, respectively. Also, education levels in four groups: Highschool, College & University, Posgraduate, and Other, are 25%, 56%, 12%, and 8%, respectively. Occupation with four groups: Managers of domestic transport enterprises, Managers of foreign transport enterprises, Port authority officials, and Seaport experts are 54%, 32%, 8%, and 6%, respectively. The majority of survey objects is married (64%). The income of 30-50 million VND per month accounts for mainly (70%).

Table 1: Characteristics of Survey Subjects

	Frequency	%		Frequency	%
Gender			Income		
Male	295	80	<30	65	18
Female	75	20	30-40	132	36
Total	370	100	41-50	124	34
Ages			>50	49	13
<30	73	20	Total	370	100
31-45	203	55	Occupation		
46-55	60	16	Managers of domestic transport enterprises	200	54
>55	34	9	Managers of foreign transport enterprises	120	32
Total	370	100	Port authority officials	30	8
Education level			Seaport expert	20	6
Posgraduate	44	12	Total	370	100
Highschool	92	25	Marital status		
College & university	206	56	Single	135	37
Other	28	8	Married	235	64
Total	370	100	Total	370	100

b) Reliability Analysis

Table 2: Scale Reliability Test and Rejected Observed Variables

No.	Scale	Observed Variable are Excluded	Alpha Coefficients	Conclusion
1	SCON	None	0.859	Good quality
2	GEOL	None	0.809	Good quality
3	PFAC	None	0.867	Good quality
4	INFT	None	0.848	Good quality
5	PAUT	None	0.851	Good quality
6	PREP	None	0.843	Good quality
7	PCOM	None	0.844	Good quality

The results in Table 2 showed that: The observed variables all satisfy the conditions in the reliability analysis of the scale through an alpha coefficient > 0.6, and a variable-total correlation > 0.3 (Nunnally and Burnstein, 1994).

c) Exploratory Factor Analysis

Table 3: Pattern Matrix

	Component						
	1	2	3	4	5	6	7
INFT1	0.815						
INFT3	0.788						
INFT2	0.764						
INFT4	0.752						
PFAC2		0.878					
PFAC3		0.869					
PFAC1		0.858					
PFAC4		0.771					
SCON2			0.855				
SCON3			0.811				
SCON4			0.791				
SCON1			0.749				
PAUT3				0.860			
PAUT2				0.825			
PAUT1				0.818			
PAUT4				0.816			
PREP4					0.836		
PREP1					0.811		
PREP2					0.807		
PREP3					0.797		
GEOL4						0.791	
GEOL2						0.756	
GEOL1						0.742	
GEOL3						0.715	
PCOM1							0.886
PCOM2							0.878
PCOM3							0.856
Kaiser-Meyer-Olkin Measure						0.827	0.725
Bartlett's test						0.000	0.000
Eigen values						1.375	2.289
% of Extracted variance						69.773	76.285

Note: 0.5 < KMO < 1; Bartlett's test has a significance level less than 0.05; Factor Loading of observed variables (Factor Loading) > 0.5; extracted variance > 50%, and Eigenvalue > 1 (Hair et al., 2006).

Table 4 shows that the factors of PCOM are extracted into six factors corresponding to the measured variables of the theoretical model. The total variance extracted is 69.773% at an Eigenvalue of 1.375; EFA of PCOM is extracted into three observed variables with an extracted variance of 76.285% at an Eigenvalue of 2.289; and the Varimax rotation method used.

d) Confirmatory Factor Analysis

Confirmatory factor analysis aims to test the theoretical measurement model in accordance with practical data (Thompson, 2004).

