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## An Analysis of Port Service Quality and Customer Satisfaction: The Case of Korean Container Ports

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### ABSTRACT

Ports play a critical role in the economy of many countries and regions. Failure or unreliability of port services can significantly influence port customers—shipping lines and cargo owners—and result in their dissatisfaction. However, what constitutes port service quality (PSQ) and its influence on the satisfaction of port customers has not been well investigated in the literature. Therefore, this study investigates the concept of PSQ and its influence on customer satisfaction in the case of Korean container ports. Following a literature review, a conceptual model of PSQ and its influence on customer satisfaction is proposed. The model was validated through a survey of 313 members of the Korean Port Logistics Association (KPLA). Partial least squares structural equation modeling (PLS-SEM) was conducted to confirm the PSQ dimensions and to examine their relationship with customer satisfaction using SmartPLS 3.2.1 software. PSQ is found to be a five-factor construct, and its management, and image and social responsibility factors have significant positive effects on customer satisfaction. In addition to its academic contribution, this study also contributes to management practices because port managers can use the PSQ scale to measure their customers' satisfaction and justify investments in the quality management of port services.

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### 1. Introduction

Ports are well known as playing an important role in multimodal transport systems and international supply chains, apart from their traditional role as clusters of economic activities. Ports engage in various activities: loading/discharging cargo onto/from vessels; providing value-added services such as labeling, packaging, cross-docking, and others; and

acting as warehouse and distribution centers (World Bank, 2007). Ports add more value to shipments that are in the port area by further integrating themselves into value chains. Many ports are increasingly being perceived as integrated and inseparable nodes in their customers' supply chains. Ports play a critical role in the effective and efficient management of

product and information flow in the supply chain because these transport nodes are important and indispensable. Any failure or unreliability in ports' services results in unhappy customers as a result of the disruption in the smooth movement of these flows in the next stage of the supply chain. This role of ports in the supply chain is increasingly being viewed in both the academic literature and management practices.

Existing studies have researched the importance of ports in regional and national economies and their changing roles in the context of logistics and supply chain management. The literature relating to the measurement of port efficiency and port choice in the logistics and supply chain context is also well developed. Despite the aforementioned importance, what constitutes port service quality (PSQ) and its effect on port customers' satisfaction has yet to be well investigated. In this paper, we aim to address these gaps in the literature by proposing and validating a conceptual model of PSQ and by examining the causal relationship between PSQ and customer satisfaction. This paper is organized as follows. First, a literature review is provided, followed by the proposed conceptual PSQ model. The research methodology is described next, followed by analyses and discussions on the findings of this study. Finally, concluding comments, including implications for academia and management and future research directions, are outlined.

## 2. Literature Review

### 2.1. Service Quality and Port Service Quality

Throughout the literature, a universal approach to the definition of the concept of quality and its associated dimensions has never been a reality, even though the research agenda has existed for quite some time. Although quality is an exclusive concept, overwhelming studies exist on the subject of quality in the service industry with both concurring and conflicting views (e.g. Anderson and Sullivan, 1993; Bolton and Drew, 1991; Gupta and Zeithaml, 2006; Maarten et al. 2015; Rust et al. 1999; Van Doorn and Verhoef, 2008). The SERVQUAL model is one of the initial and most commonly used tools to measure service quality (Parasurman et al., 1988) and consists of five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Hopkins et al. (1993) evaluated cognitive service quality in the logistics sector using SERVQUAL model, and identified the meeting of customer expectations being the fundamental requirement for customer satisfaction. However, various scholars criticized the SERVQUAL model despite its pervasive application. For example, Cronin and Taylor (1992) proposed the SERVPERF model, which considers only actual performance and, thus, eliminates the expectation component present in the SERVQUAL model. Another common critique of the SERVQUAL model was that its dimensions lack dimensional stability (Carman, 1990), which is limited to applications in the five service industries (Parasuraman et al., 1985, 1988). Many researchers who questioned whether the SERVQUAL model can be applied to all service industries as a generic scale suggested that industry-specific measurement determinants be required to provide more accurate measurements (Babakus and Boller, 1992; Caro and Garcia, 2007; Ladhari, 2008; Van Dkyke et al., 1997).

