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An Empirical Assessment of Maritime Logistics Service Quality in Myanmar

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ABSTRACT

This research empirically examines the composition of maritime logistics service quality and its impact perceived by both service providers and customers in Myanmar maritime transport industry. With the strong support of exploratory factor analysis (EFA) and structural equation modeling (SEM) analysis, the findings indicate that such a maritime logistics service quality (MLSQ) is represented by the six-dimensional construct consisting of logistics professional skills, resource, process, outcome, service costs, and image along with the associated measurement indicators. In addition, each of the six dimensions of maritime logistics service quality has a significant positive effect on customer satisfaction as well as long-term commitment. The significant direct relationship between customer satisfaction and long-term commitment of the customer to repurchasing intent of the service is also confirmed. Some insights, academic and managerial implications, and limitation of the research are further discussed.

Keywords: Maritime logistics service quality (MLSQ), Dimension, Measurement indicator, Customer satisfaction, Long-term commitment

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1. Introduction

In accordance with the increasingly important role of maritime transportation as a result of growing international and intraregional trade (UNCTAD, 2009; Berle et al., 2011), the key players of maritime transport industry including shipping companies and agencies, port and terminal operators, and freight forwarders are encouraged to provide a wider variety of logistics services nowadays (Lee, 2010). For instance, some sort of logistics services such as door-to-door service, multimodal service, and other integrated services provided by shipping companies seem necessary for shippers for the reduction of total transaction costs (Chen et al., 2009; Fremont, 2009). Moreover, Wang (2008), Berle et al. (2011), and Bae (2012) highlighted the role of ports in the maritime transport context and it has been found that port's activities of movement of cargo are well integrated with value-added logistics services such as warehousing, packaging, repackaging, and labeling. Lu and Dinwoodie (2002), Burkovskis (2008), and Banomyong and Supatn (2011) further mentioned that freight forwarders are responsible not only for transporting freight but also for facilitating trade transaction by providing shippers with various logistics service activities such as booking space, documentation, customs clearance, consolidation services for small scale exporters, negotiating with shipping lines or other carriers, and support coordination between all related parties.

In an attempt to gain a competitive advantage over its competitors, the key players of maritime transport industry must place great emphasis on the quality of logistics services that they provide the customers such as manufacturers and traders in their respective business areas. Undoubtedly, customer satisfaction as well as long-term commitment of customers to the logistics service delivered in the maritime transport industry can be achieved through the improved service quality. In this regard, the conceptualization and assessment of perceived service quality in various industries including shipping industry have been the most debated topics in the services marketing literature to date (Brady and Cronin, 2001). However, it is absolutely new to Myanmar.

Myanmar, one of the developing countries in Southeast Asia, is now in a transition period of opening up to trade, encouraging foreign investment, and deepening its financial sector in line with country's wide-ranging economic and policy reforms (ADB, 2012), and consequently it is expected to increase its maritime trade with foreign countries in the near future. The vital role of logistics service in maritime transport industry of Myanmar has also been acknowledged in this regard. However, UNCTAD (2003) reported that most of the developing countries are usually confronted with a number of factors such as technologies and physical infrastructure; security and safety; facilitation; legal aspects; and market access that are particularly detrimental to their countries' logistics service quality. Moreover, there are also different obstacles as to each of these factors and thus many of importers; manufacturers and exporters have only limited access to logistics service provided by local service providers in these countries. Such considerations led to a main reason for the necessity of research on how to assess maritime logistics service quality and what influencing factors are of critical importance to its substantial improvement in Myanmar context.

A number of previous studies found out the service quality attributes which have been used as selection criteria for mode, carrier and logistics service providers in specific shipping industry such as container shipping or liner shipping, and tramp shipping (Lu, 2000; Koo et al., 2009; Yang et al., 2009; Banomyong and Supatn, 2011; Thai et al., 2014). This research aims to investigate service quality indicators which represent the logistics service quality of maritime transport industry as a whole titling maritime logistics service quality (MLSQ). The research further intends to develop and empirically test the conceptual model that indicate the relationship between maritime logistics service quality (MLSQ), customer satisfaction, and long-term relationship between service providers and customers in Myanmar maritime transport industry.

2. Conceptual background and research model

2.1 Service quality

Service quality refers to an overall evaluation of the service delivery system of a firm and it can also be defined as the customer's overall impression of the relative inferiority or superiority of the firm's performance (Martinez and Martinez, 2010). Further, service quality has often been viewed as the evaluation of discrepancy between customers' expectation and actual service performance (Ruyter et al., 1997). Moreover, they indicated that service quality is an antecedent of customer satisfaction, and the perception of customers on the service performance is the most important indicator of service quality. In addition, service quality can be formed as a multidimensional construct of service related attributes being assessed by the customers (Ekinci, 2001; Kang and James, 2004). There have been a number of previous studies that explore the different dimensions of service quality along with associated measureable items in order to evaluate the performance of various service industries (Donabedian, 1980; Parasuraman et al., 1988, 1991, 1994; Brady and Cronin, 2001; Ekinci, 2001; Kang and James, 2004; Fullerton, 2005; Thai, 2008). According to Durvasula et al. (1999) and Chowdhary and Prakash (2007), a generalization of quality dimensions in evaluating the service quality was not possible among all types of services due to the variation in basic nature and consequently the measurement indicators involved in the formation of quality dimensions for the assessment of service quality are specific to each and every service industry.

2.2 Logistics service quality

Delivering logistics services is of critical importance to the effective supply chain management (SCM) in order to sustain a strategic competitive advantage through increased customer satisfaction (Bottani and Rizzi, 2006). According to Caro and Garcia (2007), logistics service quality is considered as a major criterion for a firm to differentiate itself from its competitors and thus offering better logistics services

from the firm is necessary in competitive situations in which logistics services are relatively important than characters and price of the product. In this regard, on the one hand the internal differentiation of a firm may focus on the number and level of different logistics services offered, but on the other value-added logistics service alternative is considered as the traditional major external logistics differentiation factor.

Due to the today's increasingly competitive and complex business nature, well-trained and skilled logistics professionals have become essential for a better logistics operational performance (Thai et al., 2011; Murphy and Poist, 1998, 2007; Mangan and Christopher, 2005). Furthermore, Wong and Karia (2010) suggested that logistics performance can be examined through firm's resources including physical resources, technology resources, and managerial competence. They also pointed out that firm's strategies, process capabilities, and resources are traditional explanatory factors for the competitive advantages of logistics service providers. In addition, physical resources including logistics hubs, warehouse capacities and transport vehicles are essential for delivering cargo, and hence these resources plays an important role in controlling logistics activity as well as improving reliability and speed of delivery (Murphy and Poist, 2000).

In accordance with the growth of maritime transportation as a result of intensifying trade globalization these days, adverse environmental impact and resource depletion have been imposed by the pollution and waste generated from ship operations (Lai et al., 2011). In this regard, Psaraftis and Kontovas (2010) explored the trade-offs between logistics efforts and policies to reduce the shipping-related environmental problems. They further postulated that the examination on the contribution of green shipping practices (GSPs) to the development of logistics service capability in shipping firms will be beneficial to improving and balancing environmental and productivity performance in their logistics operations. In order to assess the logistics service quality in various industries, some authors have developed the distinct quality constructs consisting of different dimensions represented by the relevant measurement indicators (Anderson et al., 1998; Mentzer et al., 1999; Lu, 2000; Rafele, 2004; Bienstock et al., 2008; Kersten and Koch, 2010; Banomyong and Supatn, 2011).

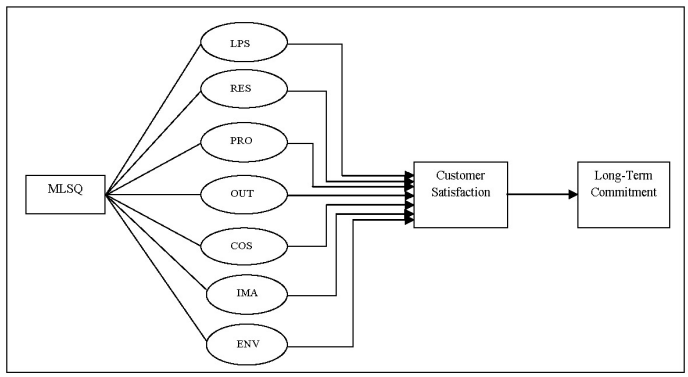
2.3 Maritime logistics service quality (MLSQ)

The conceptualization of maritime logistics service quality (MLSQ) is based on the concept of service quality and logistics literature. The term maritime logistics service quality (MLSQ) can be conceptualized as the customers' overall evaluation of logistics services which are delivered by the key logistics service providers of the maritime transport industry including shipping companies and agencies, port and terminal operators, and freight forwarders in the movement of goods and services together with information worldwide by sea. In the maritime transport context in order to offer the efficient and reliable logistics service; for example, door-to-door delivery service to the customer, maritime transport operators are forced to coordinate with operators of other modes of transport such as road, rail, and air. It is consequently suggested from the literature that logistics professional skills is necessary for maritime

transport operators to accomplish such sort of logistics integration system. Furthermore, it can be seen repeatedly from literature not only on general service quality but also on logistics related service quality that resource, process, outcome, service costs and image are strategically important for the quality assessment of customer service. Additionally, the environmental problems caused by shipping and port-related cargo movement activities in the international trade have been widely noticed by customers nowadays. Hence, maritime logistics service providers are encouraged to respond to such environmental concerns by adopting environmental management practices; for instance, green shipping practices in their operations in an environmentally responsible manner.

Accordingly, the maritime logistics service quality (MLSQ) is further conceptualized as a construct of seven dimensions along with their related measurement indicators. These dimensions include : (i) Logistics professional skill (LPS) which refers to the provision of skills and knowledge being necessary for senior-level logisticians or logistics managers who perform a logistics operation in the maritime transport industry; (ii) Resource (RES) which refers to anything tangible or intangible owned or acquired by a service firm; (iii) Process (PRO) which refers to the evaluation of how service is delivered during the service performance; (iv) Outcome (OUT) which refers to the evaluation of what services are delivered after the service performance; (v) Service costs (COS) which refers to any financial offer resulted from the differentiated logistics activity; (vi) Image (IMA) which refers to the corporate reputation that reflects the customer perception of firm's performance; and (vii) Environmental responsibility (ENV) which refers to the evaluation of the performance of the firm on environmental protection against adverse impacts caused by cargo movement and its concomitant logistics activities. The measurement indicators that represents each dimension of maritime logistics service quality (MLSQ) are extracted on the basis of findings from previous literature and semi-structured interviews conducted with a number of practitioners and academics in the logistics related field of maritime transport industry.

Figure 1. Conceptual model of maritime logistics service quality (MLSQ)



2.4 Customer satisfaction and Long-term commitment

Customer satisfaction refers to an outcome assessment of the extent to which customers are pleased and have positive emotional evaluation of providers' service performance (Flint et al., 2011). In addition, customers satisfaction is often based on the perception of how the service is offered and the main concurrence is that a satisfied customer is more likely to be loyal and a long-term client of the service provider (Caruana et al., 1999; Durvasula et al., 2002). Several previous empirical studies examined the relationship between perceived service quality and customer satisfaction in various service settings and they confirmed that service quality is positively related to customer satisfaction (Brady and Robertson, 2001; Cronin et al., 2000; Dabholkar et al., 2000; Yang et al., 2009; Deng et al., 2010). Long-term commitment refers to the loyalty of customers operationalised by their intention of continuing a long-term relationship with service providers or repurchasing services from the service provider (Wong and Karia, 2010). In this regard, building strong long-term relationship with customers or developing the loyalty of customers can be regarded as the key factor in winning market share and sustaining competitive advantage for the service providers (Deng et al., 2010; Flint et al., 2011). According to Fornell (1992), high customer loyalty is mainly resulted from high customer satisfaction. In addition, Sivadass and Baker-Prewitt (2000) stated that the long-term commitment reflected by customer loyalty is the ultimate objective of customer satisfaction measurement. Accordingly, it is anticipated in this research that maritime logistics service quality (MLSQ) has a positive effect on long-term commitment of customers to the logistics service delivered by the service providers of maritime transport industry through the enhanced customer satisfaction.

2.5 Conceptual model and research hypotheses

The conceptual model of maritime logistics service quality (MLSQ) is presented in Fig. 1 which portrays the association between the perceived maritime logistics service quality (MLSQ) and the outcome in terms of customer satisfaction which effects the long-term commitment of customers to repurchasing intent of the service. In this conceptual model, the maritime logistics service quality (MLSQ) is viewed as an antecedent of customer satisfaction and long-term commitment, and a number of reasonable hypotheses on the conceptual model are proposed as follows.

Hypothesis 1: Maritime logistics service quality (MLSQ) is described by a seven-dimensional construct and there is a positive effect of MLSQ on the customer satisfaction. In particular, the seven dimensions of MLSQ such as logistics professional skills (LPS), resource (RES), process (PRO), outcome (OUT), service costs (COS), image (IMA) and environmental responsibility (ENV), are hypothesized to have a positive effect on customer satisfaction.

Hypothesis 2: There exists a positive relationship between customer satisfaction and long-term commitment.

Hypothesis 3: Maritime logistics service quality (MLSQ) has an indirect positive

effect on the long-term commitment through customer satisfaction. Particularly, each of the dimensions of MLSQ has an indirect positive effect on the long-term commitment through customer satisfaction.

3. Research methodology

3.1 Survey instrument

The research instrument for the study is a questionnaire designed to collect data on logistics service quality of maritime transport industry and its concomitant impact perceived by both service providers and customers. The research instrument was developed through a two-step process. Firstly, an extensive literature review in the area of transportation, production economics, energy policy, management, customer service, marketing, and logistics was conducted in order to gain insight into composition of maritime logistics service quality, customer satisfaction, and long-term commitment. Secondly, a number of semi-structured interviews with practitioners and academics were carried out to identify and confirm the relevance and appropriateness of dimensions along with associated measurement items/indicators for the assessment of maritime logistics service quality in Myanmar.

