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Competitiveness in a Multipolar Port System: Striving for Regional Gateway Status in Northeast Asia

Authors

First Author:

Sihyun Kim, Lecturer in Gyeongsang National University, South Korea, Email: bud1111@nate.com (Former: Plymouth University)

Second Author:

Dalwon Kang, Guest Professor in Korea Maritime and Ocean University, Email: kangdw@kmou.ac.kr

Corresponding author:

John Dinwoodie, Professor in Plymouth University, United Kingdom, Email: jdinwoodie@plymouth.ac.uk

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Abstract

The determinants of competitiveness between hub ports in the multipolar Northeast Asian system will decide which achieve regional gateway status. A survey instrument to assess 21 pertinent measurement items generated 203 responses from Shanghai, Hong Kong and Busan. Exploratory factor analysis revealed a valid and reliable competitiveness construct underpinning 19 measurement scales and a four-factor model incorporating availability, operational efficiency, port costs and service quality. Differences in factor importance revealed that success as a regional gateway port depends on whether port areas develop strategically into multi-functional business centres. The model offers a management tool to guide future port improvement.

Keywords: Port competitiveness, regional gateway port, hub-and-spoke networks, multipolar port system, factor analysis, Northeast Asia.

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I. Introduction

Intense regional port competition in Northeast Asia (NEA) has focused interest on the concept of port competitiveness (Yeo et al., 2008) and the determinants of competitiveness (Yeo *et al*., 2011; Tongzon, 2009; Yeo *et al*., 2008; Yeo and Song, 2006). This interest arises because shipping lines' perceptions of the competitiveness and attractiveness of commercial port operations determine the operational sustainability of ports (Yeo *et al*., 2011; Cheon and Deakin, 2010).

Research on port competitiveness has typically focused on identifying key factors that influence competitiveness (Yeo *et al*., 2011, 2008; Tongzon; 2009; de Langen, 2007; Murphy *et al*., 1992, 1989), strategic development such as supply chain management, intermodal links, and hinterland development (van den Berg and de Langen, 2011; Wiegmans *et al*., 2008; de Langen, 2007; Haezendonck and Notteboom, 2002) and regional container port competition (Yeo *et al*. 2011; Wang and Cheng, 2010; Yap *et al.*, 2006; Hsu and Hsieh 2005).

To date, prior work on port competitiveness has not identified definitively which factors influence the competitive position of ports striving for regional gateway status amongst hub ports. Research in NEA has highlighted issues which influence either port competitiveness or regional gateway status, but not both, overlooking differences in the nature of competition. This study proposes research to link these issues in NEA's multipolar port system (Figure 1) by investigating the determinants of competitiveness between hub ports vying for regional gateway status in NEA, using an empirically-based instrument. In the remainder of the paper, Section 2 reviews the competitive port environment in NEA and the generic determinants of port competitiveness and regional gateway status. Section 3 discusses the research design and data collection processes which, to enhance the external validity of findings, targeted contenders for regional gateway port status. Data analysis and results are presented in section 4 before considering their conceptual and substantive implications, and suggestions for future research.

II. Literature Review

2.1 Competition between hub ports seeking regional gateway status in Northeast Asia

The major container ports in NEA have experienced an unprecedented boom in container shipping along with ever-intensified port competition (Yeo *et al*., 2008; Wang and Cheng, 2010; Yap *et al.*, 2006). As a consequence of deployment of mega container ships, regional gateway port status comprises a significant component of the local economy and economic cooperation with its surrounding areas (Imai *et al*., 2013; Gelareh *et al.*, 2010; Low *et al*., 2009), which integrates production and distribution systems (Yeo *et al*., 2011; Hall, 2007). The major ports in NEA, therefore, aspire to achieve regional gateway status, to broaden their sphere of influence from that of a sea-shore interface to a comprehensive port which boosts global or major regional trade and the local economy (Wang and Cheng, 2010; Low *et al*., 2009).

Figure 1 Port competition structure in Northeast Asia (Source: Author)

Figure 1 depicts competition between hub ports vying to become the central point for regional trade in the economy of NEA, holding regional gateway port status. In terms of their calling patterns in NEA in recent years, shipping lines typically concentrated sequentially on the main trunk route to transhipment ports in NEA: Hong-Kong, Kaohsiung, Busan, Yokohama, Tokyo and Seattle (Yap *et al*., 2006). At that time, transhipment cargo on mainline and feeder services was a crucial issue for the major ports seeking to revitalise their economy and to avoid underutilisation of port facilities (Midoro *et al*., 2005), creating competition between ports vying to become a regional gateway, focused on transhipment markets (Yeo *et al*., 2011; Wang and Cheng, 2010; Low *et al*., 2009). However, the deployment of mega container ships and the proliferation of direct calls by mother ships, has transformed calling patterns, creating new direct shipping networks. For example, reducing costs and enormous local container volumes induced direct calls to Chinese ports, the so-called 'China effect' (Yap *et al*., 2006). Hsu and Hsieh (2005) explained these phenomena in Northeast Asia using objective comparisons between hub-and-spoke and direct shipping, revealing that when cargo volumes increase with the growth of global trade, direct shipping has an advantage over container shipping involving transhipment by feedering. This arises because in a traditional hub-and-spoke system, inventory costs, waiting time and shipping time costs exceed shipping costs comprised of capital, operating and fuel costs and port charges (Stopford, 2009). In a direct call system the opposite attains (Hsu and Hsieh, 2005).