In addition, the SERVQUAL model arguably neglects the service encounter outcome because it was designed to only address the service delivery process (Baker and Lam, 1993). Grönroos (1984) developed a model consisting of the three dimensions of technical quality, functional quality, and corporate image, which effectively consider the service

outcome component when measuring the quality of a service. Technical quality describes how the customer obtains the service and functional quality describes the service achieved in the end. Meanwhile, corporate image influences the perception of quality in a positive, neutral, or negative manner. Lehtinen and Lehtinen (1991) emphasized the importance of this attribute by proposing a model including the three dimensions of physical quality, interactive quality, and corporate quality.

In the most recent literature, SERVQUAL has been pointed out as not being a universal tool to measure service quality in specific contexts, such as in B2B services (Benazić and Došen (2012), corporate banking (Guo et al., 2008), supply chains (Seth et al., 2006), and others. Further studies on various service industries using the conceptualization and measurement instrument of SERVQUAL also indicated that it is not applicable for all industries or in all socio-cultural and economic environments. Indeed, various authors also found that the dimensions of service quality indicated in SERVQUAL are either too many or too few for the specific context of their research.

Despite numerous studies on service quality measurement in various industries, little research has been conducted in the maritime industry in general and ports in particular. Rather than focusing on detailed service quality measurements, most maritime-related literature researched the issue of carrier and port selection. Among a few relevant studies in this respect, Ugboma et al., (2004) found that all five SERVQUAL dimensions were valid. Meanwhile, efficiency, timeliness, and security were found by Lopez and Poole (1998) to contribute to the quality of port services. Brady and Cronin (2001) identified the aspects of service quality including "rational quality", "result quality", and "physical environmental quality". This study further developed sub-factors of the port service quality, for example, the "relational quality" includes port sales, customer relations and distribution network, while the "exogenous quality" indicates the volume of cargo flows, hinterland, and the size of free trade zones (FTZ) (Cho et al. 2010). Ha (2003) identified a group of port service quality factors, including "ready information availability of port-related activities," "port location," "port turnaround time," "facilities available," "port management," "port costs," and "customer convenience." On another note, separate measurement tools of port service quality comprising "endogenous quality," "exogenous quality," and "relational quality" were also developed (Cho et al., 2010). They explored the effects of port service quality on customer satisfaction, loyalty and referral intentions. A few subsequent studies focusing on the efficiency and service quality of Asian ports (Lee, 2000; Song and Yeo, 2004) have utilized these frameworks and evaluated customers' reaction to various factors of service quality (Cho et al. 2010). However, these studies neglected the critical dimension of social responsibility, which can enhance or damage the image or reputation of organizations and, hence, the perceived quality of their services. This fact is particularly important in the context that many ports around the world are now attempting to implement green port initiatives.

Thai (2008) developed and validated a measurement model (ROPMIS) to explore the concept of service quality in maritime transport. This model consists of the following six dimensions: resources, outcomes, process, management, and image and social responsibility. This model incorporated newly developed elements, such as management-, image-, and social responsibility-related quality dimensions, on the basis of a comprehensive review of various service quality dimensions and factors in previous studies. Compared with the SERVQUAL model, the ROPMIS model is more applicable to the maritime industry because it incorporates the image and social responsibility aspects that are critically important in

this industry. The author suggested that these factors could be revised for specific sub-sectors in the maritime industry, such as ports, even though the model was supposed to be generally applicable to maritime transport service. The current research adopted this model and revised the operationalized measurement items specific to the port sector.

## 2.2. Service Quality and Customer Satisfaction

Essentially, customer satisfaction is the sense that customers get when they experience service that fulfills or surpasses their expectation. Primarily in marketing, satisfaction is defined as the global evaluation of relationship fulfillment by a firm (Dwyer and Oh, 1987) or the positively affected state resulting from the assessment of a firm's working relationship (Farrelly and Quester, 2005; Gaski and Nevin, 1985). Satisfaction is also one of the most important elements to explain any type of relationship among participants (Sanzo et al., 2003) and a consumer's fulfillment response (Oliver, 1997).

Generally, customer satisfaction is known as an outcome of service quality, which means that it is related to the quality of the products or services provided to the customer in a positive manner. The level of customer satisfaction is also believed to be enhanced, along with an increased level of perceived quality of the product or service. In particular, customer satisfaction is considered to be an intrinsic variable that explains returning customers and their post-behaviors of purchasing products and services (Oliver, 1980; Lee, 2000; Szymanski, and Henard, 2001). Numerous studies in many service sectors confirmed the positive relationship between service quality and customer satisfaction (Brady and Robertson, 2001; Cronin and Taylor, 1994; Parasuraman et al., 1994) with some conflicting evidence (Rosen and Suprenant, 1998). The few studies in the transportation sector, including aviation (Anderson et al., 2009) and high-speed railways (Cao and Chen, 2011), revealed a positive relationship between service quality and customer satisfaction. Nevertheless, research in the maritime sector on this relationship, particularly in the context of ports, is scant and the subject deserves further investigation.