The instrument was then pilot-tested with a group of 30 part-time postgraduate students studying for the postgraduate degree in shipping management and port management in the Myanmar Maritime University. These postgraduate students were chosen to pretest the questionnaire due to their proper work experience and educational background in relation to the maritime related logistics services as some of them are currently working in shipping lines and shipping agencies, port management companies, and freight forwarding companies, whereas some are working in export and import companies operated through the maritime transportation. Although some minor wording mistakes were found, the results of the pilot test proved to be satisfactory since all the respondents found that most of the questionnaire items are relevant, appropriate and clearly understandable.

3.2 Measures

Measures for seven quality dimensions conceptualized in this study including logistics professional skills, resource, process, outcome, service costs, image, and environmental responsibility were constructed based upon the previous studies as well as information collected from 26 semi-structured interviews with practitioners and academics in the field of shipping and port logistics in Myanmar. Each of such latent dimensions of maritime logistics service quality was measured by multi-indicator scale and all those indicators were subsequently scored against a five-point Likert scale anchoring from “1 = extremely unimportant” to “5 = extremely important”.

In order to assess the dimension of logistics professional skills, eight measurement indicators were adapted from Murphy and Poist (1998), Mangan and Christopher

(2005), Murphy and Poist (2007), Daud et al. (2010), and Thai et al. (2011). Similarly, eight measurement items were used to measure the dimension of resource based on the previous studies (Lu, 2000; Murphy and Poist, 2000; Lai et al., 2004; Fullerton, 2005; Thai, 2008; Yang et al., 2009; Wong and Karia, 2010). Process dimension was measured by seven indicators extracted from Anderson et al. (1998), Lu (2000), Fullerton (2005), Bienstock et al. (2008), Thai (2008), Yang et al. (2009), Wong and Karia (2010), Kersten and Koch (2010), and Banomyong and Supatn (2011). Thirteen measurement items adapted from Anderson et al. (1998), Lu (2000), Murphy and Poist (2000), Durvasula et al. (2002), Fullerton (2005), Bienstock et al. (2008), Thai (2008), Yang et al. (2009), Kersten and Koch. (2010), and Banomyong and Supatn (2011) were used to assess the dimension of outcome. Five measurement items were extracted from Pirttila and Huiskonen (1996), Anderson et al. (1998), Lu (2000), and Banomyong and Supatn (2011) to measure the service costs dimension. Dimension of image was assessed by four items adopted from the previous studies (Lu, 2000; Thai, 2008; Kersten and Koch, 2010). Lastly, three measurement items were adapted from Thai (2008), Psaraftis and Kontovas (2010), Lindstad et al. (2011), Fitzgerald et al. (2011), Lai et al. (2011), and Thai et al. (2011) to measure the dimension of environmental responsibility.

In this research, the impact of maritime logistics service quality was evaluated through customer satisfaction and the extent of long-term relationship between service providers and customers. Measurement indicators of three items for customer satisfaction were built on a literature basis (Hayes, 2008; Lewin, 2009; Li, 2011). In the same way long-term commitment of customers to the logistics service rendered by the providers in maritime transport industry was measured by three measurement items adapted from the previous studies (Deng et al., 2010; Udo et al., 2010; Li, 2011; Zhao et al., 2012).The indicators for the constructs of customer satisfaction and long-term commitment were scored by five-point Likert scale anchoring from "1 = strongly disagree" to "5 = strongly agree". A list of survey items used to assess the maritime logistics service quality, customer satisfaction, and long-term commitment are included in Table 2.

3.3 Sample and data collection

The survey was conducted in Yangon where is the major place of doing maritime transport business in Myanmar. The data used to test the hypotheses were collected from both service providers and customers because several studies have indicated that front line providers' perceptions are highly correlated with those of customers not only in their overall assessment of service quality, but also in their evaluation of specific aspects of the firm's service setting (Schneider and Bowen, 1985; Schlesinger and Zornitsky, 1991; Tornow and Wiley, 1991; Goodale et al., 1997). In addition, although the majority of service quality research has focused on customers as the primary source of data (Parasuraman et al., 1988, 1991; Carman, 1990; Cronin and Taylor, 1992), in some respects service providers are superior to customers as a source of service quality data (Goodale et al., 1997). The inclusion of both service providers and customers in this research was further expected to gain a comprehensive

and wider perception of logistics service quality of maritime transport industry as a whole.

The unit of analysis for this research was defined as each individual logistics service provider's company and customer's company. The research population of maritime logistics service providers is being composed of three categories of service providers such as shipping companies and agencies, port and terminal operators, and freight forwarders who provide their customers with logistics services in the Myanmar maritime transport industry. The samples of shipping companies and agencies as well as port and terminal operators were selected from the registered lists controlled by the Department of Marine Administration (DMA) under the Ministry of Transport in Myanmar, whereas the sample of freight forwarders was selected from the members' list of the Myanmar International Freight Forwarders' Association (MIFFA). On the other hand, the sample of customers was selected from the population of exporters and importers who run the business of manufacturing and/or trading and are registered in the members' list of the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI).

Table 1. Profile of the respondent companies

Service provider companies				Customer companies			
Respondent's position		Business category		Respondent's position		Business category	
Administrator	1.39%	Freight forwardin	51.39%	Assistant director	6.35%	Manufacturing	36.51%
Assistant manager	17.36%	Port operation	7.99%	Assistant manager	18.65%	Trading	63.49%
Deputy general manager	4.16%	Shipping	40.62%	Director	21.03%		
Director	10.07%			Manager	49.84%		
General manager	2.78%			Managing director	4.13%		
Manager	55.21%						
Managing director	9.03%						
Length of service in years		No. of employees		Length of service in years		No. of employees	
< 5	39.24%	< 200	89.92%	< 5	36.11%	< 300	76.19%
5-9	35.07%	200-399	4.51%	5-9	31.75%	300-599	9.92%
10-14	17.71%	400-599	4.17%	10-14	21.83%	600-899	7.54%
15-19	6.25%	600-899	0.70%	15-19	8.33%	900-1199	2.78%
≥ 20	1.73%	≥ 900	0.70%	≥ 20	1.98%	1200-1499	2.38%
						≥ 1500	1.19%

Ownership

	Freight forwarding	Port operation	Shipping	Total
Local	148	17	105	270 (93.75%)
Foreign-local	-	1	-	1 (0.35%)
Foreign-owned	-	5*	12	17 (5.90%)
Total	148	23	117	288 (100%)

*Under the build, operate and transfer (BOT) scheme

Ownership

	Manufacturing	Trading	Total
Local	22	160	182 (72%)
Foreign-local	26	-	26 (10%)
Foreign-owned	44	-	44 (18%)
Total	92	160	252 (100%)

Since the size of the population of maritime logistics service providers in Myanmar is not very large, all the population elements of 331 consisting of 147 shipping companies

and agencies, 23 port and terminal operators, and 161 freight forwarding companies were considered to be included in the sample in this research. The total population elements of customers were shown as 857 in the members' list of the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI) by the end of March, 2013, and thus the sample size was determined to be 270 by using the sample size table of Saunders et al. (2009). For this reason, 331 final versions of questionnaires together with the cover letter and self-addressed envelope for returning the responses were sent to the service provider companies and also those of 270 were sent to the randomly selected customer companies in the first week of January, 2014 using standard mail survey procedures suggested by Dillman (1991). A follow-up mailing was sent four weeks after the initial mailing and subsequently a total of 561 responses consisting of 296 from the service providers and 265 from the sample group of customers were received over a three-month period. Out of these returned questionnaires, 21 were rejected due to being unreasoning and significantly incomplete answers. There were 288 usable responses from service provider companies with a response rate of 87%, and 252 usable responses from customer companies with a response rate of 93%, respectively. The total number of usable responses were therefore 540, and the overall response rate of this research was 89.85%.

Table 1 reports the organizational characteristics of the respondent companies. It was found that more than 80% of responses come from those whose position is manager and above endorsing the reliability of the survey findings. In addition, over half (52.78%) of the responding service provider companies had worked in delivering their service for 5 to 14 years while 39.24% for less than 5 years. Similarly, 53.58% of the responding customer companies had been in operation for 5 to 14 years and 36.11% for less than 5 years respectively. Further, the responding service provider companies include 148 freight forwarding companies (51.39%), 117 shipping companies and agencies (40.62%), and 23 port and terminal operators (7.99%), whereas the responding customer companies are composed of 92 manufacturing companies (36.51%) and 160 trading companies (63.49%) respectively in this research. The vast majority of responding service provider companies are quite small with below 200 employees (89.92%) and only port and terminal operators act as a large service delivery firm with more than 600 employees in Myanmar maritime transport industry. In contrast, the largest proportion (76.19%) of responding customer companies operate their business with less than 300 employees, and only manufacturing companies manage 600 and above employees. As regards the ownership pattern, more than 90% of the service provider companies are local firms while only a few proportions: 0.35% and 5.90% are foreign-local firm and foreign-owned firms respectively. Similarly, the majority of customer companies (72%) are local firms, while 10% and 18% are foreign-local firms and foreign-owned firms respectively.

4. Data analysis and findings

4.1 Comparison of perceptions between service provider and customer

The data analysis was initially started with comparison of perceptions between service provider and customer in assessing the importance or agreement of each and every indicator that can capture the proposed dimensions of maritime logistics service quality and its concomitant impact. The independent t-test and Levene's F-test were used to test whether there is a marked difference in the assessment of quality indicators between service provider and customer in terms of mean score and its variance respectively. The p-value for examining the significance of t and F statistics were described in Table 2. The results showed that the only one indicator, namely discount offering is statistically significant at 5% significance level since both of the p-value were lower than 0.05 meaning that the indicator of discount offering was assessed differently by service providers and customers. However, almost all the indicators ensured the remarkable similarity of perceptions between service providers and customers. Therefore, the comparison results of t-test and F-test were strong enough to support combining the observed data collected from service providers and that from customers for subsequent analyses.

4.2 Factor structure of maritime logistics service quality

Factor analysis is a useful technique for reducing a large set of variables to a smaller set of underlying factors in order to detect the presence of meaningful patterns among the observed variables (Field, 2009). In this research, an exploratory factor analysis (EFA) with principal component extraction and oblique rotation was performed by using the statistical software SPSS 17 to identify the strategic latent dimensions (factors) represented by proposed measurement items ensuring the construct validity (Rossiter, 2002). The sufficiency of the data for performing factor analysis was indicated through the Kaiser-Meyer-Olkin (KMO) of 0.946 with p-value of 0.000 for Bartlett's test of Sphericity (Hair et al., 1998). A large KMO value which exceeds the acceptable limit of 0.50 and a high level of significance of the test of Sphericity suggest that the inter-correlation matrix contains enough common variance to make factor analysis worth pursuing (Norusis, 2002). The exploratory factor analysis showed that most measurement indicators could determine each dimension of maritime logistics service quality as proposed. However, measurement items for the dimensions of image and environmental responsibility were loaded on the same factor. The cut-off point of loading was used as 0.40 for the measurement item selection, and consequently items with low loading (below 0.40) and those with cross loadings were dropped out of the analysis (Field, 2009).

Table 2. Comparison results

Dimension	Quality Indicators	Mean (Provider)	Mean (Customer)	Mean Difference	P-value (Mean)	P-value (Variance)
Logistics Professional Skills (LPS)	LPS1. Ability of managing customer relationship	3.37	3.23	0.14	0.150	0.977
	LPS2. Problem-solving ability	3.50	3.38	0.12	0.220	0.402
	LPS3. Cost control ability	3.38	3.43	-0.05	0.607	0.012*
	LPS4. Strategic management ability	3.09	3.15	-0.06	0.590	0.033*
	LPS5. Risk management ability	3.08	2.96	0.12	0.250	0.238
	LPS6. Ability of identifying opportunities and threats	3.38	3.21	0.17	0.083	0.769
	LPS7. Ability of using knowledge	2.86	3.06	-0.20	0.058	0.486
	LPS8. Professional integrity	3.44	3.42	0.02	0.822	0.196
Resource (RES)	RES1. Physical infrastructure	3.47	3.35	0.12	0.208	0.743
	RES2. Supportive regulation	3.41	3.42	-0.01	0.876	0.507
	RES3. Equipment and facilities availability	3.51	3.37	0.14	0.179	0.052
	RES4. Shipment tracking capability	3.04	3.04	0.00	0.951	0.629
	RES5. Financial stability	3.34	3.31	0.03	0.678	0.112
	RES6. Frequency of sailings and geographical coverage of service	3.08	3.13	-0.05	0.604	0.008*
	RES7. Skillful human resource	3.36	3.35	0.01	0.870	0.902
	RES8. Knowledge of customer needs and requirements	3.45	3.37	0.08	0.358	0.455
Process (PRO)	PRO1. Timely response to customers' inquiries and request	3.43	3.30	0.13	0.165	0.288
	PRO2. Meeting customers' requirements	3.15	3.06	0.09	0.399	0.558
	PRO3. Effective support of IT and EDI	3.44	3.44	0.00	0.936	0.159
	PRO4. Personal contact and relationship	3.37	3.39	-0.02	0.790	0.292
	PRO5. Accommodating the changes needed by customers	3.39	3.47	-0.08	0.420	0.539
	PRO6. Timely information on the ongoing process	3.10	3.04	0.06	0.575	0.940
	PRO7. Simplicity of documentation	3.45	3.44	0.01	0.912	0.403
Outcome (OUT)	OUT1. Speed of service performance	3.06	3.01	0.05	0.608	0.268
	OUT2. Reliability of service performance	3.11	3.15	-0.04	0.707	0.906
	OUT3. Flexibility of handling different types of cargo depending upon the specific nature and characteristics	3.07	3.06	0.01	0.925	0.629
	OUT4. Ability to provide customized service	3.55	3.37	0.18	0.060	0.062
	OUT5. Ability to provide door-to-door service	3.38	3.48	-0.10	0.325	0.691
	OUT6. Ability to provide warehousing service	3.52	3.41	0.11	0.235	0.684
	OUT7. Ability to provide customs clearance service	3.42	3.56	-0.14	0.143	0.279
	OUT8. Ability to provide insurance service	2.98	3.10	-0.12	0.234	0.180
	OUT9. Ability to provide consolidation service	3.43	3.58	-0.15	0.109	0.380
	OUT10. Shipment safety and security	3.05	3.05	0.00	0.950	0.775
	OUT11. Accuracy of documentation	3.14	3.06	0.08	0.407	0.361
	OUT12. Reliability of booking space	3.47	3.57	-0.10	0.310	0.011*
	OUT13. Competitive price of service	3.49	3.47	0.02	0.857	0.072
Service Costs (COS)	COS1. Reasonable price	3.17	3.56	-0.39	0.000*	0.074
	COS2. Ease of payment	3.26	3.06	0.20	0.060	0.243
	COS3. Appropriate credit term	3.13	2.99	0.14	0.172	0.380
	COS4. Discount offering	3.17	3.40	-0.23	0.019*	0.036*
	COS5. Promotion	3.15	3.49	-0.34	0.000*	0.899
Image (IMA)	IMA1. Being well-known in the industry	3.30	3.25	0.05	0.621	0.875
	IMA2. Reputation for reliability	3.31	3.26	0.05	0.656	0.889
	IMA3. Reputation for quality and customer oriented service	3.30	3.29	0.01	0.988	0.046*
	IMA4. Reputation for corporate social responsibility	3.05	3.07	-0.02	0.874	0.494

* Significant at the 5% level of significance.