The changes in the calling patterns resulted in the emergence of a multipolar port system with conventional hub-and-spoke networks in NEA (Wang and Cheng, 2010). Haralambides (2011) pointed out that an emerging multipolar port system reflects global port development, growing intra-regional trade, amplification of inland transport and logistics infrastructure, and intensified competition in shipping markets. In such systems, the needs increase for a regional port-centric logistics hub to function as a regional transport hub and distribution centre for global and regional trade. Moreover, differing from other economic regions such as the EU and North America, the high dependence on intra-regional trade of this economic region was reported by

UNCTAD (2013). Due to growth of intra-industry trade in this region, intra-regional trade has increased from 23.6 % in 2002 to 32.8 % in 2009 recording approximately 44,050,000 TEU, indicating high dependence on intra-regional trade in seaborne trade, compared to other regions including Europe (5.2%) and North America (1.0%). These phenomena highlighted requirements to develop ports into multi-functional business centres as a central point for global and regional trade and the local economy (Wang and Cheng 2010; Low *et al*., 2009), and stimulated more sophisticated port competition featuring new types of regional port competition between hub ports vying for regional gateway status in NEA (Figure 1). This paper aims to clarify constructs which determine the competitiveness of hub ports seeking regional gateway status to function as the central point in a regional economy. Prior research highlighted Shanghai, Hong Kong and Busan as the main contenders for regional gateway port status in the multipolar port system in NEA (Low et al., 2009). In the next section, some determinants of port competitiveness are reviewed.

2.2 Determinants of competitiveness required to become a regional gateway port

Port competition relating to multiple-hub ports evolved from conventional hub-and-spoke systems, but also implies a more sophisticated competition structure involved in striving to become a central point in global or regional trade. Reviews span the determinants of port competitiveness as a regional gateway, prior studies on general port competitiveness to become a hub, and also to achieve regional gateway status.

2.2.1 Port competitiveness

Prior literature offers useful insights into port competitiveness in different contexts and how key factors which determine port competitiveness have changed over time. In early work to identify key factors which determine port competitiveness, physical attributes including port facilities, port rates and charges, and port location were the basic factors in port selection and competitiveness (e.g. Murphy *et al*. 1989). Literature from the 1990s (e.g. Tongzon, 1994; Murphy *et al*., 1992) reveals a gradual change in the relative weights of the determinants of port choice, and featured more evaluation criteria such as work practices within a port, traffic volume, productivity and terminal efficiency. Besides, port productivity played an important role in enhancing port performance and port competitiveness. Since 2000, with the growth of international trade and liberalisation of transport markets, the scale and the scope of a port have prominently increased. Pre-2000, academic work favoured a resource-based view to evaluate port competitiveness, based on port physical attributes such as facilities and location, whereas, after 2000, literature on port competitiveness placed great emphasis on activity-based and demand-based views for analysing port competitiveness (van den Berg and de Langen, 2011; Cho *et* *al*., 2010; Tongzon, 2009; Yeo *et al*., 2008; de Langen, 2007; Hall 2007; Notteboom and Rodrigue, 2005; Yeo and Song, 2006). At this stage, business stability and sustainability became important issues indicating how well the industry was adapting to an ever-changing environment. Furthermore, with the growing scale of ports, the role of port hinterland has transformed into a strategic base from which logistics activities perform various services, and become a critical component to link elements of the supply chain more effectively (Notteboom and Rodrigue, 2005). With the change of port environments, service quality and hinterland condition, landside accessibility, strategic differentiation, port (terminal) operational efficiency level, reliability, cargo handling charges, and port selection preference of carriers and shippers have become the major factors that influence port competitiveness (Ahn *et al.*, 2014; Yeo *et al.*, 2011, 2008; Yeo, 2010; Li and Oh, 2010; Cho *et al*., 2010; Tongzon, 2009; Notteboom and Rodrigue, 2008). Reviews indicate that attention has shifted to considering how to create and sustain port competitiveness whilst accommodating customers' expectations.