## 2.3. Social Responsibility and Customer Satisfaction

It is nowadays believed that socially responsible firms, which contribute both economically and ethically to the society and local communities they serve, are better positioned to grow in terms of reputation and revenues (Drobetz et al. 2014). The benefits corporate social responsibility (CSR) for companies, including increased profits, customer loyalty, trust, positive brand attitude and combating negative publicity, are well-documented (e.g. Brown and Dacin, 1997; Drumwright, 1996; Maignan and Ferrell, 2001; Murray and Vogel, 1997; McDonald and Rundle-Thiele, 2008; Sen and Bhattacharya, 2001; Sen et al. 2006). Maignan and Ferrell (2004) identified a number of studies on CSR programs' positive effects on customers. Studies by Barone et al. (2000), Berger and Kanetkar (1995), and Creyer and Ross (1997) established that consumers are willing to actively support companies committed to cause-related marketing, environmentally-friendly practices, or ethics. Murray and Vogel (1997) investigated the effect on consumers of combined programs of socially responsible business practices, cause promotions, community volunteering, corporate social marketing, as well as pro-active economic factors and consumer protection. Lua and Bhattacharya (2006) identified a direct positive path between CSR and customer satisfaction on Fortune 500 companies. However, they have also identified instances

where CSR did not always lead to customer satisfaction indicating that there is a need to better understand the relationship between satisfaction and CSR.

Homburg et al. (2013) organized the differentiate studies from supplier versus customer perspectives and distinguishes findings from business-to-consumer (B2C) versus business-to-business (B2B) contexts. In all B2C context, it is evident that they have established a link between a firm's CSR activities and important consumer outcomes such as firm and product evaluations, satisfaction, and loyalty (e.g. Bhattacharya and Sen, 2004; Brown and Dacin, 1997; Lichtenstein et al. 2004). CSR also is an issue in B2B industries because these companies are often at the forefront of engaging in CSR (Homburg et al. 2013). Levy (2010) also claimed that CSR programs are vital for B2B companies. Existing research in the B2B realm has typically focused on how firms implement CSR issues within their business operations (Homburg et al. 2013). Researcher from a B2B customer perspective has examined antecedents of a firm's CSR orientation by studying "purchasing social responsibility (e.g. Carter and Jennings, 2004). Vaaland et al. (2008) indicated that whereas CSR is an issue in relation to all business partners, the empirical studies focus on consumer marketing and consumer responses, thereby excluding B2B marketing.

The implementation of employee safety and enhancement of working conditions as well as supporting community projects may result in improvements to firm's social performance and reputation (Gimenez et al. 2012). Relationship with the local community to promote positive image and building trust through various efforts from port authorities have been implemented (Saengsupavanich et al. 2009; Puig et al. 2015). Port authorities take statutory duties to meet social and environmental obligations whilst embedding CSR concept in port management systems and undertaking routine operations and development projects commercially (Pettit, 2008). Increased CSR reporting enhances firms' transparency and lowers information costs on the part of investors, potentially leading to positive financial effects (Drobetz et al. 2014). Environmental management can reduce the negative effects of their activities on the natural environment and enhance firm's competitive positions (Sharivastava, 1995). Success in addressing environmental management could improve a firm's image (Hick 2000) and provide new opportunities for firms to enhance their capabilities (Hansmann and Caludia, 2001).

## 3. Methodology

### 3.1. Conceptual Framework and Measures

As previously mentioned, we adopt the ROPMIS conceptual model that was developed and validated by Thai (2008) to measure port service quality. Because a close relationship exists between an organization's social responsibility profile and its perceived image in the market and society, the image and social responsibility dimensions are combined into a new dimension of image and social responsibility in our revised PSQ model. Each PSQ dimension is measured using a number of variables that are revised from the ROPMIS model to suit the specific context of ports. For example, the measurement item "physical infrastructures" under the resource-related dimension in the original ROPMIS model has been expanded to include "physical infrastructures such as berths, yards, warehouses, distribution centers and hinterland connection networks," which are the critical physical assets of a port. Meanwhile, customer

satisfaction is a well-developed construct in the existing literature, as are measurement items used to assess the customer’s satisfaction of the equipment and facilities, satisfaction of services, and overall satisfaction (Anderson et al., 2009; Pantouvakis, 2010). Additionally, once customers are satisfied with a service, the logical inference made is that they will probably use the service and refer it to others (Cao and Chen, 2011). For these reasons, these measurement items are also included in the customer satisfaction construct.