Table 2. Continued.

Dimension	Quality Indicators	Mean (Provider)	Mean (Customer)	Mean Difference	P-value (Mean)	P-value (Variance)
Environmental Responsibility (ENV)	ENV1. Practicing the environmentally safe operations (i.e., waste reduction, resource conservation)	3.23	3.25	-0.02	0.862	0.148
	ENV2. Following the international standards on environmental management system (i.e., ISO 14001)	3.35	3.34	0.01	0.928	0.856
	ENV3. Understanding and mitigating the impact of climate change on logistics operations	3.11	3.03	0.08	0.400	0.103
Customer Satisfaction (SAT)	SAT1. Logistics service provided in maritime transport industry meets the customers' needs.	3.35	3.55	-0.20	0.040*	0.279
	SAT2. Logistics service provided in maritime transport industry exceeds the customers' expectations.	3.55	3.38	0.17	0.078	0.011*
	SAT3. Logistics service provided in maritime transport industry is totally satisfied by the customers.	3.45	3.41	0.04	0.665	0.189
Long-term Commitment (LOG)	LOG1. Having a long-term relationship between service provider and the existing customer for the past several years	3.41	3.48	-0.07	0.443	0.521
	LOG2. Keeping up a long-term relationship between service provider and the existing customer at present	3.59	3.56	0.03	0.806	0.351
	LOG3. Planning a long-term relationship between service provider and the existing customer for the next several years.	3.36	3.50	-0.14	0.137	0.251

*Significant at the 5% level of significance.

Accordingly, four items from logistics professional skills, two items from resource, two items from process, seven items from outcome, two items from service costs, one item from image, and one item from environmental responsibility were removed and the exploratory factor analysis was repeated during the purification process. As a result, a total of eight factors with eigenvalues greater than one were emerged from the factor analysis accounting for 76.31% of the total variance and thus could be considered to adequately represent 35 measurement indicators as described in Table 3. Specifically, the exploratory factor analysis identified the six dimensions for maritime logistics service quality and two dimensions for its subsequent impact. These were labeled as follows:

- Factor 1 represents the dimension of outcome consisting of six items: ability to provide customs clearance service; reliability of booking space; ability to provide door-to-door service; competitive price of service; ability to provide warehousing service; and ability to provide consolidation service.
- Factor 2 represents the dimension of process which included five items: simplicity of documentation; effective support of information technology (IT) and electronic data interchange (EDI); personal contact and relationship; timely response to customers' inquiries and request; and accommodating the changes needed by customers.

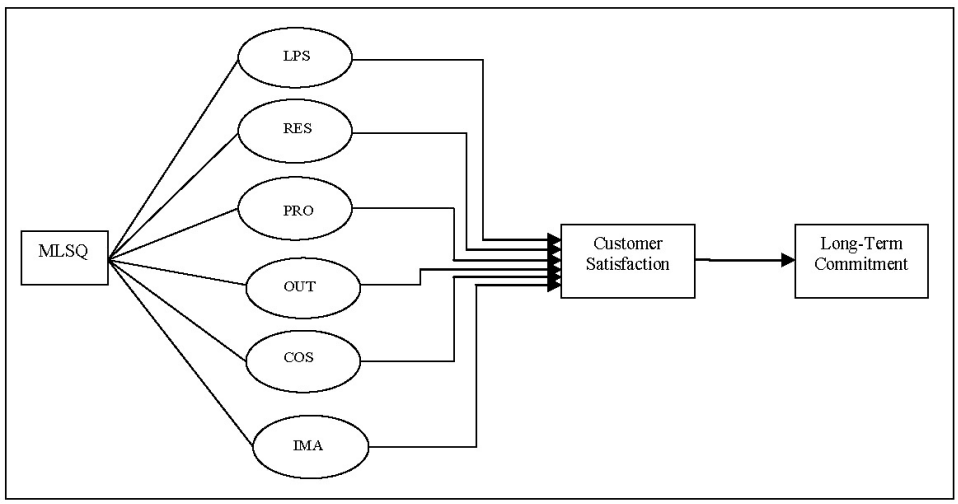
• Factor 3 represents the dimension of image including five items: practicing the environmentally safe operations; following the international standards on environmental management system; reputation for quality and customer oriented service; reputation for reliability; and being well-known in the industry. The first two items were initially identified as indicators for the proposed environmental responsibility dimension. Unfortunately, the dimension of environmental responsibility was failed to extract as underlying factor as proposed. This result is in line with the previous studies of Russo and Fouts (1997), Hunter and Bansal (2006), Walker and Wan (2012), and Amores-Salvado et al. (2014). They stated that the firm's corporate image is closely linked to the perception of its environmental performance especially in environmentally sensitive industries such as energy generation and polluting industries. Therefore, the environmental-related indicators seem to be reasonable enough to represent the underlying factor of image dimension in this research.

Table 3. Exploratory factor analysis and factor loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
OUT7	0.885							
OUT12	0.866							
OUT5	0.865							
OUT13	0.839							
OUT6	0.717							
OUT9	0.712							
PRO7		0.866						
PRO3		0.859						
PRO4		0.844						
PRO1		0.802						
PRO5		0.771						
ENV1			-0.924					
ENV2			-0.905					
IMA3			-0.850					
IMA2			-0.812					
IMA1			-0.796					
COS1				0.906				
COS5				0.896				
COS4				0.882				
LOG3					0.889			
LOG1					0.872			
LOG2					0.859			
RES2						0.844		
RES1						0.839		
RES8						0.837		
RES5						0.822		
RES7						0.808		
RES3						0.771		
LPS1							-0.883	
LPS8							-0.859	
LPS2							-0.774	
LPS6							-0.758	
SAT3								-0.892
SAT2								-0.808
SAT1								-0.578
Eigenvalue	12.713	3.917	2.512	2.139	1.825	1.378	1.223	1.000
Percentage of variance	36.324	11.191	7.178	6.111	5.215	3.938	3.495	2.858

- Factor 4 represents the dimension of service costs consisting of three items: reasonable price; promotion; and discount offering.
- Factor 5 represents the dimension of long-term commitment which included three items: having a long-term relationship between service provider and the existing customer for the past several years; keeping up a long-term relationship between service provider and the existing customer at present; and planning a long-term relationship between service provider and the existing customer for the next several years.
- Factor 6 represents the dimension of resource including six items: supportive regulation; physical infrastructure; knowledge of customer needs and requirements; financial stability; skillful human resource; and equipment and facilities availability (including EDI and internet service).
- Factor 7 represents the dimension of logistics professional skills including four items: ability of managing customer relationship; professional integrity; problem-solving ability; and ability of identifying opportunities and threats.
- Factor 8 represents the dimension of customer satisfaction which consisted of three items: logistics service provided in maritime transport industry meets the customers' needs; logistics service provided in maritime transport industry exceeds the customers' expectations; and logistics service provided in maritime transport industry is totally satisfied by the customers.

Figure 2. Revised model of maritime logistics service quality (MLSQ)



The Cronbach's alpha coefficient and corrected item-total correlation (CITC) were subsequently used to test the reliability of constructs and measurement items extracted (Hair et al., 2010). Satisfactory Cronbach's alpha coefficient were illustrated in Table 4 since all varied from 0.865 to 0.924 which exceeded the cut-off point of 0.70 recommended by Nunnally (1978). In addition, all CITC values were larger than the minimum acceptable value of 0.50. Based on the Cronbach's alpha coefficient

and CITC values, the reliability of all constructs was confirmed. Being a lack of identifying environmental responsibility as one of the underlying factors in the exploratory factor analysis, the conceptual model was revised and in which maritime logistics service quality is specified as a six-dimensional construct as portrayed in Fig. 2.

Table 4. Descriptive statistics and construct reliability values

Construct	No. of items	Mean	Standard deviation	Cronbach's alpha	CITC range
LPS	4	3.37	1.12	0.896	0.742-0.796
RES	6	3.40	1.10	0.924	0.757-0.804
PRO	5	3.41	1.12	0.907	0.734-0.804
OUT	6	3.48	1.11	0.923	0.723-0.809
COS	3	3.31	1.13	0.885	0.764-0.788
IMA	5	3.29	1.15	0.924	0.774-0.835
SAT	3	3.45	1.13	0.881	0.752-0.802
LOG	3	3.48	1.09	0.865	0.737-0.751

4.3 Structural equation modeling (SEM) analysis

The structural equation modeling (SEM) was applied by using LISREL 8.54 to analyze the hypothesized associations among various constructs specified in the revised conceptual model as shown in Fig. 2. In this model customer satisfaction and long-term commitment are both seen as endogenous latent constructs which are influenced by six exogenous latent constructs, namely logistics professional skills, resource, process, outcome, service costs and image. The full model represents an eight-construct with 35-indicator recursive system while input data consist of a covariance matrix based on 540 observations.

Table 5. Measurement model results

Construct	Quality Indicator	Unstandardized factor loading	Completely standardized factor loading	t-value*	R2 (item reliability)	CRa (composite reliability)	AVEb
Logistics professional skills (LPS)	LPS1	1.00	0.88	-c	0.78	0.92	0.74
	LPS8	0.90	0.88	28.35	0.77		
	LPS2	1.01	0.85	26.71	0.73		
	LPS6	0.77	0.82	25.16	0.68		
Resource (RES)	RES2	1.00	0.81	-	0.66	0.94	0.72
	RES1	1.39	0.88	25.01	0.78		
	RES8	1.01	0.84	23.13	0.70		
	RES5	1.26	0.85	23.70	0.72		
	RES7	1.22	0.85	23.81	0.73		
	RES3	1.35	0.86	24.21`	0.74		
Process (PRO)	PRO7	1.00	0.86	-	0.74	0.93	0.71
	PRO3	0.90	0.85	25.44	0.72		
	PRO4	0.81	0.81	23.37	0.65		
	PRO1	0.92	0.90	28.11	0.80		
	PRO5	0.85	0.81	23.41	0.65		
Outcome (OUT)	OUT7	1.00	0.86	-	0.74	0.94	0.71
	OUT12	0.98	0.86	26.37	0.73		
	OUT5	1.01	0.86	26.73	0.74		
	OUT13	0.85	0.87	27.23	0.76		
	OUT6	0.80	0.82	24.36	0.67		
	OUT9	0.79	0.79	22.85	0.62		
Service costs (COS)	COS1	1.00	0.90	-	0.80	0.91	0.77
	COS5	0.92	0.88	27.67	0.78		
	COS4	0.87	0.86	26.76	0.74		

Table 5. Continued.

Construct	Quality Indicator	Unstandardized factor loading	Completely standardized factor loading	t-value*	R2 (item reliability)	CRa (composite reliability)	AVEb
Image (IMA)	ENV1	1.00	0.90	-	0.81	0.94	0.76
	ENV2	1.23	0.91	32.68	0.83		
	IMA3	0.91	0.84	27.16	0.70		
	IMA2	0.79	0.86	28.58	0.73		
	IMA1	0.91	0.85	28.27	0.73		
Customer satisfaction (SAT)	SAT3	1.00	0.81	-	0.66	0.90	0.75
	SAT2	1.03	0.88	24.31	0.78		
	SAT1	1.17	0.90	24.81	0.81		
Long-term commitment (LOG)	LOG3	1.00	0.84	-	0.70	0.89	0.73
	LOG1	0.92	0.85	22.75	0.72		
	LOG2	1.17	0.88	23.47	0.77		

*All factor loadings are significant at $p<0.05$ or better.
aCR = (sum of standardized indicator loadings)2/ [(sum of standardized indicator loadings)2 + (sum of indicator error variances)].
bAVE = (sum of squared standardized indicator loadings)/[(sum of squared standardized indicator loadings) + (sum of indicator error variances)].
c Being a fixed parameter, it is not accompanied by t-value.