2.2.2 Port operations required to become a regional gateway

A regional gateway port in a hub-and-spoke network is considered as a significant component of the local economy and economic cooperation with its surrounding areas can integrate the overall production and distribution systems (Low *et al*., 2009; Hall, 2007). In order to become a regional gateway port, ports in NEA aspire to broaden their sphere of influence from a sea-shore interface to a comprehensive port which boosts global or major regional trade and the local economy (Wang and Cheng 2010). Just as the economies of scale of mega-container ship operations are influenced by technical and economic feasibility, so critical issues on regional gateway port operations are closely connected with: physical capacities including water depth, berths and approach channels (Sys *et al*., 2008); economic conditions such as sustainable cargo creation based on the local economy (Ishii *et al*., 2013; Notteboom and Rodrigue, 2008) and attractiveness to shipping lines in mainline and feeder markets (Yeo *et al*., 2011).

As revealed by Low *et al*. (2009), scale economies and port efficiency is the most important dimension in determining a port's success as a regional gateway port in NEA. Prior studies on mega port operations aimed to identify economies of scale in port operations from both a concentration of container traffic and port efficiency. In terms of port location, geographic location plays a significant role in determining a regional gateway port. The ports located on the main trunk route have a priority in terms of intermediacy which affects connectivity. Moreover, a regional gateway port must have a centricity determined by economic size such as a market niche and hinterland conditions (van den Berg and de Langen, 2011; Wang and Cheng, 2010), because Chinese ports occupied a high position in world port rankings. Superior centricity and intermediacy lead to more calls at the port and benefits for intermodal transport, utilisation of service facilities related to port and cargo consolidation and related services which benefit from economies of scale.

Regarding port operations, any delay at the port or the terminal has negative economic and financial implications (Imai *et al*., 2013). Efficient port operation is one important factor for accommodating mega-container ships. For example, efficient and speedy handling at the terminal directly influences the transit time and operational costs of mega ships (Stopford, 2009). Therefore, economies of scale for mega-container ships are highly dependent on terminal efficiency. Then again, Imai *et al*. (2013) indicated that handling efficiency of mega ships is evaluated by handling time while other ships' efficiency is determined by handling time plus waiting time (service time). They argued that an efficient ship handling service in a port is particularly important to avoid the complexities of berthing small ships in terms of total service time because a mega ship has a priority at the berth.

With respect to the roles and responsibility of a regional gateway port, with enlargement of the scale and scope of a port, a regional gateway port contributes to global or major regional trade and the local economy. Therefore, a regional gateway port, as an economic catalyst to revenue and employment (Ducruet and Lugo, 2013; Wang and Cheng, 2010) and with a central position serving industries related to international trade (Notteboom and Rodrigue, 2008), is required to perform as a multifunctional business centre which can produce added-value and growth in its host city (Wang and Cheng, 2010). As a result, in order to be a regional gateway, the major ports in NEA need to promote a balance between valuable land, labour and technology, as well as to ensure harmony between growth and the environment (Hall, 2007), as economic stability and social responsibility shed a new light on port operations literature (Dinwoodie *et al*., 2012; Cheon and Deakin, 2010).

2.2.3 Determinants of port competitiveness required to become a regional gateway

Literature reviews identified that port competitiveness is determined by considering diverse factors including port availability, economic size, efficiency, productivity, cost factors (e.g. total transport costs per container and inland logistics costs), soft factors such as reliability, service differentiation, and professional and workforce development, and supportive factors including market niche, incentives and IT application (Imai *et al*., 2013; Yeo *et al*., 2011, 2008, Wang and Cheng, 2010; Tongzon, 2009; Notteboom and Rodrigue, 2008; Yap *et al*., 2006). As suggested by Yeo *et al*. (2008), after eliminating overlapping and interrelated elements, this study carefully selected components of port competitiveness. Finally, twenty one measurement items were extracted (Table 1).

Table 1 Selected components of port competitiveness (Source: Author)

III. Research Method

3.1 Overview of research design

This paper aims to investigate the structure of port competitiveness analysing multi-measurement items, based on hub ports striving to be a regional gateway in new hub-and-spoke networks in NEA. A questionnaire survey examined 21 multi-measurement items in container port operations derived from the available literature using items, each anchored by five-point Likert scales (1– strongly disagree to 5– strongly agree). Exploratory factor analysis (EFA) using SPSS 21 was deployed to identify the sub-dimensions of port competitiveness and eliminate potentially superfluous items and based on the results, target ports were compared. To enhance the external validity of findings, after translating the questionnaire into three different versions (Chinese including Mandarin and Cantonese, Korean) questionnaires were distributed to the major container ports in NEA: Shanghai (1st), Hong Kong (3rd) and Busan (5th), each vying for regional gateway status (Low *et al*., 2009).

3.2 Data collection

Prior to collecting data in 2013 a pilot survey was conducted by email. Thirty respondents included a group of researchers and experts who were selected as practitioners working in a container port. Based on pre-tests, a revised questionnaire was compiled. In total 2000 questionnaires were distributed to port stakeholders in the container ports of Shanghai, Hong-Kong and Busan; 104 were returned as non-deliverable. Two weeks after an initial mailing a cover letter was despatched along with reminder emails to all potential respondents, ahead of a final email, two weeks later. The final response of 203 gave an effective response rate of 10.7% (203/1896). Table 2 presents the general characteristics of the sample collected which is representative of all stakeholder groups. Seven types of organisation are represented in a diverse range of organisational sizes. Almost half of the organisations represented had existed for over two decades, and over 80% of respondents had worked for their organisation for over 10 years. Most respondents (82.8%) were in senior and middle groups entitled vice president or above, board member, director, manager of department, section chief, operational supervisor, although more junior levels representing operational staff were also represented.