The conceptual framework for this research is presented in Fig. 1 and a summary of measures is presented in Table 1.

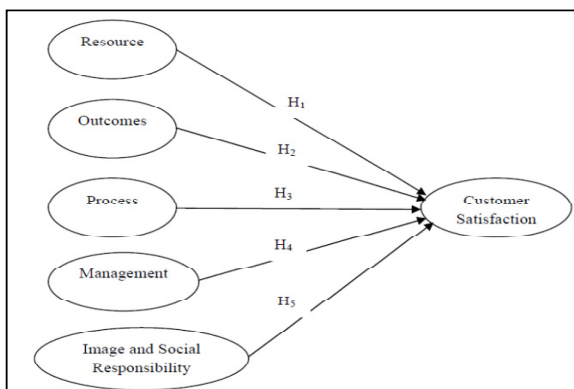


Fig. 1. Conceptual framework of PSQ and customer satisfaction

Table 1  
Constructs and measurement items

Research variables & measurement items	Code	Author(s)	
<b>Resource-related PSQ</b>			
The port that we are using always has available equipment and facilities to meet our requirements	RESOU1	Revised from Thai (2008)	
The equipment and facilities of the port that we are using are modern and always function properly	RESOU2		
The port that we are using has strong and stable financial stability	RESOU3		
The port that we are using has excellent shipment track and trace capability	RESOU4		
The port that we are using excellent physical infrastructure such as berths, yards, warehouses, distribution centers, and hinterland connection networks	RESOU5		
<b>Outcome-related PSQ</b>			
The port that we are using always provide fast service	OUTCO1		
The port that we are using always provide service in a reliable manner	OUTCO2		
The port we are using always provide service in a consistent manner	OUTCO3		
The port that we are using always ensure safety and security to our ships/shipments	OUTCO4		
The port that we are using always produce error-free invoice and related documents	OUTCO5		
The port that we are using always offers competitive price of service	OUTCO6		
<b>Process-related PSQ</b>			
The port that we are using can always meet our service requirements anytime and anywhere we want	OUTCO7	Anderson et al. (2009), Pantouvakis (2010), Cao and Chen (2011)	
<b>Management-related PSQ</b>			
The staff in the port that we are using always demonstrate professional attitude and behavior in meeting our requirements	PROCE1		
The staff in the port that we are using always respond quickly to our enquiries and request	PROCE2		
The staff in the port that we are using always demonstrate good knowledge our needs and requirements	PROCE3		
The level of ICT applications in customer service at the port that we are using is comprehensive	PROCE4		
<b>Image and Social Responsibility-related PSQ</b>			
The level of ICT applications in port operations and management at the port that we are using is comprehensive	MANAG1		
The port that we are using demonstrates high level of efficiency in operations and management	MANAG2		
The management in the port that we are using always demonstrate good knowledge and competence, including incident-handling capability	MANAG3		
The management in the port that we are using always demonstrate good understanding of our needs and requirements	MANAG4		
The port that we are using always collect our feedback about their services and reflect on their improvement	MANAG5		
The port that we are using continuously improve their customer-oriented operation and management processes	MANAG6		
<b>Customer Satisfaction</b>			
Overall, we are satisfied with the facilities, equipment and other infrastructures of the port that we are using	SATIS1		
Overall, we are satisfied with the management and employees of the port that we are using	SATIS2		
Overall, we are satisfied with the service quality of the port that we are using	SATIS3		
We will refer service of the port that we are using to our business partners	SATIS4		
We will continue using services of the port we are using	SATIS5		

3.2. Research Hypotheses

Because the relationship between service quality and customer satisfaction is under-researched in the port sector, this study examines how PSQ as a five-dimensional construct affects the satisfaction of port customers. Hence, the following five hypotheses were developed:

- H1: Resources-related PSQ positively influences customer satisfaction.
- H2: Outcomes-related PSQ positively influences customer satisfaction.
- H3: Process-related PSQ positively influences customer satisfaction.
- H4: Management-related PSQ positively influences customer satisfaction.
- H5: Image- and social responsibility-related PSQ positively influences customer satisfaction.