4.3.1 Measurement model analysis

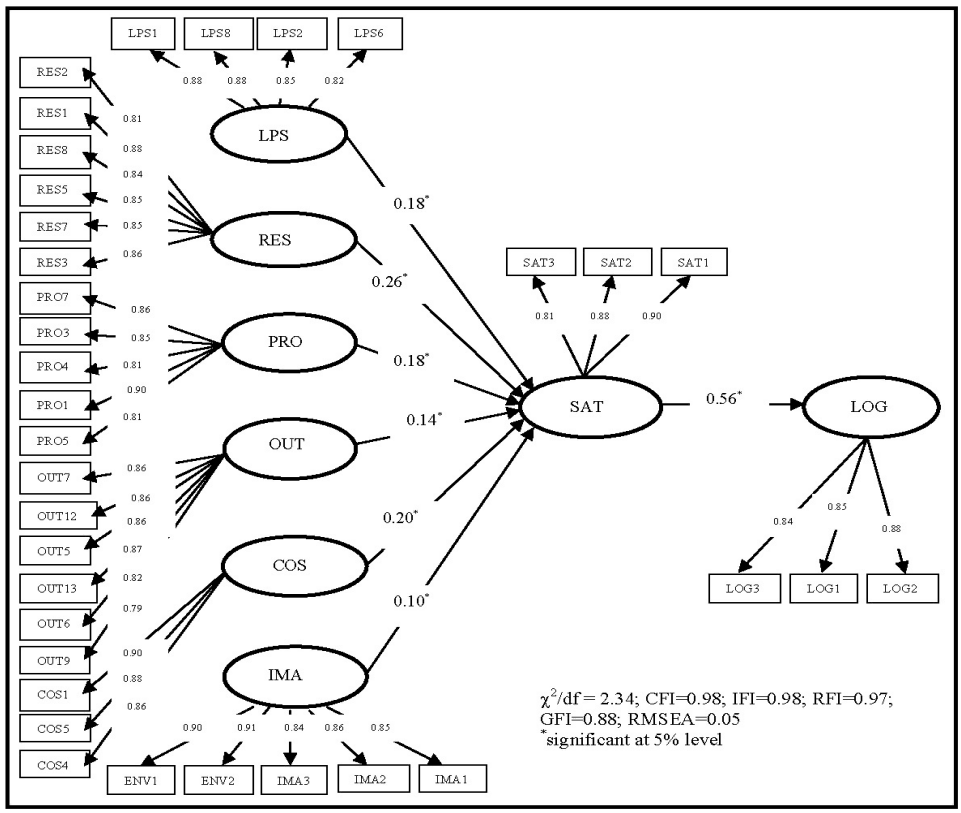
The relationships between latent constructs and their indicators are emphasized in evaluating the measurement part of the model. The analysis of measurement model was conducted to determine the validity and reliability of the measurement indicators used to represent the constructs concerned through assessing the indicator loadings and squared multiple correlations (R2). In this research, all indicator loadings were significant at the 0.05 level of significance, as indicated by t-values well in excess of 1.96 in absolute terms as described in Table 5. This indicates the validity evidence of measurement indicators and thus all indicators were significantly related to their specified constructs. The squared multiple correlation (R2) shows the proportion of variance in an indicator that is explained by its underlying latent construct, and a high R2 value denotes high reliability for the indicator concerned (Diamantopoulos and Siguaw, 2000). Additionally, Bollen (1989) suggested that R2 values above 0.50 provide the evidence of acceptable reliability. It can be seen from Table 5 that all items exhibited an R2 value greater than 0.50 in this research.

Table 6. Discriminant validity analysis

Construct	SAT	LOG	LPS	RES	PRO	OUT	COS	IMA
SAT	0.75a							
LOG	0.29b (0.54)c	0.73						
LPS	0.35 (0.59)	0.10 (0.32)	0.74					
RES	0.35 (0.59)	0.10 (0.32)	0.14 (0.38)	0.72				
PRO	0.28 (0.53)	0.08 (0.29)	0.48 (0.69)	0.07 (0.26)	0.71			
OUT	0.37 (0.61)	0.11 (0.33)	0.18 (0.43)	0.53 (0.73)	0.11 (0.33)	0.71		
COS	0.18 (0.43)	0.05 (0.23)	0.08 (0.28)	0.05 (0.22)	0.07 (0.27)	0.06 (0.24)	0.77	
IMA	0.21 (0.46)	0.06 (0.25)	0.13 (0.36)	0.22 (0.47)	0.08 (0.29)	0.27 (0.52)	0.01 (0.11)	0.76

a: Diagonal value represents the average variance extracted (AVE).
b: Squared correlation (R2).
c: Correlation (R)

Figure 3. Structural equation modeling results



In addition to assessing the reliability of the individual indicators, the composite reliability was used to measure the reliability of each latent construct which is also known as the construct reliability. Since, as presented in Table 5, all the composite reliability values were greater than the minimum cut-off value of 0.7, the latent constructs identified in this model are considered satisfactorily reliable (Diamantopoulos and Siguaw, 2000). The average variance extracted (AVE) was also used to assess the convergent validity of the constructs, and the AVE value larger than 0.50 suggests that a substantially higher amount of variance in the indicators is captured by the construct compared to that accounted for measurement error (Anderson and Gerbing, 1988). The convergent validity was achieved in this research since the AVE values for all of the dimensions were well above the threshold value of 0.50 as described in Table 5. The discriminant validity was further evaluated by comparing the AVE values with squared correlation between constructs. Table 6 indicates the high discriminant validity between each pair of constructs as the AVE for each construct was greater than the standardized squared correlation of the given construct with any other construct in the model, and thus the constructs were considered different from one another (Fornell and Larcker, 1981).

4.3.2 Structural model analysis

The linkages between various endogenous and exogenous latent constructs are focused in evaluating the structural part of the model. Structural model analysis was conducted to determine whether the theoretical relationships specified at the conceptualization stage are actually supported by the data (Diamantopoulos and Siguaw, 2000). Table 7 presents the LISREL results of the goodness-of-fit measures for the model depicted in Fig. 2. The ratio of chi-square (c2) to the degrees of freedom (df) was 2.34 which is less than 3, and is acceptable fit value for the model with relatively large sample (Hair et al., 2010). The other common fit indices such as goodness-of-fit index (GFI), adjusted goodness-of- fit index (AGFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), normed fit index (NFI), incremental fit index (IFI), and relative fit index (RFI) were also evaluated in Table 7, and the model exhibited a fit value exceeding or close to the common threshold for the respective indices recommended in the literature (Bentler and Bonett, 1980; Bentler, 1990; Deng et al., 2010; Hair et al., 2010 and Zhao et al., 2012). Overall, the revised model showed the evidence of a reasonable fit with the data collected.

Fig. 3 further depicts the structural equation modeling testing results for the revised model. All the hypotheses were found to be supported by the data. As summarized in Table 8, all of the six dimensions of maritime logistics service quality: logistics professional skills, resource, process, outcome, service costs, and image had significant positive influence on customer satisfaction. In addition, customer satisfaction was found to have a significant positive effect on long-term commitment of customers to the service offered by the providers. The parameter estimates for all of the structural equations were significant at the 5% significance level since t-value exceeded 1.96 in absolute terms. The squared multiple correlations (R2) for customer satisfaction and long-term commitment were 0.61 and 0.29 respectively. Therefore, 61% of the variance in customer satisfaction was jointly explained by logistics professional skills, resource, process, outcome, service costs, and image whereas 29% of the variance in long-term commitment was accounted for by the customer satisfaction. Additionally, LISREL results showed the significant indirect effects of the six dimensions of maritime logistics service quality on long-term commitment via customer satisfaction as shown in Table 9.

Table 7. Fit statistics for structural equation model

Fit statistics	c2	df	c2/df	GFI	AGFI	CFI	RMSEA	SRMR	NFI	IFI	RFI
Recommended value	-	-	< 3	³0.90	³0.80	³0.90	£0.08	£0.05	³0.90	³0.90	³0.90
Value in the revised model	1261.44	538	2.34	0.88	0.86	0.98	0.050	0.044	0.97	0.98	0.97

The supplementary insights into the relative impact of each dimension on customer satisfaction as well as long-term commitment were gained by looking at the standardized parameter estimates of the respective structural equations. Accordingly, it was found that the dimension of resource had a greatest impact on customer satisfaction as

indicated by largest standardized parameter estimate of 0.26. In contrast, the image has a lowest impact on customer satisfaction as indicated by its smallest standardized parameter estimate of 0.10. Similarly, the resource dimension was found to have the largest standardized indirect effect on long-term commitment as opposed to the image.

Table 8. Hypotheses testing results

Paths	Parameter estimate	Standard error	t-value	Result
H1: Maritime logistics service quality ® Customer satisfaction				
Logistics professional skills ® Customer satisfaction	0.18	0.05	3.80*	Supported
Resource ® Customer satisfaction	0.26	0.06	4.68*	Supported
Process ® Customer satisfaction	0.18	0.04	3.95*	Supported
Outcome ® Customer satisfaction	0.14	0.04	3.42*	Supported
Service costs ® Customer satisfaction	0.20	0.03	6.16*	Supported
Image ® Customer satisfaction	0.10	0.04	2.66*	Supported
H2: Customer satisfaction ® Long-term commitment	0.56	0.05	11.45*	Supported

* Parameter estimate is significant at $p<0.05$ or better.

Table 9. Indirect effect of maritime logistics service quality on long-term commitment

Paths	Parameter estimate	Standard error	t-value	Result
H3: Maritime logistics service quality ® Long-term commitment				
Logistics professional skills ® Long-term commitment	0.10	0.03	3.66*	Supported
Resource ® Long-term commitment	0.15	0.03	4.42*	Supported
Process ® Long-term commitment	0.10	0.03	3.79*	Supported
Outcome ® Long-term commitment	0.08	0.02	3.31*	Supported
Service costs ® Long-term commitment	0.11	0.02	5.60*	Supported
Image ® Long-term commitment	0.06	0.02	2.61*	Supported

* Parameter estimate is significant at $p<0.05$ or better.

5. Conclusion and implications

The purpose of the research mainly included: (1) understanding the concept of maritime logistics service quality, (2) developing and testing the instrument that captures the dimensions of maritime logistics service quality and its concomitant impact, and (3) investigating the relationship between maritime logistics service quality, customer satisfaction, and long-term commitment. Although the maritime logistics service quality was initially conceptualized as seven dimensional construct, the six dimensions consisting of logistics professional skills, resource, process, outcome, service costs, and image, along with the respective reliable and valid measurement indicators were extracted through the exploratory factor analysis. The dimension of environmental responsibility was dropped out during the analysis since all of its proposed measurement indicators significantly represented the image dimension instead, and this finding

ensured the close link between firm's image and its environmental responsible manner while engaging in maritime transport industry of Myanmar. The results of structural equation modeling analysis further indicated that maritime logistics service quality has a significant positive influence on customer satisfaction. In particular, logistics professional skills, resource, process, outcome, service costs, and image were found to impact on customer satisfaction significantly. Among these dimensions the resource has a greatest impact on customer satisfaction followed by service costs, logistics professional skills, process, outcome, and image. The indirect effect of each of these dimensions on long-term commitment via customer satisfaction was also significant.

Additionally, the indicator of "physical infrastructure" was found to be the most important quality indicator for the resource dimension followed by "equipment and facilities availability", "skillful human resource", "financial stability", "knowledge of customer needs and requirements", and "supportive regulation". The most important indicator for the dimension of service costs was "reasonable price" followed by "promotion" and "discount offering". For the logistics professional skills, the most important indicator was "ability of managing customer relationship" followed by "professional integrity", "problem-solving ability", and "ability of identifying opportunities and threats". The most important indicator for the process was "timely response to customers' inquiries and request" followed by "simplicity of documentation", "effective support of IT and EDI", "personal contact and relationship", and "accommodating the changes needed by the customer". For the outcome, the most important indicator was "competitive price of service" followed by "ability to provide door-to-door service", "ability to provide customs clearance service", " reliability of booking space", "ability to provide warehousing service", and "ability to provide consolidation service". Lastly, the most important indicator for the image was "following the international standards on environmental management system" followed by "practicing the environmentally safe operations", "reputation for reliability", "being well-known in the industry", and "reputation for quality and customer oriented service".

It can be inferred from the findings that the sufficient physical infrastructure and proper equipment and facilities play a significance role in delivering effective and efficient maritime logistics service in Myanmar. As a developing country, Myanmar still needs to improve physical infrastructure, skills, experience and knowledge relevant to its local logistics operations as well as successful integration of its logistics service into regional and international logistics network. In this regard, the government's logistics infrastructure development strategy through encouraging private sector participation, for instance, investment in the implementation of Yangon inner harbor development plan; deep sea port projects in the strategic location of country's coastal area, seems necessary for maritime logistics service providers to meet the service level required by their customers. It is also noted that service costs represented by reasonable price; promotion and discount offering is being considered as the traditional fundamental service attribute for maritime logistics service like in other business industries of Myanmar.

Moreover, the strategically important role of logistics professional skills in improving customer care and customer relationship for the sustainable growth of service firms was further acknowledged in Myanmar logistics context. In this regard, the

supportive coordination of United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Myanmar International Freight Forwarders' Association (MIFFA), and Myanmar Maritime University (MMU) to often provide those who work for either public firm or privately-owned firm operating in the maritime transport industry with logistics service training courses under the human resource development programme, would be highly beneficial to their logistics-related professional skills and knowledge improvement.

Further, the government of Myanmar has made an effort to develop the information technology and related infrastructure under the country's national economic development plan these days. Accordingly, the effective support of information technology (IT) and electronic data interchange (EDI) for the electronic communication of customers with service providers and other governmental departments during the service provision would have been increased today than that in the past. The improvement of other process-related indicators and all of the outcome-related indicators can be achieved internally by service providers themselves. In Myanmar, the environmental awareness has now also been raised in various industries though adopting the international environmental management system such as ISO 14001 certification system. This practice of environmental responsibility reflected well the image of service provider as a quality service firm in Myanmar. Overall the findings can assist the logistics service providers in the maritime transport industry in their attempt to improve service quality as a source of sustainable competitive advantage and to generate better solutions for the satisfaction of their customers in order to maintain the long-term commitment.

A number of previous studies attempted to explore the distinct constructs of service quality indicators as useful criteria for either selecting mode and carrier or selecting logistics service providers in specific shipping industry such as container shipping or liner shipping, and tramp shipping. Moreover, the assessment of indicators which constitute the service quality in shipping industry was mostly conducted by the shippers/customers. This research tried to investigate the constructs of logistics service quality indicators which were assessed by both service providers and customers in order to gain a wide and deep insight into composition of logistics service quality of the maritime transport industry as a whole. Accordingly, the model developed and tested in this research is considered to be the valuable academic implication to the literature on logistics service quality in the maritime transport context.