Table 2 Sample demographics

3.3 Assessing non-response bias and common method bias

To assess non-response bias widely accepted extrapolation methods were used whereby late respondents are hypothesized to behave similarly to non-respondents. Comparison between the central tendency of the responses of the first and fourth quartiles of respondents revealed no significant difference at the 0.05 level on t-tests for key factors (Wanger and Kemmerling, 2010). In addition, to assess common method bias at the level of measurement item, Harman's single factor test in SPSS (Podsakoff *et al*., 2003) revealed that no single factor accounted for the majority of the covariance in EFA. Based on these results, non-response bias and common method bias is not expected to inhibit analysis (Wanger and Kemmerling, 2010; Podsakoff *et al*., 2003).

IV. Data Analysis and Results

4.1 Results of factor analysis

EFA using SPSS 21 determines how clearly and to what extent an observed variable links to the underlying factors, and eliminates potentially superfluous items. To extract the minimum number of factors which account for co-variation amongst observed variables, principle components analysis with Varimax rotation was adopted because it assumes independence between factors and maximises the sum of the variances of squared loadings. The criteria used for selecting measurement items were eigen-value (>1.0) and factor loading (>0.50) (Hair *et al*., 2010). Twenty one items for competitiveness were assessed and EFA grouped the scale of items of competitiveness into four dimensions (Table 3). Each measurement item recorded factor loadings >0.50, but two items (COM 14, cargo handling charges and COM 21, service differentiation) were eliminated due to low communality <0.50 (Hair *et al*., 2010), to enhance the reliability and validity of items. Factor loadings for the 19 purified items between 0.682 and 0.825, and communality values >0.50, exceeded acceptable standards (Hair *et al*., 2010) implying that factor analysis is reliable with variables well represented by the extracted factors. A Kaiser-Meyer-Olkin's measure of sampling adequacy (85.7%) indicates that observed variables link closely to their underlying facts. The four competitiveness factors extracted explain 64.5% of the inherent variation in their items. Finally Cronbach's α >0.70 for all extracted factors indicates constructs which are internally consistent and valid (Hair *et al*., 2010).

Table 3 Results of exploratory factor analysis (Source: Author)

Based on EFA 19 measurement items incorporating hard, soft and supportive factors were grouped into four sub-dimensions. Taking into account prior work (Tongzon, 2009; Yeo *et al*., 2008), the determinants of port competitiveness required to become a regional gateway in NEA were developed (see Figure 2), using labels of ‘*availability*’, ‘*operational efficiency*’, ‘*port costs*’, and ‘*service quality*’.

Availability: a regional gateway port is considered a significant component of the local economy and economic cooperation with its surrounding areas (Imai *et al*., 2013). Port availability as an international logistics hub incorporates physical and functional availability such as port facilities, hinterland development and economic size (Yeo *et al*., 2011, 2008; Low *et al*., 2009; Tongzon, 2009). Therefore, a regional gateway port must have competitive capacities not only to accommodate mega-container ships, but also to perform expanded port functions as a comprehensive logistics centre which boosts global or major regional trade and the local economy, which strengthens hub status (Ducruet and Lugo, 2013; Gelareh *et al*., 2010; Wang and Cheng, 2010). The components of port availability include local cargo volume (PA1), port infrastructure and facilities utilisation (PA2), market niche (PA3), preference of shipping liners (PA4), and port physical capacity (PA5).

Operational efficiency: Operational efficiency in port operations is required to be a logistics hub (Low *et al*., 2009). A higher level of efficiency attracts more port users as the importance of faster turnaround time within the port is critical for hub port operations in NEA (Imai *et al*., 2013; Yeo *et al*, 2011, 2008). Besides, the efficiency of inland transport and hinterland connection has become critical in a port’s potential future competitiveness (Notteboom and Rodrigue, 2008). The world’s mega container ports (i.e. Shanghai, Hong Kong, and Busan) already view this as a key factor to support their long-term vision (Yeo and Song, 2006). The elements for operational efficiency include terminal productivity (OE1), hinterland development (OE2), simplification of procedures (OE3), cargo handling speed (OE4), and supply chain cooperation (OE5).

Port costs: Lower port charges whilst holding other factors constant lead to a more competitive position (Ishii, 2013; Yeo *et al*., 2011; Tongzon, 2009; Murphy *et al*., 1989; Slack, 1985). Lower costs achieve a higher level of port competitiveness (Yeo *et al*., 2011). Commonly, port costs including transport costs per container (PC1), port charges (PC3), and port service costs (PC4) are a significant factor for evaluating port competitiveness. Further, trans-shipment cost (PC2) is a critical element of the cost factor in managing mega port competitiveness because mega-container ships imply transhipment markets with a feeder-and-hub relationship (Imai *et al*., 2013).