3.3. Sampling and Data Collection

The survey was selected as the method of data collection in this study. The mailing list covers all categories of the port’s customers, such as shipping lines and cargo owners or their representatives, such as freight forwarders or logistics service providing companies. The sampling frame was constructed from Korea Port Logistics Association (KPLA) members, and the total sampling approach was taken. The mailing list comprised 313 members of the KPLA. In South Korea, members of the KPLA manage 28 ports. Questionnaires were posted to each company in the mailing list from December 2012 to January 2013. The questionnaire, which was preceded by a cover letter on the letterhead of the authors’ institutions, employed both fixed-alternative and opened-ended response questions. It consisted of two sections in which respondents were asked to indicate their attitude toward statements describing the service quality factors of the port that their company uses most of the time in Korea, and their satisfaction with that port’s services. The respondent’s attitude is measured using a five-point Likert scale, ranging from 1 representing “strongly disagree” to 5 representing “strongly agree.” The second section asked demographic questions, such as the respondent’s business sector, their designation, and work experience. Before distribution, the questionnaire was pre-tested with a small group of academics and shipping companies to ensure the language clarity and face validity of the measurement constructs. The questionnaire survey was then administered by post.

A follow-up request was sent two weeks after the initial mailing. By the cut-off date, 103 questionnaires were returned from the KPLA. Among the 103 responses obtained, 99 valid replies were used for further analysis. The valid response rate was 31.6%. As for years in business, 38%.4 of the respondents in the sample started their work between five and 10 years ago, 23.2% engaged in business between 11 and 15 years ago, 17.2% between 16 and 20 years ago, and 21.2% were in business for more than 20 years.

4. Analysis and Findings

4.1 Partial Least Square Structural Equation Modeling (PLS-SEM) Analysis

The measurement of the five-factor PSQ and customer satisfaction model was evaluated for overall fit using tests of reliability and convergent and discriminant validity through partial least square structural equation modeling (PLS-SEM) and SmartPLS 3.2.1 software. PLS is a useful tool for structural equation modeling in applied research projects,

particularly with limited participants and skewed data distribution (Wong, 2011). PLS-SEM becomes a good analysis tool in the following situations (Hwang et al. 2010; Wong, 2010):

- 1) The sample size is small;
- 2) Applications have little available theory;
- 3) Predictive accuracy is paramount; and,
- 4) The correct model specification cannot be ensured.

It is important to note that PLS-SEM is not appropriate for all kinds of statistical analysis. There exist some weaknesses of PLS-SEM, including (Wong, 2010):

- 1) High-valued structured path coefficients are needed if the sample size is small;
- 2) Problem of multicollinearity if not handled well;
- 3) Since arrows are always single headed, it cannot model undirected correlation;
- 4) A potential lack of complete consistency in scores on latent variables may result in biased component estimation, loadings and path coefficients; and,
- 5) It may create large mean square errors in the estimation of path coefficient loading.

In spite of these limitations, PLS is useful for structural equation modeling in applied research projects especially when there are limited participants and that the data distribution is skewed (Wong, 2011). PLS-SEM has been deployed in many fields, such as behavioral sciences (e.g. Bass et al. 2003), marketing (e.g. Henseler et al. 2009), organization (Sosik et al. 2009), management information system (e.g. Chin et al. 2003), and business strategy (e.g. Hulland, 1999). As mentioned in the previous section, the fact that the current research had limited participants (99 respondents) and was conducted only in Korean Container Ports justifies the use of PLS-SEM research tool.

The first run of the PLS-SEM did not result in satisfactory construct validity results. Hence, several PLS-SEM runs were subsequently conducted to derive the best reliability and validity results. Through this process, nine items which had indicator reliability lower than 0.4 were deleted (Hulland, 1999): OUTCO5 (0.321), OUTCO6 (0.3663), IMAGE3 (0.164), IMAGE5 (0.370), IMAGE7 (0.336), MANAG3 (0.385), MANAG4 (0.349), PROCE2 (0.266), and PROCE3 (0.373). The PSQ measurement model and customer satisfaction based on PLS-SEM are depicted in Table 2 and Fig. 2.