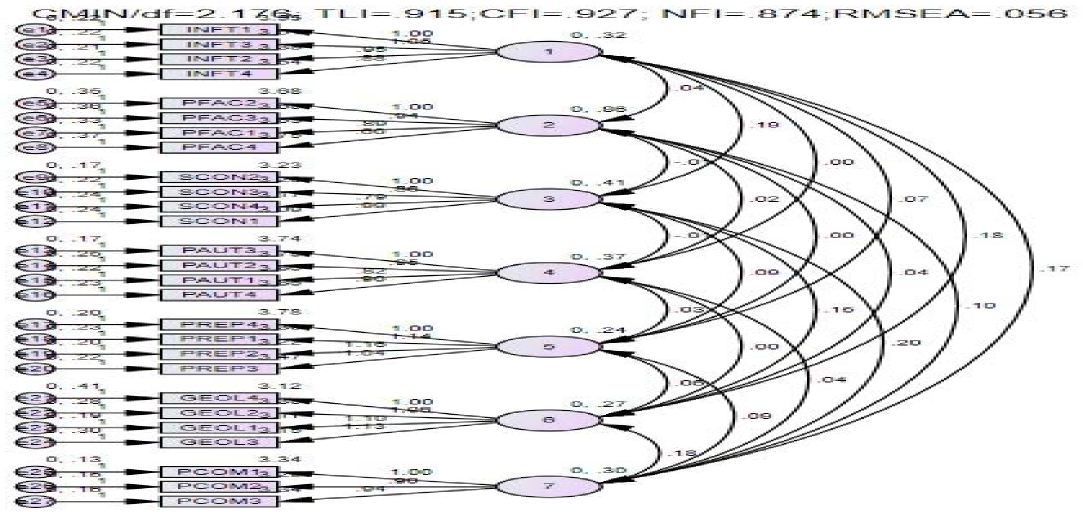

Figure 2: Confirmatory Factor Analysis

Table 4: The Fit Indices of the CFA

No.	Measures	Indicator Standard Values	Model Value	Results
1	Cmin/df	χ2/d.f. < 3 good fit; < 5 accepted; the smaller the better (Bentler and Bonett, 1980; Bagozii and Jy, 1988)	2.176	Good
2	TLI (Tucker-Lewis Index)	TLI: the closer it is to 1, the more appropriate; TLI > 0.90 is consistent; TLI ≥ 0.95 is in good ag reement (Hu and Bentler, 1995)	0.915	Good
3	CFI (Comparative Fit Index)	CFI > 0.90; 0 < CFI < 1, the closer to 1, the more suitable (Hu and Bentler, 1995).	0.927	Good
4	NFI (Normal Fit Index)	NFI, the closer it is to 1, the more suitable; NFI close to 0.90 is accepted; NFI > 0.95 is, a good fit (Chin and Todd, 1995; Hu & Bentler, 1995)	0.874	Accepted
5	RMSEA (Root Mean Square Error Approximation)	RMSEA < 0.05, the model fits well; RMSEA < 0.08, accepted; the smaller the better (Browne and Cudeck, 1993)	0.056	Good

Table 4 shows that the measurement model is consistent with the actual data.

e) Multivariate Linear Regression Analysis

The scales of the measurement model are converted to quantitative variables

Xi = Mean (observed variables of the scale)

Thus, the regression model of the study has the form:

PCOM = f(SCON,GEOL, INFT, PFAC, PAUT, PREP) *f) Regression Analysis Results*

Table 5: Coefficients

	Unstandardized Coefficients		Stand. Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	-0.002	0.238		-0.009	0.993	-0.470	0.465		
SCON	0.241	0.040	0.268	6.008	0.000	0.162	0.320	0.756	1.323
GEOL	0.297	0.042	0.326	7.090	0.000	0.215	0.380	0.716	1.397
PFAC	0.099	0.026	0.148	3.789	0.000	0.047	0.150	0.990	1.010
INFT	0.154	0.045	0.163	3.419	0.001	0.065	0.243	0.667	1.500
PAUT	0.083	0.036	0.089	2.296	0.022	0.012	0.155	0.995	1.005
PREP	0.113	0.040	0.117	2.870	0.004	0.036	0.191	0.915	1.092

Dependent Variable: PCOM

In Table 5, with the t-student test, the independent variables have a statistically significant correlation with the PCOM dependent variable with the significance level ≤ 0.05 (Green, 1991); Other tests include: adjusted R^2: 0.598, model interpretation level 59.8% (Hair *et al*., 2006); ANOVA: Sig. = 0.000, the regression model is suitable (Hair *et al*., 2006); VIF < 10, no collinearity; 1 < d = 2,069 < 3, no autocorrelation (Belsley *et* al., 1980). The study applied Park test to consider the stability of residual variance (Park, 1966).