Service quality: Ports must meet port users' needs or expectations. Service quality presents the overall quality of service provided to users in a port area (Tongzon, 1994), and good service quality increases the reputation of the port and reliability of its services, thereby strengthening a port's competitiveness (Yeo *et al*., 2011; Cho *et al*., 2010). Further, port service quality positively affects customer satisfaction, loyalty, and referral intentions (Cho *et al*., 2010). Reliability of service performance (SQ1), shipment safety and security (SQ2), application of IT and EDI in operations (SQ3), quick response to port user's needs (SQ4) and low congestion in a port (SQ5) are categorised into the construct of service quality in managing port competitiveness as a regional gateway.

Figure 2 Structure of port competitiveness among hub ports (Source: Author)

4.2 Comparison among the target ports

The significance of the relative importance of each dimension is presented in relation to the overall competitiveness of target ports, based on the results of EFA in a two-step process. Firstly, to reflect the relative importance of sub-dimensions, the value of variance explained (%) was employed to assess the average absolute value of each factor (x_i) (formula 1).

1st step: $x_i = \frac{\%\ of\ Variance}{Total\ varience\ explained} * m\ (Mean\ values\ of\ each\ dimension)$ ------------- (Formula 1)

Thereafter, to calculate the overall competitiveness of each port, these were summed over all ports. The set of average absolute values was used to evaluate overall competitiveness (see Formula 2). Table 4 presents the results of the evaluation of competitiveness amongst the target ports.

2nd step: $\sum_{i=1}^{n} x = x_1 + x_2 \ldots + x_n = Overall\ port\ competitiveness$ ---------------------- (Formula 2)

Comparisons of the mean value of each dimension show that Shanghai has the highest value in availability (4.3), followed by efficiency (3.5), costs (3.5), and service quality (2.7). Hong Kong shows the highest value in efficiency (4.1) and service quality (4.2). In addition, Busan shows comparatively well distributed values in all dimensions (Model 1). Firstly we calculated overall competitiveness without considering the relative importance of each dimension. The results showed that Shanghai takes first place followed consecutively by Busan (2nd) and Hong Kong (3rd). However, by considering the relative importance of each dimension, the ranking in comparison was different between Busan and Hong Kong (Model 2). Results indicate that the ranking of competitiveness with multiple-determinants can reflect the relative importance of each dimension.

Table 4 Comparison amongst the target ports (Source: Author)

V. Implications and Conclusions

This paper proposed a new model of port competitiveness and evaluated hub ports seeking to achieve regional gateway status in NEA. Findings have both conceptual and substantive implications, because the critical factors identified differ from other studies (i.e. Tongzon, 2009; Yeo *et al*., 2008) and offer new knowledge about port competitiveness in a multipolar port system.

5.1 Implications

Conceptually, the four factor model advances understanding of the structure of port competitiveness relating to competition between hub ports. Although the determinants of port competitiveness are familiar (Imai *et al*., 2013; Tongzon, 2009; Yeo *et al*., 2008), the four factor model invites future testing in the context of competition between hub ports striving for regional gateway status, and differences in the relative importance of factors which influence port competitiveness and improvement strategies. For example, physical and functional aspects of port availability explained more model variance than operational aspects such as operational efficiency, port costs and service quality, implying that enhancement of a port's competitive position as a regional gateway depends most importantly on port availability. A focus on ports which are strong contenders for achieving regional gateway status in NEA enhances the external validity of findings, and could assist understanding of ports competing for regional gateway status in sophisticated hub-and-spoke networks worldwide. Moreover, because the determinants presented were assessed by various practitioners, empirical findings that port competitiveness for example depends on factors including hard, soft and supportive factors (Table 1) spanning port availability, operational efficiency, port costs, and service quality will assist future studies. As the first study of hub ports competing for regional gateway status in a multipolar port system, this work will also guide strategic management in relevant contexts.

New knowledge is offered for port operators seeking to develop strategies to achieve regional gateway status (i.e. Tongzon, 2009; Yeo *et al*., 2008). Findings that physical and functional aspects of port availability significantly determine port competitiveness as a regional gateway imply future strategic development of the port area into a multi-functional business centre, by securing appropriate physical capacities to accommodate increased ship sizes. Ports need to secure and improve appropriate physical capacities to be a central point for regional trade; intermediacy and connectivity to the import and export areas, market, and host city; diversification of infrastructure in and around the port area; and centricity based on local cargo volumes and an attractive business environment in and around a port which improves a port's functional availability to invite shipping lines and industry. By not restricting port activities to cargo handling or related services, ports can maintain stable and flexible functions. Services and facilities to improve a port's availability as a central position for industries related to international trade might include a convention centre, financial complex or arbitration centre (Notteboom and Rodrigue, 2008). Superior functional availability as a central point of international shipping and trade can enhance port competitiveness, particularly where intra-regional trade is high. To improve port competitiveness as a regional gateway, strategies for future port development must supplement roles as a comprehensive logistics hub with plans to offer an attractive business environment for shipping lines and related industries.