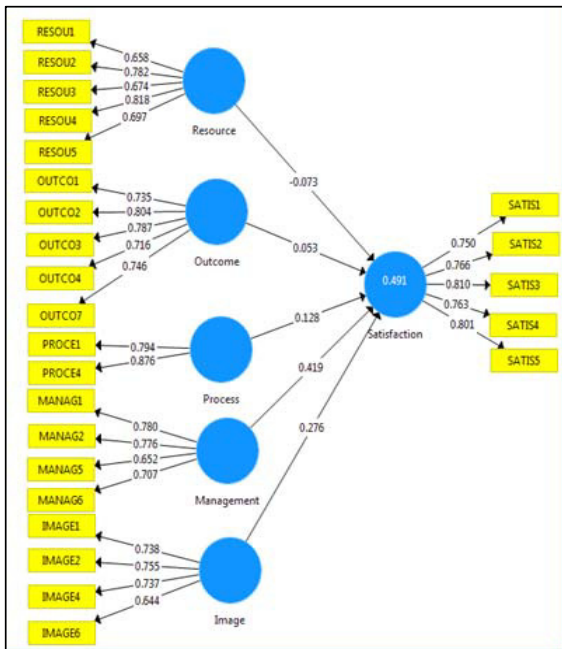
**Table 2**  
Constructs and measurement items

Constructs	Variables	Loadings	Indicator Reliability	AVE	CR
Resources	RESOU1	.658	.433	.531	.849
	RESOU2	.782	.612		
	RESOU3	.674	.454		
	RESOU4	.818	.669		
	RESOU5	.697	.486		
Outcomes	OUTCO1	.735	.540	.575	.871
	OUTCO2	.804	.646		
	OUTCO3	.787	.619		

	OUTCO4	.716	.513		
	OUTCO7	.746	.557		
Process	PROCE1	.794	.630	.699	.822
	PROCE4	.876	.767		
Management	MANAG1	.780	.608	.534	.820
	MANAG2	.776	.602		
	MANAG5	.652	.425		
	MANAG6	.707	.500		
Image & Social Responsibility	IMAGE1	.738	.545	.518	.811
	IMAGE2	.755	.570		
	IMAGE4	.737	.543		
	IMAGE6	.644	.415		
Satisfaction	SATIS1	.750	.563	.606	.885
	SATIS2	.766	.587		
	SATIS3	.810	.656		
	SATIS4	.763	.582		
	SATIS5	.801	.641		

**Table 3**  
Model summary – T-Statistics of outer loadings

	Estimates	Standard Error	T
IMAGE1←Image & Social Responsibility	.738	.071	10.410
IMAGE2←Image & Social Responsibility	.755	.047	16.094
IMAGE4←Image & Social Responsibility	.737	.064	11.519
IMAGE6←Image & Social Responsibility	.644	.107	6.002
MANAG1←Management	.780	.041	19.231
MANAG2←Management	.776	.060	13.038
MANAG5←Management	.652	.080	8.136
MANAG6←Management	.707	.102	6.940
OUTCO1← Outcomes	.735	.058	12.698
OUTCO2← Outcomes	.804	.034	23.372
OUTCO3← Outcomes	.787	.047	16.639
OUTCO4← Outcomes	.716	.061	11.707
OUTCO7← Outcomes	.746	.082	9.112
PROCE1← Process	.794	.062	12.868
PROCE4← Process	.876	.040	22.097
RESOU1← Resources	.658	.085	7.716
RESOU2← Resources	.782	.055	14.187
RESOU3← Resources	.674	.089	7.613
RESOU4← Resources	.818	.052	15.852
RESOU5← Resources	.697	.125	5.571
SATIS1← Satisfaction	.750	.055	13.569
SATIS2← Satisfaction	.766	.057	13.335
SATIS3← Satisfaction	.810	.035	22.878
SATIS4← Satisfaction	.763	.041	18.633
SATIS5← Satisfaction	.801	.042	18.838



**Fig. 2.** PSQ and customer satisfaction model based on PLS-SEM

The results of PLS-SEM showed that the indicator reliability of all item loadings are significant, higher than the recommended minimum acceptable value of 0.40, and close to the preferred level of 0.7 (Hulland, 1999). The T-statistics result of the outer model is presented in Table 3, which shows that all T-statistics are larger than 1.96 and statistically significant (p = .000). Therefore, the outer model loadings could be said to be highly significant.