There are also several managerial implications of this research. Firstly, logistics service providers in maritime transport industry can be able to use the quality indicators as guidelines for the improvement in their service performance. Secondly, the managers of the service provider companies can be able to develop research instrument based on the model designed and tested in this research for a survey that produce feedback from their customers on quality of logistics service they provided and thus this would be helpful to managers for devising their service improvement plan. Thirdly, although this research was conducted in a single country such as Myanmar, the results offer insights into which indicators managers of logistics service provider companies need to stress as important ones for the enhancement of customer satisfaction and long-term commitment while improving their logistics service quality.

Despite of the academic and managerial implications, a limitation is also found that since this research was conducted in Myanmar, one of the developing countries, the generalization of the findings beyond the region of Myanmar might be interpreted with caution. Another point one may consider as a limitation is that this research was based on the majority of local service providers and customers. Therefore, if there are substantial numbers of multinational service providers who offer maritime logistics service in Myanmar, further study could be attempted to compare the perceptions of such a quality assessment between local and multinational service providers and customers. The result will then be beneficial to those providers for the better performance of international maritime logistics service in Myanmar. The future research may also conduct using the same instruments on customers and service providers separately, and compare the findings in order to strengthen the validity and reliability of the dimensions and indicators identified in this research.

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A Study on Improving Interconnectivity of Regional Logistics Markets in the Era of the Pan Yellow Sea Region

- From the Perspective of South Korea's Chungnam Province -

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ABSTRACT

Based on changing global economy and logistics environment, this study proposes strategy for regional logistics inter-connectivity improvement in terms of economic utilization of Chungnam Province. The study uses GL Index to find the specialty of logistics flows between Chungnam and China. The results are summarized as follows. First, Chungnam needs to upgrade its sea port functions to be a logistics center for China. Second, it needs to open and extend car-ferry route for China. Third, it should reinforce multi-modal transport system between Chungnam's and China's sea ports in the Yellow Sea Region. Fourth, it needs to establish automobile assembly cluster for China in its sea port hinterlands. Fifth, it needs to attract Chinese enterprises for promotion of supply chain management and so on. South Korean government and its local government should quickly carry out the proposed strategies for promoting its economic growth through positive effects from Chinese economic growth.

Key words: Pan Yellow Sea Region, Chungnam Province, logistics center, Grubel-Lloyd Index, port, business model, supply chain management (SCM)

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1. Introduction

Globalization and intensification of international division of labor in world economy has been accelerating global trade volume expansion. Especially in the Asian region including China, consumer's expansion and increasing demands are expected to keep the growth rate of regional trade market persistently higher.

As the Pan Yellow Sea Region's economy, which includes South Korea's west coast and China's east coast regions, has risen in the 2000s, the weight of China in the world economy is expected to be kept heavier. It is reasonable to predict that South Korea, one of the geographically closest neighbors to China, will be influenced from this effect such as intensification of mutual exchanges. Particularly the Free Trade Agreement (FTA) recently concluded between the governments of the two countries is expected to make the Yellow Sea Region emerge as one of the most important logistics marketx in the Northeast Asian region.

In response to this change, Chungnam Province—located in the closest distance from China's east coast, and in the center of the Korean Peninsula—needs to develop effective strategies for logistical integration with China, which enables various added value creation through trade with China, and which should be based on its geopolitical strengths and well-defined characteristics. In contrast to this necessity, logistics policy conducted at local level has hovered around much limited and conventional activities—for example, improvement of port facilities, expansion of shipping routes, foundation of hinterland logistics centers, and domestically oriented marketing strategies. In order to revitalize port logistics market in the South Korea's central region connecting with China's one, it is essential to conduct more innovative activities such as identification of cargo groups and their related industries based on analysis of cargo movements between foreland and hinterland, and analysis of supply chain management (SCM) flow, which enable cargo groups and industries to be more effectively connected—as prerequisites for precise calculation of suitable facilities and appropriate functions for attraction of foreign enterprises.

Based on this presumption, this study conducts an analysis of regional logistics structure in the Pan Yellow Sea Region, giving attention to recent situation of China's logistics market and its relationship with South Korea's central region. For this purpose, the study adopts Grubel-Lloyd (GL) Index tool, one of the most popular methodologies regarding trade specialization analysis using port traffic data, in order to discover categories of industries capable of added value creation and possibility to interconnect Chungnam Province's logistics system with Chinese one.

By doing so, the study attempts to provide some policy-relevant recommendations for making Chungnam Province a logistics hub toward Chinese east coastal region in the era of the Pan Yellow Sea Region.

2. Theoretical Background and Literature Review

2.1. Definition of "the Pan Yellow Sea Region"

Although the conceptual definition of the "Pan Yellow Sea Region" has not yet fixed in undisputable fashion, but in geographical term, there exists a acceptable consensus. A report recently issued in China (The Organization for the East Asian Economic Development, 2012) puts it as "all of the coastal regions including South Korea's west coast, Japan's southwest coast."[1] Considering focus areas, and for the purpose of research convenience, this study excludes Japan's west coast, while, at the same time, including Chungnam Province (except for Kyeonggi Province) in South Korea, and Chinese Bohai Bay region.

2.2. Logistics Trends in the Pan Yellow Sea Region

2.2.1 Logistics market in China

Based on the 12th Five-year Plan (2011-2015, "12.5 Plan"), PR China has been pursuing balanced developments between urban and rural areas, sustainable urbanization, and logistics modernization simultaneously as its urgent priorities. Whilst not one of the seven strategic investment industries[2], the transport and logistics sector has a huge meaning for the successful achievement of these goals and implementation of the 12.5 Plan itself. Especially for achieving the goal of the balanced urban-rural development, China has adopted urbanization by designation of industrial and/or economic bases at national level, and, to this end, has pursued construction of modern transport and logistics networks.[3]

Between 2006 and 2013, China's total value of its nationwide logistics sector is as shown in the Figure 1. Except for 2009 when global financial crisis dealt a fierce blow, Chinese logistics sector maintained double digit growth in the same period by annual growth rate of 18.7%--mainly due to the increasing demands from industrial sectors and the expansion of domestic retail and consumer markets. In 2013, the total value of social logistics in China increased by 11.6% with RMB 197.8 trillion yuan compared with its previous year. Furthermore, according to World Bank statistics such as Logistics Performance Index (LPI), the overall performance of logistics in China has continuously been improved.[4]

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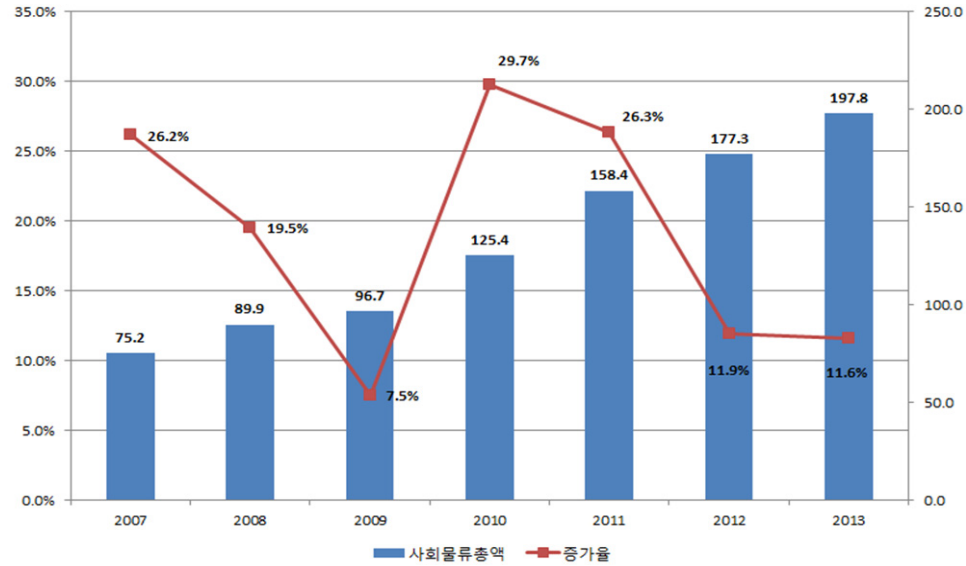
1) DongHyun Lee, Woochul Ahn, "A Study on the Selection of Port Alliances through Analyzing the Container Cargo Flows between Ports in the Pan-Yellow Sea," International Commerce and Information Review, Volume 16, Number 2, March, 2014, p. 159. One the other hand, a OECD report (2009) includes South Korea's south coast (including Ulssan and Busan), and Japan's Kyushu Island (including Fukuoka) and part of Hoshu Island (including Shimonokei).

2) Seven strategic emerging industries (SEIs) includes: energy saving and environmental protection; new generation of information technology; biotechnology; high-end equipment manufacturing; new energy; new materials; and new energy vehicles. Ping Gong and Jessica Wang, "China's 12the Five-Year Plan: An Overview," May 18, 2011.

3) 中央政府门户网站(www.gov.cn),「国民经济和社会发展第十二个五年规划纲要(全文)」, March 16, 2011.

Figure 1. The values and growth rates of social logistics sector in PR China (2006~2013)



Source: National Development Reform Commission.

China's logistics market is expected to continue higher growth rate than those of macro-economic indicators in China's national economy—despite recent slowdown of macro-economic growth rate—mainly led by several factors: the quality improvement of domestic markets, continuation of balanced development, advancement of urbanization that would likely boost construction and social infrastructure sectors. Moreover, Chinese production network has also experienced significant structural changes along with its trade patterns—namely, from "inter-industry trade" to "intra-industry trade." In this respect, the future growth and structural improvement in China's logistics industry should have a significant impact on South Korea's economy, which relies its international trade heavily on China, while, at the same time, playing a crucial role in South Korea's efforts to discover new opportunities of value creation in its international logistics sector.

2.2.2. International logistics system in the Pan Yellow Sea Region

Maritime cargo traffics in the Pan Yellow Sea Region has experienced a persistence increase in recent years, while, at the same time, air traffics did so but in more rapid pace among China, Japan, South Korea, and the ASEAN countries. With heating competition for international logistical hubs in the Northeast Asian region, and as a result, competitions for expansion of sea port and logistical facilities are becoming more fierce.

Competitions for attracting foreign direct investments are accelerating as well.

4) According to World Bank, China's rank in terms of logistics performance has steadily climbed from 30th in 2007 to 24th in 2014. See to The Logistics Performance Index and its Indicators, World Bank. http://siteresources.worldbank.org/TRADE/Resources/239070-1336654966193/LPI_2014_final.pdf

For example, China puts its energy into developing Waigaoqiao Bonded Area in Shanghai sea port, Large and Small Yangshan Hinterland Logistics Complexes, and the Special Economic Zone in Shenzhen. Japan has also been implementing its "Super Hub Port" project, which aims at reducing port costs by 30% and shortening lead time from three or four days this day to approximately one day, by improving the efficiency of port operation.[5)]

Apart from governmental level's efforts, global logistics giants such as DHL and TNT are competitively constructing or planning specialized cargo terminals in major airports in the Northeast Asian region. Global shipping companies are implementing their own strategies for expansion of their logistics services and networks mainly by doing consolidation of their own alliance, introduction of ultra large containerships, and through this way, reduction of ports of call.

On land, designation and construction of free trade zones (FTZs) for improving efficiency of logistical operations and, by doing so, attracting global firms, are increasing in their respective port regions. For instance, since 1990s, China has been running more than 15 free trade zones along its east coast—mostly located in its port regions. Apart from the FTZs, various forms of development zones such as SEZs and Coastal Economic Opening Zones along the China's east coast have been opened or being operated.

2.2.3. Impacts on South Korea in the regional logistics sector

Persistent growth of Chinese logistics market has been, and is being driven by inflows of foreign capital into China as well as by the enormous expansion of its domestic demands. In this respect, South Korean firms, located closely to China, have been accessing to Chinese market. Especially this phenomenon has been consolidated by acceleration of international division of labor, inter- and intra-industry trades, and intensification of supply chain in the manufacturing sector with improved inter-connectivity of China, Japan, and South Korea as its center.

On the basis of 2012, about 4,000 South Korean firms entered into their businesses in China. Among them, manufacturers account for about 80% (3,416 firms), many enough to say that South Korean firms' entry into China has been led mainly by manufacturing sector. Most of the firms headquarter South Korea, and/or have a close business relationship with their homeland.[6)] As the bilateral trade volume increases, interaction of logistical systems across the Yellow Sea is growingly increasing.

As the level of consumption goes up in China's coastal region, wholesalers, retailers, and service providers from South Korea are running into China for finding their business opportunities. Among them, increase of logistics-releting businesses such as distribution, transportation, and warehousing can be seen as a reflection of process that has been reinforced by the increase of merchandise trade and business

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5) The Super Hub Port Project was introduced by the Ministry of Land, Infrastructure, ad Transport, in Japan, in 2004. Six major ports, Tokyo, Yokohama, Nagoya, Yokkaichi, Osaka, and Kobe, were selected as "Super Hub Port." See to Pookong Kee and Hudetaja Yoshimatsu, eds., Global Movements in the Asia Pacific, World Scientific Publishing Co., 2010, p. 292.

6) *Overseas Korean Business Directory: China 2011-2012*, KOTRA, 2012.

partnerships between Chinese and Korean manufacturers. International division of labor accelerates not only in the exchange of varieties of end-products in different industries (inter-industry trade) but also parts and components in the same industry (intra-industry trade), which means the growing importance of international logistic markets between South Korea and China in the Pan Yellow Sea Region. Accordingly, South Korean local governments—especially located in the Pan Yellow Sea Region—need to cope with this importance by making efforts to devise effective and efficient measures to improve the inter-connectivity with Chinese market, and taking up benefits from added value creation.[7)]

2.3. Literature Review

Various researches and studies relating to the Pan Yellow Sea Region have been conducted and produced since the early 2000s when its regional economy has emerged rapidly and its economic integration driven by market forces has been advanced. Most of the researches have a common interest in laying out inter-connectivity and economic cooperation of respective economies between local governments in both sides of the Yellow Sea. On the other hand, Empirical study on the measurement of intra industry trade began in the mid1960s with Balassa(1966) And the most well-known study is Grubel and Lloyd(1975).