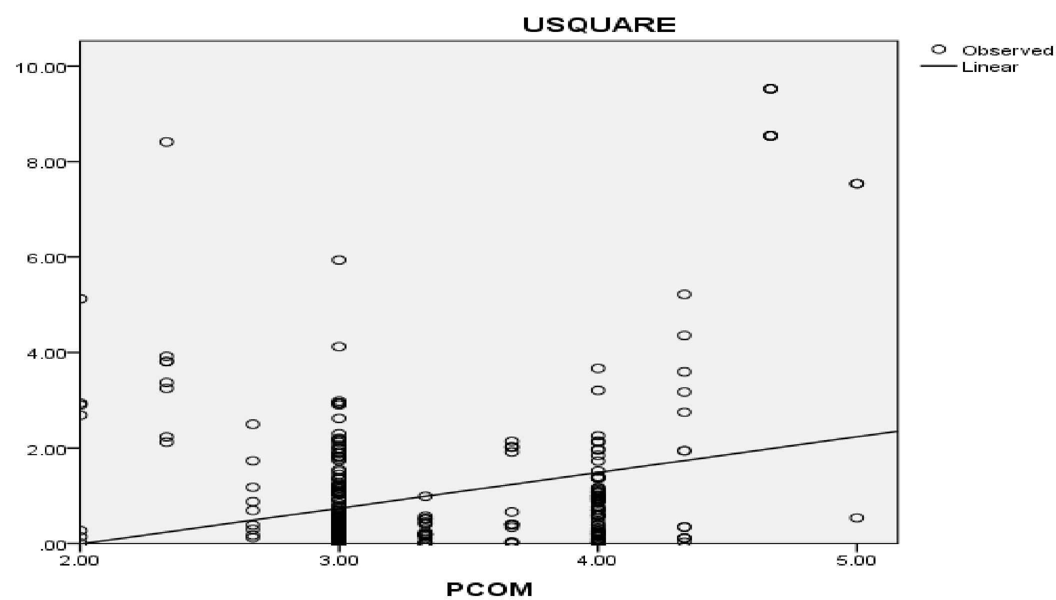

Figure 3: Park Test

In Figure 3, the correlation curve is linear, with constant residual variance.

Conclusion: Through 6 tests, factors affecting port competiveness: SCON, GEOL, PFAC, INFT, PAUT, and PREP'

Table 5: Hypothetical Results

Hypothesis	Impact			Beta	Sig.	%	Position	Decision
H1	PCOM	<---	SCON	0.268	0.000	24.1	2	Accepted
H2	PCOM	<---	GEOL	0.326	0.000	29.3	1	Accepted
H3	PCOM	<---	PFAC	0.148	0.000	13.3	4	Accepted
H4	PCOM	<---	INFT	0.163	0.001	14.7	3	Accepted
H5	PCOM	<---	PAUT	0.089	0.022	8.0	6	Accepted
H6	PCOM	<---	PREP	0.117	0.004	10.5	5	Accepted
	Total			1.111		100		

The results presented in Table 5 show that all hypotheses are accepted at a confidence level of over 95%. Based on the standardized regression coefficient, Beta (Norusis, 1993), factors affecting port competitiveness in order of influence: GEOL (Geographical location), SCON (Seaport connection), INFT (Information technology), PFAC (Seaport facilities), PREP (Port reputation), and PAUT (Port Authority).

g) Using BOOTSTRAP to Analyze the Reliability of LRM Results

Methods of CFA often require large samples (Anderson and Gerbing, 1988), whereas academic research is often limited in sample size. Bootstrap is a suitable alternative (Schumacker and Lomax, 2010). Bootstrap is an alternative, repeatable sampling method in which the original sample acts as a population. The Bootstrap method generates random samples from the original sample, which has numerous observations, often choosing 1,000 observations. The estimated results from N samples are averaged, and this value tends to be close to the estimate of the population. The smaller the difference between the average value of Bootstrap regression coefficients and the model estimate with the original sample, the more reliably the model estimates can be concluded.

Table 6: Bootstrap Implementation Results

Parameter			SE	SE-SE	Mean	Bias	SE-Bias	CR
PCOM	<---	PFAC	0.053	0.001	0.179	0.004	0.002	2.0
PCOM	<---	INFT	0.033	0.001	0.098	0.001	0.001	1.0
PCOM	<---	SCON	0.044	0.001	0.261	-0.001	0.001	-1.0
PCOM	<---	PAUT	0.051	0.001	0.099	0.001	0.002	0.5
PCOM	<---	PREP	0.063	0.001	0.152	-0.004	0.002	-2.0
PCOM	<---	GEOL	0.056	0.001	0.394	-0.002	0.002	-1.0

**CR (Critical Ratios) = (Bias)/(SE-Bias)*

The absolute value of CR is less than or equal to 2, so it can be said that the bias is very small, the difference is not statistically significant at the 95% confidence level (Hair *et al.,* 2006). Regression coefficient results before Bootstrap are reliable with a confidence level greater or equal to 95%.

Table 6 shows regression coefficient results before Bootstrap was reliable.

VI. Discussion and Policy Implications

Our study has identified 6 factors affecting "Competitiveness" and we sort them in descending significance order as follows: Geographic location; Seaport connectivity; Information technology; Seaport facilities; Port reputation; and Port Authorty. This result is consistent with previous research on the port industry in the Bay of Bengal by the Indian Ocean, Croatia by Tijan *et al.* (2022), Turkey by Baştuğ *et al.* (2022), China by Yi *et al.* (2021) and Poland by Pietrzak *et al.* (2020).