5.2 Limitations and suggestions for future research

Because of resource limitations the list of determinants of port competitiveness investigated here is not exhaustive, and other variables such as corporate strategy invite further work. In an operational context, strategies for operations and development may influence future port competitiveness. Given the emphasis in strategic operations and operations management on developing a firm's competence in understanding customer needs and how to satisfy them (Ling, 2000), research might investigate additional factors to accommodate customers' expectations and strategic issues including opportunities for sustainable growth. Further studies are required to empirically verify the unique port competitive situation in NEA, to test the structure of the model of competitiveness presented here, and to test findings using surveys of port competition in other regions. Further interesting work might consider the performance of port operations, and impacts of the determinants of port competitiveness which underpin operational management.

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Supplementary Data

Table 1 Selected components of port competitiveness

Code*	Elements	Reference
COM1	Local cargo volume (economic size)	Imai *et al*., 2013; Yeo *et al*., 2011, 2008; Notteboom and Rodrigue, 2008
COM2	Port facilities utilisation (business infrastructure)	Yeo *et al*., 2011, 2008; Tongzon, 2009; De Langen, 2007;
COM3	Proximity (to the import/export area, market and host city)	Ducruet and Lugo, 2013; Van den Berg and de Langen, 2011; de Langen, 2007
COM4	Preference of shipping liners and the relevant industries	Ducruet and Lugo, 2013; Yeo *et al*., 2008; Low *et al*., 2009
COM5	Port physical capacity	Yeo *et al*., 2011, 2008; De Langen, 2007; Murphy *et al*., 1992, 1989
COM6	Hinterland development	Van den Berg and de Langen, 2011; Yeo *et al*., 2008; de Langen, 2007
COM7	Terminal productivity	Tongzon, 2009; Low *et al*., 2009
COM8	Cargo handling speed	Imai *et al*., 2013; Yeo *et al*., 2008; Stopord, 2009
COM9	Supply chain cooperation	Cheon and Deakin, 2010; Low *et al*., 2009
COM10	Simplification of procedure	Tongzon, 2009
COM11	Total transport costs per container	Ishii, 2013; Tongzon, 2009; Yeo *et al*., 2008
COM12	Trans-shipment costs	Imai *et al*., 2013
COM13	Port charges	Ishii, 2013; Tongzon, 2009; Murphy *et al*., 1989
COM14	Cargo handling charges	Yeo *et al*., 2011, 2008; Murphy *et al*., 1992, 1989
COM15	Port service costs	Yeo *et al*., 2011, 2008; Tongzon, 2009; Murphy *et al*., 1992
COM16	Reliability of service performance	Cho et al., 2010; Tongzon, 2009
COM17	Safety and security	Hall, 2007; Cho *et al*., 2010
COM18	Application of IT	Yeo *et al*., 2011, 2008
COM19	Quick response to port user's needs	Tongzon, 2009; Cho *et al*., 2010
COM20	Low congestion in a port	Imai *et al*., 2013; Yeo *et al*., 2008
COM21	Service differentiation	Tongzon, 2009; Cho *et al*., 2010

Source: Tabulated by Author *COM: competitiveness

Table 2 Sample demographics

Variable	Frequency	Percentage (%)
Organisation Type		
Port Authority	36	17.8
Terminal Operator	48	23.6
Shipping line	23	11.3
Inland Shipper	27	13.3
Forwarder/Cargo Owner	26	12.8
National/Local Government	26	12.8
Local Community/Researcher	17	8.4
Firm's Age		
Less than 5 years	9	4.4
5-10	46	22.7
11-20	51	25.1
Over 20 years	97	47.8
Number of Employees		
Less than 50	46	22.6
50- 100	28	13.8
101-200	30	14.8
201-300	49	24.2
More than 300	50	24.6
Working Experience		
Less than 5 Years	16	7.8
5-10	18	8.9
11-20	124	61.0
Over 20	45	22.3
Job Position		
Senior	106	52.3
Middle	62	30.5
Junior	35	17.2

(Source: author)

Table 3 Results of exploratory factor analysis (Source: Author)

Items*	Factor Analysis				
	PA	OE	PC	SQ	Cronbach's α
COM1	.815				
COM2	.809				
COM3	.800				.861
COM4	.726				
COM5	.710				
COM6		.825			
COM7		.815			
COM8		.812			.854
COM9		.724			
COM10		.699			
COM11			.797		
COM12			.785		
COM13			.742		.785
COM14			.690		
COM15				.794	
COM16				.791	
COM17				.777	.862
COM18				.746	
COM19				.682	
Eigen-value	6.073	2.402	2.207	1.705	
% of Variance	31.962	12.641	10.904	8.971	Total: 64.478

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.857

* COM: competitiveness; PA: port availability; OE: operational efficiency; PC: port costs; SQ: service quality.