To further confirm the validity and reliability of the PSQ and customer satisfaction model, their convergent and discriminant validities were also examined using composite reliability (CR), average variance extracted (AVE), and the square root of AVE (Bagozzi and Yi, 1998; Fornell and Larcker, 1981). Traditionally, Cronbach's alpha is used to measure internal consistency reliability; however, it tends to provide a conservative measurement in PLS-SEM (Wong, 2011). Therefore, prior studies suggested the use of composite reliability as a replacement (Bagozzi and Yi, 1998; Hair et al., 2012). As Table 2 indicates, these values are larger than 0.7, indicating a high level of internal consistency reliability among all reflective constructs. For convergent validity, each construct's AVE is evaluated. Again, Table 2 shows that all of the AVE values are larger than the acceptable threshold of 0.5, confirming convergent validity.

For the discriminant validity test, Fornell and Larcker (1981) suggested that the square root of AVE in each construct can be used to establish discriminant validity if the value is larger than other correlation values among the constructs. Table 4 illustrates the square root of AVE in bold on its diagonal along with the correlations between the constructs. For example, in the current study, the construct of management's AVE is found to be 0.534 (from Table 2), making its square root 0.731. This number is larger than the correlation values in the management column (0.556, 0.659, 0.692, and 0.649) and larger than the values in the management row (0.604). A similar observation is also made for the image and social responsibility, outcomes, process, resources, and satisfaction constructs. These results indicate that the discriminant validity is well established.

**Table 4**  
Results of discriminant validity test (Fornell-Larcker criterion)

	Image & Social Responsibility	Management	Outcome	Process	Resource	Satisfaction
Image & Social Responsibility	.720					
Management	.604	.731				
Outcomes	.522	.556	.758			
Process	.508	.659	.512	.836		
Resources	.538	.692	.660	.551	.729	
Satisfaction	.583	.649	.448	.532	.471	.778

#### 4.2 The Impacts of PSQ on Customer Satisfaction

The bootstrapping process of the PLS-SEM analysis was applied to generate *T*-statistics to significance test the model at the 95% confidence level, with customer satisfaction as the dependent variable and the extracted five factors of the PSQ model as predictors. The results of this analysis are summarized in Table 5 and Table 6. The multiple R ( $R=0.701$ ) shows that ample correlation exists between the dependent variable (customer satisfaction) and five predictors, and this correlation is statistically significant ( $p = .000$ ). With the exception of the resource factor, the other four predictors have a positive influence on customer satisfaction, but this causal relationship is only statistically significant for two predictors, namely image and social responsibility, and management, but is not for outcomes and process. Specifically, the management-related PSQ factor has the strongest positive influence on customer satisfaction ( $\beta = .419$ ), followed by the image and social responsibility-related PSQ ( $\beta = .276$ ). Hence, the first three hypotheses are rejected, whereas the remaining two hypotheses are supported at 5% significance level and the path coefficient will be significant if the *T*-statistics is larger than 1.96.

**Table 5**  
Model summary-coefficient of determination

Model	R	R Square	Adjusted R Square	Standard Error
C	.701 <sup>a</sup>	.491	.463	.064

Note: a. Predictors: (Constant), RESOU, OUTCO, PROCE, MANAG, IMAGE  
Dependent Variable: SATIS

**Table 6**  
Model summary-T-Statistics of path coefficients (Inner model)

	Estimates	S.E. <sup>a</sup>	t-value	p-value	Results
Resources → Satisfaction	-.073	.114	.645	.519 <sup>†</sup>	Not supported
Outcomes → Satisfaction	.053	.097	.550	.583 <sup>†</sup>	Not supported
Process → Satisfaction	.128	.091	1.409	.159 <sup>†</sup>	Not supported
Management → Satisfaction	.419	.141	2.98	.003*	Supported
Image & Social Responsibility → Satisfaction	.276	.104	2.641	.009*	Supported

Note: a = S.E. is an estimate of the standard error of the covariance

\* = Significant at  $p < .05$  ( $t \geq 1.96$ )

† = Non-significant

It is interesting to note that the influence of resources- (0.645), process- (1.409), and outcomes-related (0.55) PSQ factors is not significant at 5% significance level. Therefore, the port's customer satisfaction can be enhanced by factors beyond the provision of physical equipment and facilities, staff knowledge, and core port service outcomes to be delivered to customers. Such enhancement of customer enhancement is particularly important for port managers to note because the port customers' satisfaction cannot be taken for granted simply on the basis of the provision of adequate and good quality physical equipment and facilities. The finding that the management-related PSQ factor has the strongest positive influence on customer satisfaction is in line with the results from Thai (2008), who found that this factor was also perceived as the most important in delivering service quality in maritime transport. In this research, customers are found to care about the level of ICT applications in port operations, demonstrating a high level of efficiency in operations and management, improving their services and considering customers' feedback, and continuously improving customer-oriented operations and management processes. With loadings of 0.780, 0.776, 0.652, and 0.707, respectively, they are good indicators of the management-related PSQ. Specifically, in this case, Korean port customers emphasized that the application of ICT in customer service and port operations and management would lead to a more positive impact on their satisfaction. This finding is somewhat expected given the high level of ICT applications in all aspects of businesses in Korea.