A wide array of research outcomes exist in various forms, studies focusing on international logistics sector in the region can be said to be relatively scarce. Through an analysis on the international division of labor structure, Lee S.W. et al(2007) suggests growth directions for sea port hinterland industrial zones in South Korea, but the study does not give much attention to the issue of the growth of international logistics markets reflecting inter-connectivity between South Korea's and China's logistics systems. Kyoung C.S. and Hwang J.H. (2011) attempts to provide estimations over future cargo traffics changes in the region based on the international trade, and from South Korea's perspective. In this study, however, there exists some limitation —especially in terms of comparative analysis focusing Chinese market.

Not only in the logistics sector but also Chungnam Province's status in, and relations with, the Pan Yellow Sea Region, there exists a great deal of insufficiency—in terms of research focus, and in terms of comparisons between research demand and supply.

Yim Y.T. (2013) provides successfully future direction for logistics industry in Chungnam Province, giving attention to the importance of preparations for the era of the Pan Yellow Sea Region. A limitation of this study, however, is that the study focuses on offering complementary measures to reduce problems that South Korea's domestic logistics market faces rather than highlighting the inter-connectivity of logistics systems across the Yellow Sea. In the case of Lee D.H. and Ahn W.C. (2014), whilst the authors do successfully select target ports for "strategic alliance" in the region, the study has a relative lack of discussions on the issue of establishment

7). Sungwoo Lee et al., A Study on Strategies for Attraction of Foreign Enterprises, Korea Maritime Institute, 2007, pp.304~306.

of more concrete implementation strategy for cargo traffic attraction—especially considering import/export goods produced by manufacturers located in port regions and its linkage with cargo traffic attraction.

Table 1. Selected studies on the Pan Yellow Sea Region

Author(s)	Main research subject
Balassa (1966)	First proposed the index of intra industry trade that measured the degree of trade overlap using the import and export values
Grubel and Lloyd (1975)	Proposed an improved index, Grubel-Lloyd index can calculate a value/weight to measure the degree of intra industry trade of the Country level
Lee Sungwoo et al (2007)	Suggestions for growth direction of South Korea's hinterland industrial zones through analysis on the international division of labor among South Korea, China, and Japan
Gyeonggi Research Institute(2008)	Suggestions for the economic cooperation in various economic areas including industry and international trade sectors, focusing on cooperative and complementary roles between South Korea's west coast and China's east coast regions.
Kim Kunsoo, Kang SeungWoo (2008)	Economic cooperation among local governments in the Pan Yellow Sea Region
Han Jiyoung et al (2010)	Analysis on Networks between China's three core economic regions (Bohai Rim, the Yangtze River Delta Region, et.) and South Korea's west coastal region. Suggestions for linkages of multi-modal transport systems (rail and shipping) and joint development of relevant infrastructure (SOC) between China and South Korea
Kyung Jongsoo, Hwang Jeonghyeon (2011)	Suggestions for laying out logistics networking strategies reflecting transport system, distribution system, industrial development level, and other economic condition in Chungnam Province, and linking it with the Pan Yellow Sea Region economy
Yim Yongtae (2013)	Future-oriented development strategies for logistics sector in Chungnam Province preparing for the era of Pan Yellow Sea Region
Yeo Kitae et al (2013)	Analysis on port competition in the Pan Yellow Sea Region by introduction of Hirschman-Herfindahl Index for anlysizing port concentration and dispersion in the region
Lee Donghyun, Ahn Woochul, (2014)	Selection of strategic alliance target ports by analysis on container traffic flows of Pyongtaek, Dangjin, Incheon, Gwangyang ports to/from other major sea ports in the Pan Yellow Sear Region

In order to reduce such limitations, this study attempts to provide suggestions for development of international logistics hub as well as for the improvement of inter-connectivity between Chungnam Province—a core sub-region located in South Korea—and Chinese west coast region.

3. Analysis of logistics potential in the Pan Yellow Sea Region

3.1. Cargo traffic volume analysis: Chungnam Province-China

3.1.1. Major Import/Export Goods(value, weight)

As seen in Table 3, goods ranked as the top 20 (on the basis of weight and the HSK 2 digits) account for a range of 95-97% in total import/export goods of Chungnam Province to/from China in terms of value and weight. Compared with the fact that the top 20 goods account for a range of 74-91% at national level, this statistics obviously shows that the Chungnam Province relies its total goods trade with China heavily on a relatively small number of goods.

According to the statistics, in the years from 2008 to 2012, the total amount of value in Chungnam import/export from/to China has been gradually increasing, but the total amount of weight, decreasing[8]. In the year of 2012, on the basis of the HSK[9] 2 (digits), and import/export weights, organic chemicals (Code: 29) ranked as the top and followed by "Mineral fuels, mineral oils, mineral waxes, and bituminous sub"(Code: 29), "plastics and articles thereof"(Code: 39), "iron and steel"(Code: 72), "salt, sulfur, earth & stone, lime & cement"(Code: 25).

In the list of the "Top 5" articles, "Mineral fuels, mineral oils, cokes, mineral waxes", which has once ranked as the top 1st in 2008 by 7.62 million M/T (weight), has gradually reduced its traded weights to 1.45 million M/T in 2012. On the other hand, "organic chemicals," which have shown a slow upward trend in the trade with China, have eventually reached the highest rank.

The total amount of value of the top 20 articles classified by HSK 2 in 2012 increased from USD 19.3 billion dollars to USD 29.0 billion dollars, but the total weights decreased from 13.42 million M/T to 6.48 million M/T in the same period. From the overview of the top 20's ranking change above, which account for overwhelming majority of the total cargo traffics, it can be found that Chungnam Province's trade pattern with China has moved with a direction of traded cargo volume reduction but expansion of value amounts. A similar pattern or trend can be found in the international trade between South Korea and China at national level—conspicuously with a huge reduction of mineral fuels in terms of import/export volume (particularly import from China), which is usually seen as "lower added value." The outcome of this overview means the necessity of additional research efforts such as cause

8) The total import/export value increased from 19.9 billion dollars in 2008 to 29.9 billion dollars. On the other hand, the total volume decreased from 14.08 million M/T to 6.66 million M/T during the same years.

Harmonized System (HS) is the acronym of "Harmonized Commodity Description ad Coding System" adopted by an international convention (shortly referred to the "HS Convention") in 1988. The objective of the HS is to promote the international trade by harmonizing commodity and products classification systems with a six-digit code system for classifying traded goods, and keep coherency of tariff rates. The HS is widely used in various areas such as tariffs, trade statistics, transportation, and insurance. The HSK ("Harmonized System of Korea) is the Korean variation, which uses basically 6 digits code but, in case of necessity, 10 digits to specification.

analysis on factors impacting on rapid decrease of the traded cargo volume, which must be instructive to develop new business models for additional cargo creation, and attract new enterprises for added value creation from the perspective of international logistics inter-connectivity.

Table 2. Major import/export goods of Chungnam Province and China (value, weight)

(Unit: USD Million, M/T)

Rank (weight)	HSK 2	Article(s)	2008		2012	
			value	weight	value	weight
1	29	organic chemicals	1,942	1,625,348	3,320	2,379,203
2	27	mineral fuels, oils, wax & bituminous sub	2,175	7,623,455	1,417	1,454,133
3	39	plastics & articles thereof	984	562,904	1,275	645,277
4	72	iron and steel	556	634,371	423	535,663
5	25	salt, sulfur, earth & stone, lime & cement	38	229,322	77	468,386
6	68	articles of stone, plaster, cement, asbestos, mica or similar materials	40	120,398	42	133,045
7	28	inorganic chem., org/inorg compounds of precious metals, isotopes	141	79,121	188	105,819
8	90	optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments & accessories	3,931	44,410	7,616	89,906
9	87	vehicles other than railway or tramway rolling stock	209	34,353	869	79,779
10	26	ores slag & ash	-	-	3	77,874
11	85	electrical machinery & equip, & parts, telecommunication equip., sound	3,385	64,553	11,073	76,063
12	84	nuclear reactors, boilers, machinery & mechanical appliances, computers	1,029	47,730	2,292	73,210
13	48	papers & paperboard, articles of paper pulp	47	48,164	58	58,561
14	69	ceramic products	13	24,106	43	57,586
15	73	articles of iron or steel	65	40,501	93	55,518
16	31	fertilizers	42	95,906	25	55,296
17	38	miscellaneous chemical products	78	69,153	78	45,312
18	23	residues from food industries, animal feed	27	99,779	11	33,354
19	76	aluminum & articles thereof	20	4,900	100	30,800
20	7	edible vegetables	9	16,397	17	27,398

Source: Korea International Trade Association (KITA), 2013
Note: 1) weight unit as 1,000kg equals 1 ton

3.1.2. Major import/export goods (G/L Index)

Usually, intra industry trade is shown as the simultaneous export and import value in the same industry. As described before, Balassa (1966) first proposed the index of intra industry trade and Grubl-Lloyd (1971) developed the methodology.

The Grubl-Lloyd (1971) index measures intra industry trade of a particular product. The formula is as follows:

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i} = 1 - \frac{|X_i - M_i|}{X_i + M_i} \quad ; 0 \leq GL_i \leq 1$$

If GL*i*= 1, there is only intra-industry, no inter-industry trade.

This means for example the Country in consideration Exports as same quantity of good *i* as much at it Imports.

Conversely, if GL*i* = 0, there is no intra-industry trade, only inter-industry trade. This would mean that the Country in consideration only either Exports or only Imports good *i*.

As shown in the Table 4, G/L Index values of major import/export goods (on the basis of HSK 2 and weight) are respectively as follows: “iron and steel” ranks the 4th by 0.706, “salt, sulfur, earth&stone, lime&cememt” ranks the 5th by 0.800, “inorganic chem., org/inorg compounds of precious metals, isotopes” ranks the 7th by 0.742. “ores slag and ash” ranks 10th by 0.588. Among others, “electrical machinery&equip, & parts, telecommunication equip, sound” (G/L Index value: 0.972), “nuclear reactors, boilers, machinery & mechanical appliances” (G/L Index value: 0.676), and “papers & paperboard, articles of paper pulp” (G/L Index value: 0.901) marks values higher than 0.5 in G/L Index terms.

Meanwhile, “aluminum & articles thereof,” which marked G/L Index value 0.571 (on the basis of weight) in 2008, began to go down lower than 0.5, and eventually marked 0.307 in 2012. In the case of “mineral fuels, oils, wax & bituminous sub,” the G/L Index value in Chungnam-China scores less than 0.5, contrasting with that of South Korea-China (G/L Index value: more than 0.5) at national level.

Table 3. Major import/export goods of Chungnam Province and China (G/L Index)

(Unit :USD million , M/T[1])

rank (weight)	HSK	Articles	2008		2012	
			value	weight	value	weight
1	29	organic chemicals	0.088	0.034	0.071	0.015
2	27	mineral fuels, oils, wax & bituminous sub	0.972	0.498	0.130	0.130
3	39	plastics & articles thereof	0.132	0.042	0.118	0.071
4	72	iron and steel	0.540	0.499	0.771	0.706
5	25	salt, sulfur, earth & stone, lime & cement	0.947	0.863	0.831	0.800
6	68	articles of stone, plaster, cement, asbestos, mica or similar materials	0.450	0.222	0.381	0.091
7	28	inorganic chem., org/inorg compounds of precious metals, isotopes	0.610	0.836	0.574	0.742
8	90	optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments & accessories	0.012	0.040	0.035	0.060

rank (weight)	HSK	Articles	2008		2012	
			value	weight	value	weight
9	87	vehicles other than railway or tramway rolling stock	0.478	0.324	0.136	0.155
10	26	ores slag & ash	-	-	0.667	0.588
11	85	electrical machinery & equip, & parts, telecommunication equip., sound	0.318	0.975	0.127	0.972
12	84	nuclear reactors, boilers, machinery & mechanical appliances, computers	0.301	0.932	0.156	0.676
13	48	papers & paperboard, articles of paper pulp	0.809	0.895	0.897	0.901
14	69	ceramic products	0.000	0.006	0.047	0.006
15	73	articles of iron or steel	0.462	0.329	0.581	0.320
16	31	fertilizers	0.000	0.001	0.000	0.001
17	38	miscellaneous chemical products	0.718	0.175	0.795	0.181
18	23	residues from food industries, animal feed	0.000	0.002	0.000	0.006
19	76	aluminum & articles thereof	0.700	0.576	0.540	0.307
20	7	edible vegetables	0.000	0.002	0.000	0.000

Source: Korea International Trade Association (KITA), 2013

Note: Leaned mark shows the articles' G/L Index value is more than 0.5 only in the Chungnam-China trade. Articles scored G/L index more than 0.5 in the table are included in the top 20 traded goods (on the basis of weight) in South Korea-China trade. Underlined articles are less than 0.5 of G/L Index in Chungnam-China trade but more than 0.5 in South Korea-China trade. Bold marked articles are more than 0.5 of G/L Index on both bases of value and weight.

The articles such as "iron and steel," "salt, sulfur, earth & stone," "inorganic chemicals," "ores slack" show their characteristics as intra-industry trade goods stronger in Chungnam region than in others. Accordingly, it can be interpreted that, in the case of Chungnam region, processing industries using iron&steel, and nonferrous minerals (demanded for mid- or lower technological level) as well as chemical industry (demanded for mid- or higher technological level) would be more relatively favorable for international division of labor. In contrast, "organic chemicals," "plastics," "articles of stone, plaster, cement etc." show their characteristics as inter-industry trade, despite larger creation of trade volume.

Therefore, it is reasonable to say that, in order to capture more opportunities for continuous cargo volume creation and at the same time, intensification of international division of labor, the Chungnam Province needs to invigorate the industries having stronger traits of intra-industry trade. Particularly, the industries related to the articles with higher scores in G/L Index in both aspects of value and weight such as "iron and steel," "salt, sulfur, earth & stone," and "inorganic chemicals" can be said to have relatively greater ripple effects on Chungnam Province's domestic economy. In addition, in order to establish more concrete strategies, Chungnam Province needs to select sub-articles in the relevant classifications to bring up strategic industries, and pursue upgrading of industrial level in order to make added value creation possible.