Table 4 Comparison amongst the target ports (Source: Author)

	Model 1*			Model 2**		
	Shanghai	Hong Kong	Busan	Shanghai	Hong Kong	Busan
Availability	4.3	3.5	3.1	2.132	1.586	1.487
Operational efficiency	3.5	4.1	3.6	0.686	0.804	0.706
Port costs	3.5	1.8	3.1	0.592	0.304	0.524
Service quality	2.7	4.2	3.6	0.376	0.584	0.501
Overall competitiveness	3.50(1)	3.325(3)	3.350(2)	3.785 (1)	3.279 (2)	3.218 (3)

*: The mean value of each dimension;
**: The average absolute value of each dimension reflecting the relative importance; and ( ) = ranking.

Figure 1

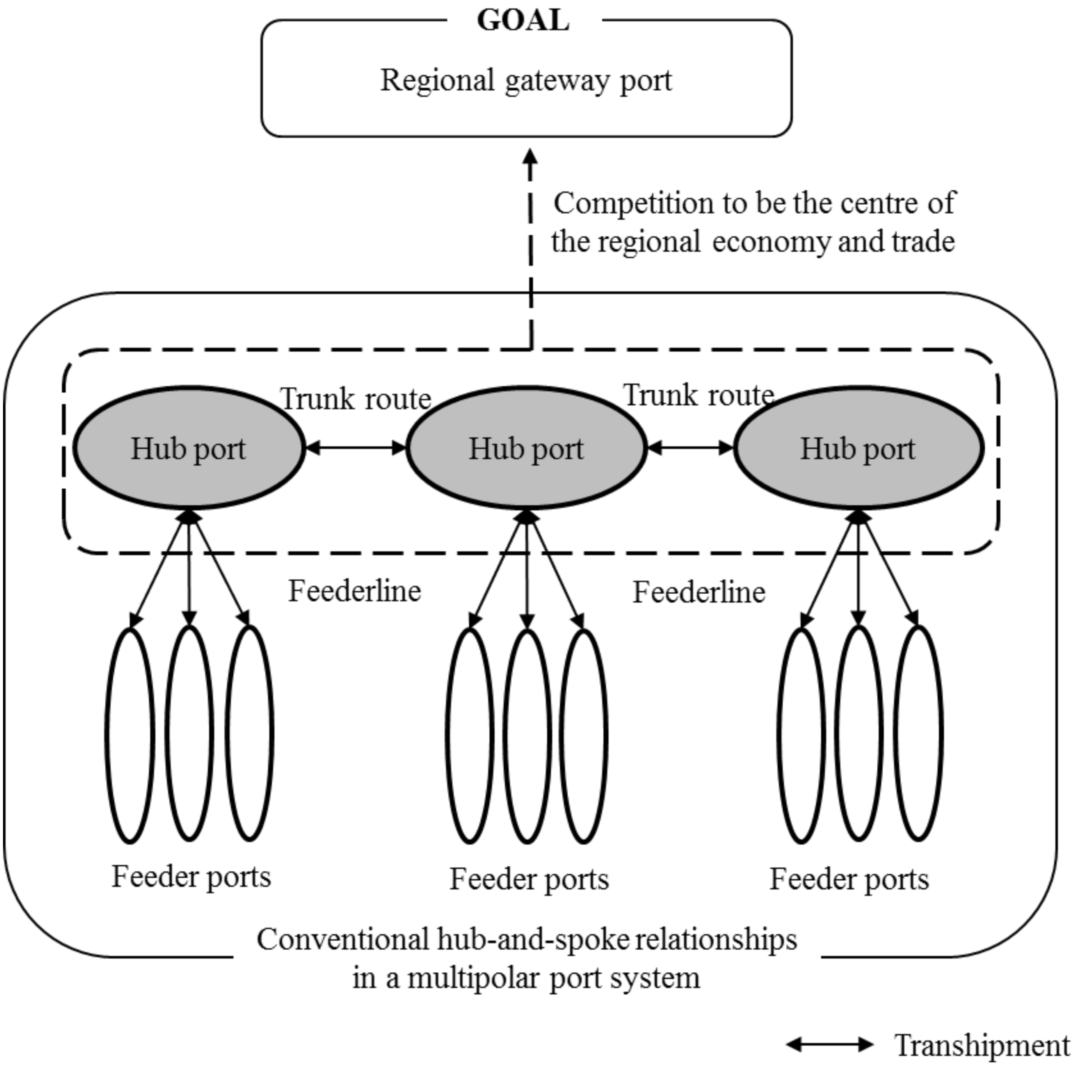
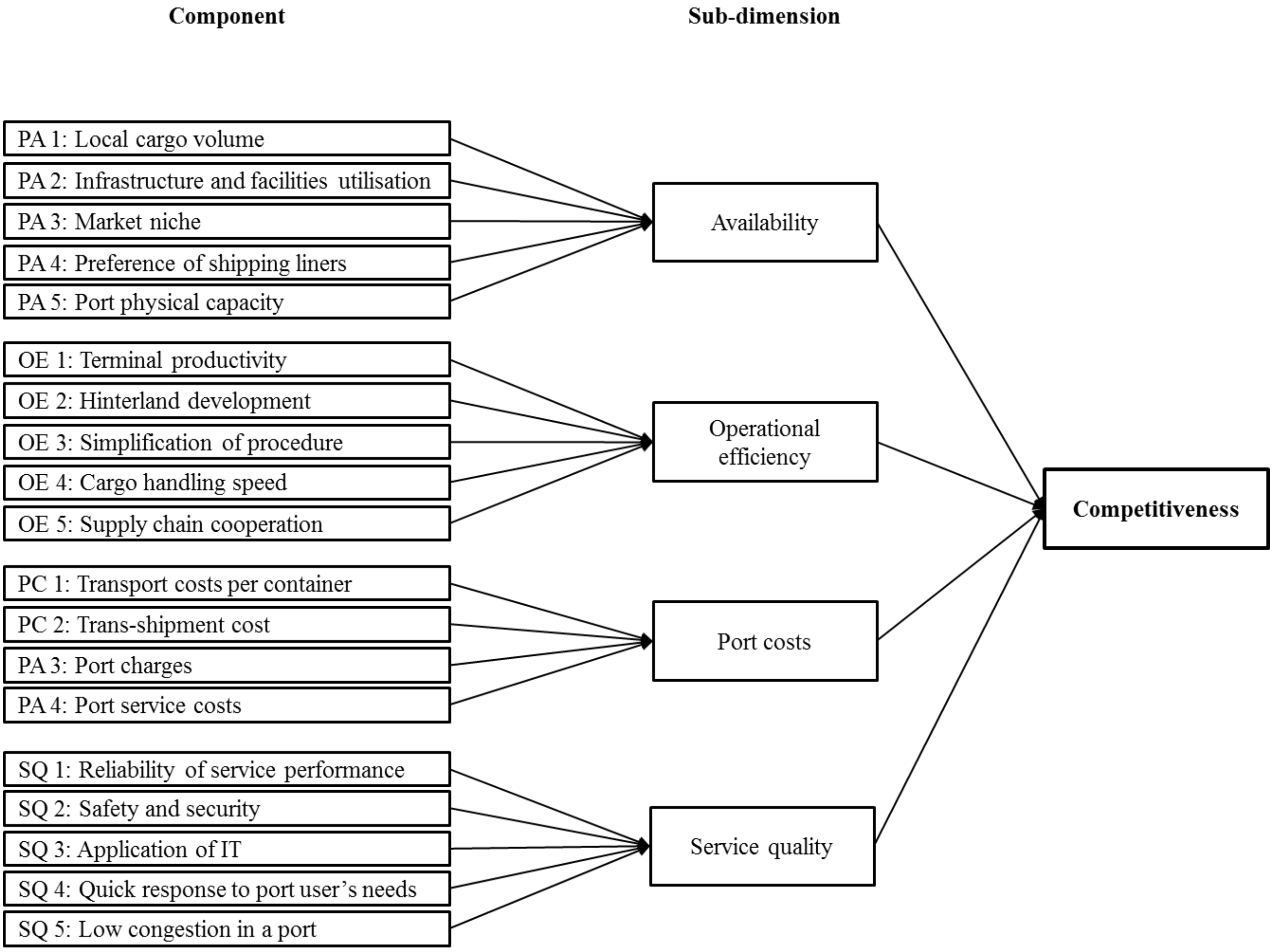

GOAL
Regional gateway port
Competition to be the centre of the regional economy and trade
Trunk route
Trunk route
Hub port
Hub port
Hub port
Feederline
Feederline
Feeder ports
Feeder ports
Feeder ports
Conventional hub-and-spoke relationships in a multipolar port system
Transhipment

Figure 2


Component
Sub-dimension
PA 1: Local cargo volume
PA 2: Infrastructure and facilities utilisation
PA 3: Market niche
PA 4: Preference of shipping liners
PA 5: Port physical capacity
OE 1: Terminal productivity
OE 2: Hinterland development
OE 3: Simplification of procedure
OE 4: Cargo handling speed
OE 5: Supply chain cooperation
PC 1: Transport costs per container
PC 2: Trans-shipment cost
PA 3: Port charges
PA 4: Port service costs
SQ 1: Reliability of service performance
SQ 2: Safety and security
SQ 3: Application of IT
SQ 4: Quick response to port user's needs
SQ 5: Low congestion in a port
Availability
Operational efficiency
Port costs
Service quality
Competitiveness