Moreover, it is noted that the image and social responsibility ( $t = 2.641$ ,  $p < 0.05$ ) PSQ factor also has a significant positive impact on customer satisfaction, implying that an emphasis on the port's corporate social performance is an important service quality enabler. Additionally, with a loading of 0.644, environmental responsible operations imply the importance of environmental management—one of the important factors for enhancing customer satisfaction.

## 5. Conclusion

### 5.1 Discussion and Implications

This paper contributes to the existing literature by exploring the composition of the port service quality construct and investigating its impact on customer satisfaction in the port sector. Port service quality was found to be a five-dimensional construct consisting of items related to resources, outcomes, process, management, and image and social responsibility. This PSQ construct covers all aspects of port service delivery. Additionally, along with services internally within the port and externally between the port and its customers, social responsibility is included—a particularly important aspect in the maritime industry. As such, this finding is unique for the port sector because it introduced and empirically validated the measurement of port service quality. The PSQ model in this research lays the foundation for further studies on the management and delivery of service quality in the port sector, a topic that has not been well studied in the literature.

This study also confirmed that delivering a quality port service has a significant positive impact on customer satisfaction. Specifically, the management-related PSQ factor, followed by the image and social responsibility-related PSQ factor, have the strongest influence on customer satisfaction, whereas the impact from the resources-, outcomes-, and process-related factors was not statistically significant. Other literature also supports the result that port service quality has a significant impact on customer satisfaction (Dehghan et al. 2012; Polyorat and

Sophonsiri, 2010). By supporting the essentials in the relational marketing domain, this research contributes to confirming the critical causal relationship between the two dimensions of service quality and customer satisfaction. In addition, this research also highlights the importance of managing port service quality from an all-around approach and not by simply focusing on the port's physical resources.

Meaningful implications for port managers are also derived from the findings of this study. First, port managers could understand the dimensions and aspects of port service quality that customers (e.g., shipping lines, cargo owners, and their representatives) appreciate and request through the current study of the validated PSQ model. Port managers may use this understanding to develop a standard measurement scale of PSQ to measure customer satisfaction. For long-term orientation, applying the PSQ model could facilitate a comparison and benchmarking between ports and enhance their service quality performance. Second, because this study confirmed that service quality has a significant positive impact on customer satisfaction, port managers should invest in the quality of their port services because doing so is critical to retaining existing customers and to attract potential customers. On a further note, port managers should also pay attention to corporate social responsibility and environmental management activities that could help enhance the port's image and, thus, perceived service quality and satisfaction in the eyes of their customers.

## 5.2 Conclusion, Limitations, and Future Research

The impact of service quality on customer satisfaction in the port sector lacks research. The results from this study reveal that PSQ is a construct of five factors, and that enhanced PSQ positively influences customer satisfaction. In terms of contributing to knowledge and practical applications, the current study helps enhance the understanding of service quality as a relational marketing tool, particularly in the context of the port sector.

The main purpose of the current study is not to evaluate the service quality of each and every port but to explore the relationship between port service quality and customer satisfaction in Korean container ports. However, one of several limitations of this study is the generalization of its findings. First, this study examined the port sector in Korea; hence, its external validity could be limited. Researchers could overcome this constraint by expanding future similar studies to cross-industry levels. Although the current research questionnaire was focused on container ports, it could be modified for other sectors in the port industry for future research. Second, this study was only conducted at the preliminary level of investigating the relationship between port service quality and customer satisfaction, in which the latter was treated as a single construct. Hence, future research which examines the influence of port service quality on other important aspects, such as customer loyalty, word of mouth intention, and repurchase intention, would be useful in view of customer satisfaction as a mediating variable. Last but not least, future research should adopt a larger sample size so that further tests on the relationship between port service quality and customer satisfaction can be conducted on various respondent's groups.

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