3.2. Analysis of trade structure and selection of prospective businesses

Considered from the analysis of the trade structure with China and its own industrial structure as shown above, the most prospective industry with huge potential would be the electrical machinery manufacturing industry, which has a close relationship with the article of "electrical machinery & equip, & parts, telecommunication equip., sound." Having its characteristics as intra-industry trade stronger, in the basis of weight, G/L Index value of "electrical machinery & equip" approaches closely "1" by the value of 0.972. In fact, the electronics industry is employing the largest bulk of labor force in Chungnam Province's manufacturing sector. Its employing rate is 20.38% of the total employment in Chungnam region. Along with this, and from the perspective of trade value amounts, the industry represents the largest in Chungnam Province's trade with China.

The electronics industry has a great influence on the regional economy in Chungnam region. A close examination into the import/export structure of this article ("electrical machinery & equip") between the Chungnam Province and China enables this argument to be more persuasive. The import weights of the article by Chungnam are larger than its export weights to China, but the value amounts of export are larger than those of import. This means that Chungnam imports the article at a lower cost (which is produced at a relatively lower skill level), while exporting the article at a higher cost (after processing and/or producing it at a relatively higher skill level).

The article "iron and steel" (G/L Index value 0.706 on the basis of weight) has a significance in Chungnam region's international logistics as well. Metal related industries in Chungnam region show higher employment shares. The number of labor force employed in metal processing industry (except for machinery and appliance), in the primary metal industry, and in non-metallic industry account respectively for 5.92% (12,952), 5.73% (12,537), 5.32% (11,625) in the total employment of Chungnam Province. From the G/L data review above, it can be concluded that these industries have the potential for additional creation of cargo volume and for a ripple effect on the regional economy (job creation and increase of income). Imported iron and steel can make additional cargo creations in the aspect that the commodity is being demanded by other connected industrial sectors such as follows: "cars and trailers" (employs 14.71% of total labor force in Chungnam's manufacturing sector), "other machinery and equipment" (employs 8.84%). Therefore, Chungnam region can conceive a business model following three steps: a. it imports mid- or lower quality of iron and steel needed as semi-products; b. it restructures and upgrades its iron and steel-related industrial group(s); c. the upgraded industries produces higher-quality steel products by processing the imported commodities. In this case, however, further studies—ranging from import to export, still to distribution, will be needed for a more plausible business model.

The commodities "salt, sulfur, earth&stone, lime&cement" (G/L index: 0.800), "inorganic chemicals, precious metals etc." (G/L index: 0.742) deserves much attention from the revitalization of Chungnam region's international logistics, and its improvement of inter-connectivity.

In the aspect that the "non-metal mineral product" industry employs 11,625 (5.23% of the total employment)[10], "chemicals and products" (except for medicine) employs 11,168 (5.11%)',[11] these industries can be seen as closed inter-connected with the regional economy in Chungnam Province. The article "papers, paperboards, pulp etc.," which has the G/L Index 0.901 (on the basis of weight) is worthwhile to be considered, in the sense that the article has a close relationship with pulp industry, printing, and document copying industry, showing its characteristics as intra-industry trade goods.

In short, Chungnam Province needs to encourage added value creation activities by selecting industries that have been vibrantly achieving international division of labor with China as priority, and with consistent efforts for improving their technological capacities.

4. Conclusion and Recommendations for Chungnam Province

The emergence of the Pan East Sea Region and the maturation of regional economy in the Pan Yellow Sea Region are expected to be the key driving force in growth and expansion of global logistics market. Especially the international logistics market in the East Asia is expected to continue its rapid economic growth mainly due to stunning pace of growth in intra-regional trade mainly led by three relationships such as China-Japan, China-Korea, Korea-Japan—despite that China's dependency on Korea and Japan has continuously decreased since the 1997 Asian Financial Crisis. Accordingly, the question of how to utilize Chinese market and gain benefits will be a daunting task in terms of expansion of logistics market share from South Korea's perspective.

From this point of view in general, but from the perspective of Chungnam Province, which is located in central part of South Korea, this study suggests measures for profit maximization by improving logistical linkage with Chinese west coast. To this end, the study introduces G/L analysis to understand international trade pattern and structure between Chungnam and China more precisely, and then, suggests path-ways to work for Chungnam Province in terms of reinforcement of value chain in international logistics system between Chungnam and China.

In order to become a critical logistical hub toward China, it is essential for Chungnam region to improve various kind of logistics infrastructure including port facilities, transport infrastructure such as roads and railways connecting ports and industrial parks, logistical centers, and cargo terminals. Based on these improvements, Chungnam needs to select and rear the industries that have great potential for continuous cargo creation, job creation, a ripple impact, and for growth of domestic economy. In order to address these tasks, Chungnam region might needs to have strategies

10) *Statistical Yearbook 2012 (52th edition)*, Chungnam Province, 2013.
11) Abid.

as follows:

First, in order to become a significant logistical hub, Chungnam needs to upgrade its ports capacity. A central element for this goal is to make appropriate port hinterland, which is focused as a foundation for cargo creation, added value activities, and job creation. Dangjin and Daeshan Ports need to secure their own hinterlands suitable for their regional industrial structure and capable of inviting various kinds of enterprises.

Second, establishment and expansion of car-ferry route to China will be needed. Chungnam has already prepared for shipping route to China with port development—targeting Daeshan Port. General shipping route, however, in this case, Chungnam is situated in more interior position. In contrast, the car-ferry route will be more competitive in the sense that there exist little competition frequency, and that the car-ferry route is easily connected with the industrial condition in Chungnam region. If the car-ferry route established, the rout will compete for market share with the existing Incheon and Pyongtaek Ports in Gyonggi Province, but these rival ports has car-ferry routes linked to China's northeast region such as Shandong, Tianjin, and Dalian. If the car-ferry route connected to southward the Shandong Province such as Yanyunjiang (Jinagsu), Shanghai, Ningbo (Zhejiang), Chungnam can gain competitiveness, avoiding fierce competitions with other Korean ports. As shown in the analysis above, electronics that Chungnam has comparative advantage can find the opportunities for cargo creation, mainly because the majority of commodities—especially electronics and electrical goods—is using the existing car-ferry route.

Third, Chungnam needs to improve its inter- and multi-modal transport capacity-especially focusing on expansion of trucking with China. As mentioned above, trailers' access by trucking to Jiangsu, Shanghai, and Zhejian regions can improve the accessibility and stability of Chungnam ports, and as a result, can contribute to enhancement of their port competitiveness. The one important aspect that deserves attention is that trucking cargoes in Northeast Asian countries are the same with the cargoes produced in port regions of Chungnam Province—electronics and electrical appliances etc. These cargoes have a great significance to inter-connect forelands and hinterlands.

Fouth, automobile industry related cluster—especially parts production needs to be established behind the logistical hub. Pyongtaek and Dangjin Ports have already played their role as export base of Korean cars to China as well as import base of foreign cars. Significant operations regarding the business are, however, run in terminals in Pyongtaek Port. In order to re-balance the car trading industry at national level, and improve Dangjin Port's functions, Chungnam needs to consider the establishment of car parts cluster between its Dangjin Port and Pyongtaek Port.

Fifth, supply chain between Chungnam region and China should be reinforced by the efforts to attract Chinese enterprises into Chungnam coastal regions. Establishment of seamless supply chain is essential for consolidation of international division of labor. Chungnam Province is no exception. The formation of parts production in China and final goods in Chungnam should be compensated with reverse formation—parts production in Chungnam and final goods in China if the Chungnam pursue for logistical hub in the Pan Yellow Sea Region. It is because the formation and reverse formation will help Chungnam's ports to increase cargo creation. For inviting

Chinese companies, Chungnam needs to make business and profit models considering costs and benefits, and time and distance.

Sixth, contemporary logistics emphasized seamless flows of goods as well as information. Chungnam Province needs to consider the establishment of cyber trade market, which might consist of, and link with exporters, manufacturers, mid- and small-size production associations, distribution networks in China. The cyber trade market will facilitate movements of cargoes between Chungnam region and China, and more importantly, begin to use the ports and logistics companies in Chungnam region.

Seventh, for becoming a major logistics hub, Chungnam needs to consider networking of logistics in China. Apart from attraction of Chinese firms and cargo invitation efforts, aggregation of cargoes toward Chungnam in China, and to this end, the establishment of joint logistics centers in China has a great necessity, especially considering inbound/outbound logistics. The logistics center which will be established, and operated by Korean firms jointly, will offer the opportunity of sharing information needed to link it with operations and management of logistics facilities located in Chungnam for efficient supply chain management and demand forecasting.

This study aims to propose the benefit maximization strategies for Chungnam Province mainly by linking its logistics system with Chinese one, and by utilizing the wave of China's economic rising in the Pan Yellow Sea Region. The study, however, needs complementary research efforts—for example, application of econometric analysis method to remove its weakness that was mainly created by its heavy dependence on the G/L analysis. It will be also necessary to expand spatial research sphere beyond Chungnam Province into the entire South Korean west coast region, and introduce a more comprehensive approach for suggestions over the issues of international value chain integration and regional logistics integration and inter-connection between South Korea and China.

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Traffic Model Based Optimization of Dredging Plan: Yangon River Channel

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ABSTRACT

The paper presents about the simulation based optimization of channel dredging plan. Yangon River channel is used as the research object. Firstly the realistic traffic simulation model of the channel in its current situation is developed with Arena simulation software. Then the model is executed in several assumptions of different available channel depths. Among the several outputs, average port time generated from each scenario is used as the optimizing parameter. Assumptions considered are 0.5 meter, 1.5 meter and 2 meter channel deepening with 10 years, 15 years and 20 years growth rate respectively. The minimum of the summation of average port times for all deepening assumptions is used as the objective function. Decision parameter here is simply yes or no; if deepening work should be commenced within the intended time interval the answer is yes and otherwise the answer is no. With this optimization model, this study answers which deepening assumption should be carried out in which time interval for the optimal port time.

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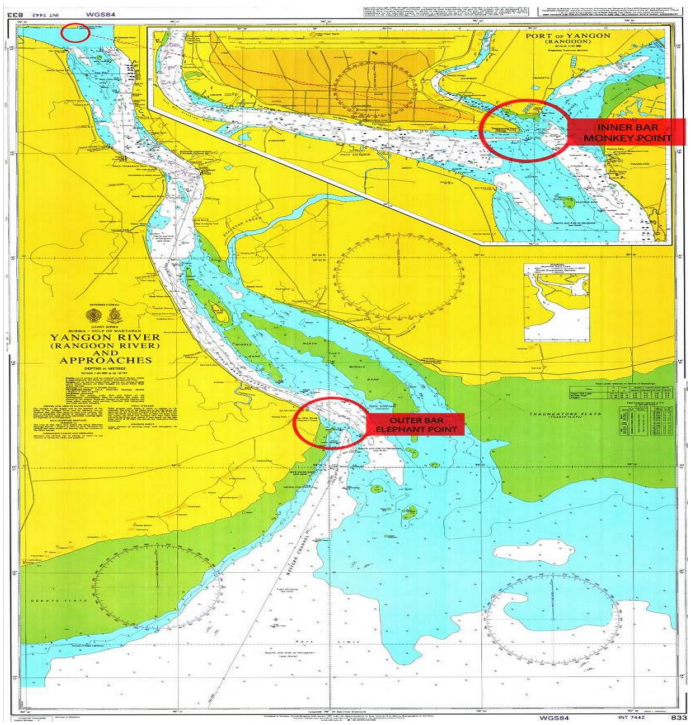
1. Introduction

The Port of Yangon is the premier port of Myanmar and handled about 90 % of the country's exports and imports [Myanmar Port Authority (2014)] and the country international trade is growing rapidly. To cope with the growth of seaborne cargo traffic and to lessen the logistics cost in maritime trade by providing accessibility for bigger vessels to the ports, Myanmar Port Authority (MPA) is taking initiatives to improve the Yangon River access channel, while development of Thilawar Port is a key solution [Min and Kudo (2012)]. In improving the access channel, dredging the two sand bars shown in Figure 1 is the main task and this study investigate the optimal dredging plan to deepen the available channel depth at these designated bars namely Outer Bar and Inner Bar.

Figure 1. Locations of the two Bars



2. Trade and Vessel Traffic and Developing Trend

The following data of annual import, export and number of vessel calls to Yangon port from 2001 to 2010 shown in Table 1 is available with the merit of Myanmar Port Authority. On these data, linear regression analysis is made and trade and vessel traffic growth for Yangon River channel is forecasted up to Year 2030 and shown

in Table 2. This work has been already published in the Journal of International Academic Research for Multidisciplinary (JIARM) with the title “Forecasting the International Trade and the Ship Arrival Rate for Yangon Port” [Win and Xiao (2013)].