We add new observation variables to the research on seaport competitiveness, specifically "Port authorities are proactively involved in investment projects of highway terminals and barge terminals outside their port area"; "Port authorities build a port community information system to allow effective communication between companies, contributing to the coordination of the transport chain"; "The port we are using has very good relationships with famous ports in the world"; "The port we are always using emphasizes responsibility for the environment and attracting tourists to Ho Chi Minh City"; "Annual share growth of the port against the adjacent region/country"; "Dynamic changes of cooperation policies based on economic fluctuations around the world and increasing revenue."

To improve the competitiveness of Ho Chi Minh City Port, it is necessary to pay attention to 6 factors: Geographic location, Seaport connection, Information technology, Seaport facilities, Reputation and Port authority. In particular, geographical location has the strongest and most obvious impact on competitiveness. This is beyond the capacity of the Port Authority, but requires Government's involvement in developing the road network from seaports to import-export industrial parks, linked ports, and central transit centers. This is also a key factor for the development and capacity improvement of Ho Chi Minh City seaport.

VII. Conclusions and Research Limitations

The current study aims to extend the theoretical framework and to provide evidence in empirical results that 6 factors impact port competitiveness, illustrated by the case of Ho Chi Minh City.

The findings highlight the geographical location has the strongest and most significant impact on competitiveness. Hence, this study provides some insights into the current research about factors affecting competitiveness.

Besides its significant contributions, this study has some some limitations. First, the subjects were drawn from only one city in Vietnam, which limits the external validity of this study. Future study should apply similar methods to cases of other sea ports, and to make comparisons to enhance the power of the findings. Finally, this study focuses on the 6 factors. Future studies can examine the effect of other factors on port competitiveness in Vietnam.

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Appendix

Table A: Measurement Scale and Observed Variables

No.	Scales and Observed Variables	Code
I	**Geographical Location**	**GEOL**
1	The port is located near industrial parks and export processing zones	GEOL1
2	The port is located near central transshipment ports	GEOL2
3	The port is located near main transportation routes	GEOL3
4	The port is located close to other linked ports, including depots	GEOL4
II	**Information Technology**	**INFT**
5	IT at the port is well connected to ensure communication between the Port and customers and public agencies (Customs, port authorities, border guards, quarantine...), as well as other port users.	INFT1
6	The port has an integrated online payment system	INFT2
7	The port has a developed IT system to manage and operate the port, using software to plan and arrange the use of wharves, yards, equipment, human resources and manage all container loading and unloading work.	INFT3
8	The availability of electronic procedures allows for faster operations.	INFT4
III	**Seaport Facilities**	**PFAC**
9	Adequacy and safety of storage facilities (storage spaces, warehouses, liquid cargo tanks...) and container loading yards.	PFAC1
10	Appropriate draft and port depth	PFAC2
11	Docking station, wharf with complete and modern loading and unloading facilities	PFAC3
12	Internal and inter-regional transport infrastructure is well planned and neatly arranged	PFAC4
IV	**Port Authority**	**PAUT**
13	PAUT establishes infrastructure access rules that can improve the efficient use of infrastructure.	PAUT1
14	PAUT establishes infrastructure access rules that can improve the efficient use of infrastructure.	PAUT2
15	PAUT builds a port community information system to help exchange data between companies effectively, contributing to the coordination of the transportation chain.	PAUT3
16	PAUT is decided on the concession of port infrastructure exploitation	PAUT4
V	**Port Reputation**	**PREP**
17	The port we are using is very reputable for its reliability in the Asian market	PREP1
18	The port we are using has very good relationships with famous ports in the world	PREP2
19	The port we are using has good operating procedures and ensures labor safety	PREP3
20	The port we are using always emphasizes being responsible for the environment and attracting tourists to Ho Chi Minh City (The most famous city in Vietnam).	PREP4
VI	**Seaport Connection**	**SCON**
21	Goods/containers enter and exit the inland through the port.	SCON1
22	Ships of large size and tonnage often call at the port	SCON2
23	The number of shipping services (Including the number of transshipment and direct maritime shipments) has increased rapidly over the years	SCON3
24	Many destination ports are connected and the cost of transporting goods from the departure port to the destination port is reasonable	SCON4
VII	**Seaport Competitiveness**	**PCOM**
25	The volume of goods through the port increases every year	PCOM1
26	The port's market share compared to the adjacent area/the whole country accounts for a high proportion	PCOM2
27	The port's revenue increases rapidly every year	PCOM3