Table 1. Current amount of annual import, export and vessel calls to Yangon port (2001 to 2011)

Fiscal Year	Number of Vessel	Import (Metric Tonnage)	Export (Metric Tonnage)	Total (Metric Tonnage)
2000-01	915	4381934	6286311	10668245
2001-02	915	4978070	5201138	10179208
2002-03	1188	4834614	6005218	10839832
2003-04	1045	4609417	5190954	9800371
2004-05	1517	4773347	5207580	9980927
2005-06	1252	4724960	5513755	10238715
2006-07	1219	5332093	5622693	10954786
2007-08	1529	5619362	6240124	11859486
2008-09	1739	6165473	6150475	12315948
2009-10	2016	6655370	9492079	16147449
2010-11	2155	6131245	12307396	18438641

Table 2. Forecasted annual import/export and vessel calls (2011 to 2030)

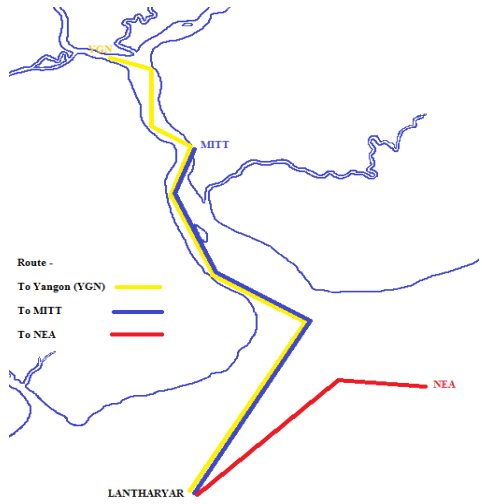
Fiscal Year	Number of Vessel	Import/ Metric Ton	Export/Metric Ton
2011-12	2113	6492915.07	9395342.8
2012-13	2231	6693160.24	9851873.83
2013-14	2348	6893405.40	10308404.85
2014-15	2466	7093650.56	10764935.88
2015-16	2583	7293895.73	11221466.91
2016-17	2701	7494140.89	11677997.94
2017-18	2818	7694386.05	12134528.96
2018-19	2936	7894631.22	12591059.99
2019-20	3053	8094876.38	13047591.02
2020-21	3171	8295121.55	13504122.05
2021-22	3288	8495366.71	13960653.07
2022-23	3406	8695611.87	14417184.10
2023-24	3524	8895857.04	14873715.13
2024-25	3641	9096102.20	15330246.15
2025-26	3759	9296347.36	15786777.18
2026-27	3876	9496592.53	16243308.21
2027-28	3994	9696837.69	16699839.24
2028-29	4111	9897082.85	17156370.26
2029-30	4229	10097328.02	17612901.29

3. Modeling vessel traffic and verification of the model

Simulation is the process of designing a model of a real or imagined system and conducting experiments with that model. The purpose of simulation experiments is to understand the behavior of the system or evaluate strategies for the operation of the system [Roger (2000)]. Simulation modeling is a common paradigm for analyzing complex systems. In a nutshell, this paradigm creates a simplified representation of a system under study. The paradigm then proceeds to experiment with the system, guided by a prescribed set of goals, such as improved system design, cost–benefit analysis, sensitivity to design parameters, and so on [Tayfur and Benjamin (2007)]. In classical thinking there are three types of simulation; discrete event, continuous, and Monte Carlo [Mike and AZ (2010)]. The majority of modern computer simulation tools (simulators) implement a paradigm, called discrete-event simulation (DES). Arena is discrete event simulation and automation software developed by Systems Modeling and acquired by Rockwell Automation. It uses the SIMAN processor and simulation language. In this study, Arena simulation software is used for modeling the vessel traffic in Yangon River channel.

The main goal behind the model development is to constitute an accurate platform to study key issues regarding the Yangon River channel's operation. The detailed simulation model of the vessel traffic in Yangon River channel is developed for the whole channel from the Pilot Station (Lantharyar Fairway) where embarkation of pilot is took place for navigation of the vessel along the channel to the inner most Port of Yangon (Inner Harbor). Three designated routes of Lantharyar Fairway to Inner Harbor, Lantharyar Fairway to Outer Harbor (Myanmar International Terminal, Thilawar (MITT)) and Lantharyar Fairway to NEA are consider and applied in the model. To develop the simulation model, Arena 14.5 of Training & Evaluation Mode (Student) version simulation software is used. Figure 2 illustrates the designated routes.

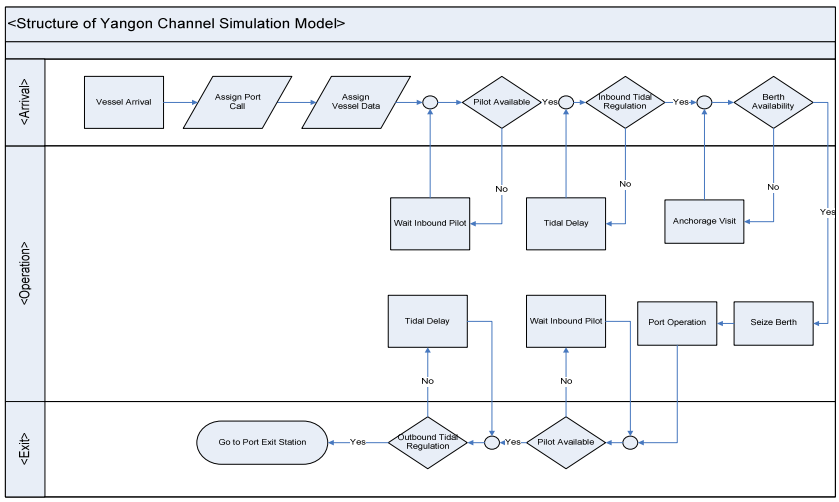
Figure 2. Main routes in Yangon channel



3.1 Model structure and development

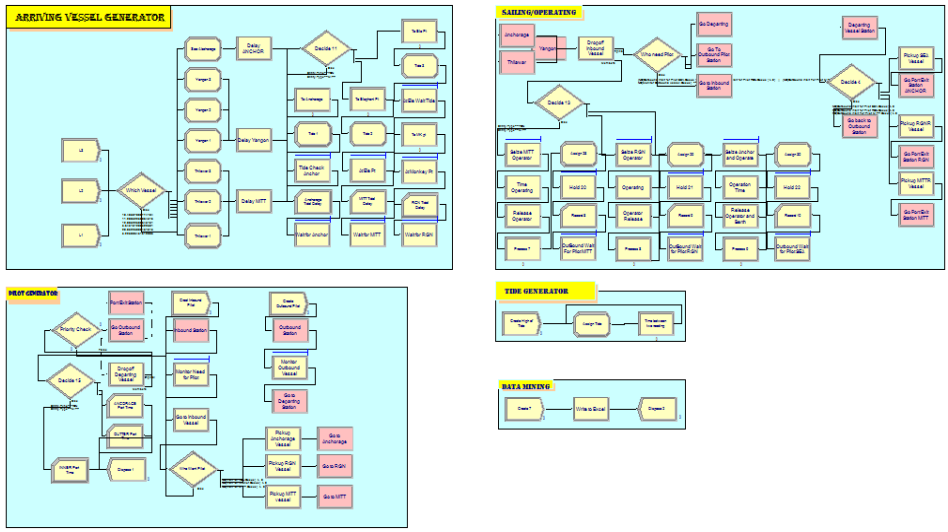
Figure 3 illustrates the structure of the simulation model. The figure is comprised of three segments. The top and the bottom segments show the procedure flows of arrival and exit whereas the middle segment depicts the processes and delays in the port system. Arriving vessel would be generated by randomized vessel arrival generator and the generated vessel would be assigned its particulars and designated port with fixed distribution pattern upon its arrival. After all necessary particulars have been assigned; the vessel would be treated with the inbound tidal regulation in accordance with the time of the tide generated from the tide generator. When the tidal regulation permits, the available pilot will bring the vessel and send to the designated terminal in accordance with the navigation rule and terminal reservation. At the terminal, the vessel is allowed to commence its port operation and after the operation has finished, the vessel would be treated again with outbound tidal regulation and the available pilot will serve the vessel with the same procedure as inbound process and send it back to the port exit station, then the vessel exit from the system. All the statistics regarding with the vessel in system would have been tracked and recorded in the system. The same procedure is applied to all vessels.

Figure 3. Structure of simulation model



Components include in the model are vessel arrival generator, pilot generator, sailing & port operation and tide generator. Detail vessel movement data for three routes namely Line 1, Line 2 and Line 3 have been survey for one month on August, 2012 and historical data of 2001 to 2013 are obtained from MPA and properly applied in the model. The simulation model involves all vessel calls, their drafts and GRT, arrival patterns, terminal operation, anchorage holding and delay, and also incorporates all the tidal activity and navigational rules as explained in "General Information on Ports and Shipping in Myanmar" [Logistics Cluster (2014)]. The high level view of model logic is shown in Figure 4.

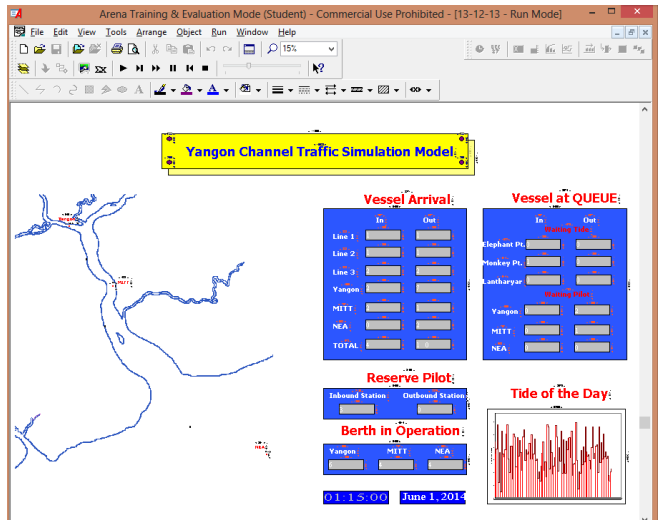
Figure 4. High level view of model logic



3.2 Verification and validation

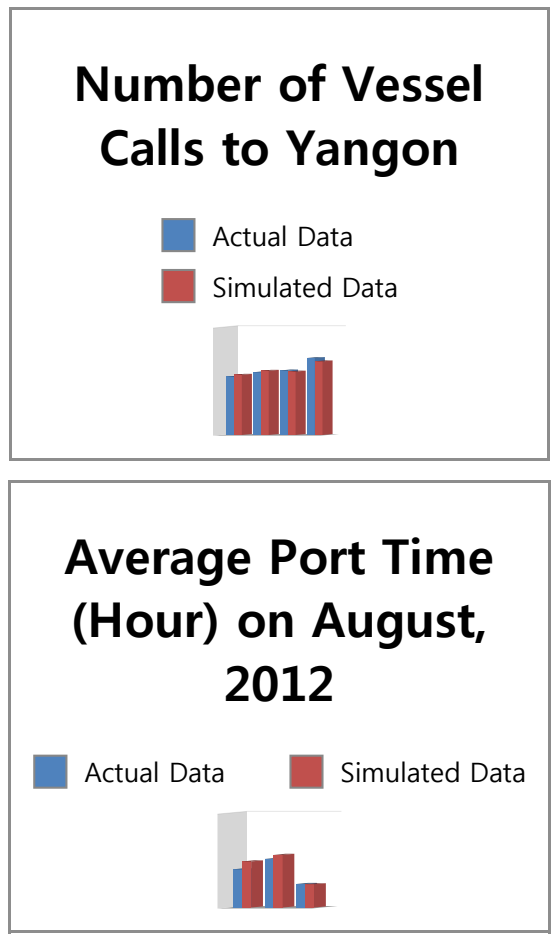
The model is verified in several steps to check if it is working the way it is intended to. The model is developed in sub-modules and each module is individually examined. Via animated interface shown in Figure 5, operation of the overall system is followed and synchronization of events is also observed and verified. The tracing approach is another method used throughout the model development phase. Detailed report of entity processing is compared with the data in hand and manual calculations through tracing in order to check if the logic implemented in the model is as intended.

Figure 5. Animated view of simulation model



For validation purposes, several tests are performed and various key performance measures are observed to see if they are close to their counterparts in reality. The simulation results of 50 replications for 20 years representing the current situation in Yangon River channel are compared to the observations of the port calls between 2010 and 2013 and port time on August, 2012. Figure 6 shows the comparison between actual data and simulated data of port calls and port times. The annual vessel calls generated from the model lies within 5 % difference from the actual value. The average port time of vessel to MITT and NEA anchorage lie within 7% difference from the actual value. Only the average port time of the vessel to inner harbor exceed the 10% difference from the actual value. On the other hand, since the port call to each port area is generated using a distribution specific to that port area, discrepancy from the actual data is only due to randomness. As a result of these comparisons between the actual data and simulation results, the simulation model built to mimic the vessel traffic in Yangon River channel is considered to have close representation of the actual system to perform the analysis.

Figure 6. Yearly port calls and port times comparisons



4. Optimizing the channel dredging plan

This secession presents the time stamped deepening steps investigated via simple optimization model. Firstly, trade and vessel traffic growth assumption is applied to the model. Based on the forecasted growth rate data discussed in section 2, vessel arrival and trade growth rate for every 5 years can be assume as given in Table 3 and is applied on top of the validated model.

Table 3. Assumed vessel arrival growth rate (2011 – 2030)

Item	% Increase Rate			
	1st 5 Years	2nd 5 Years	3rd 5 Years	4th 5 Years
Vessel	22.24%	15.39%	15.43%	13.34%
Import	12.33%	10.98%	9.89%	9.00%
Export	19.44%	16.27%	13.99%	12.28%

Then the available channel depth is assumed to be deepened 0.5 meter without allowing larger vessel as the first step, 1.5 meter with allowing larger vessel as the second step and 2 meter with allowing larger vessel as the final step and the model is run with assumed growth rate of 10 years, 15 years and 20 years. Average port time of each deepening assumptions for respective growth rate generated from the developed traffic model is shown in Table 4.

Table 4. Generated average port times

Average Port Time (Hour)	10 Year	15 Year	20 Year
0.5 m Deepen	515.79	517.24	515.5
1.5 m Deepen	519.52	517.27	551.37
2 m Deepen	525.63	519.06	514.34

Optimization objective could be simply to minimize the cost of production or to maximize the efficiency of production. A traditional way to develop answers to optimization problems is to propose a number of choices from various options for the controlled parameters. Then the processes under investigation are simulated under these options, and the results are compared [Josef and Anna (2014)].

An optimization model has three main components of objective function, decision variables and constraints. The formulation of an optimization problem begins with identifying the underlying variables, which are primarily varied during the optimization process. Objective function is the function that needs to be optimized. The solution to the optimization problem is the set of values of the decision variables for which the objective function reaches its optimal value. Constraints in the optimization model restrict the values of the decision variables. In the following sections, natures of the objective function, decision variables and constraints are presented and discuss how these parameters are fixed for this optimization problem.

4.1 Decision variable

Finding the optimal values of the decision variables is the goal of solving an optimization model [Extreme Optimization Numerical Libraries for .NET (2014)]. A decision variable is a quantity that the decision-maker controls [OptTek Systems, Inc (2014)]. Decision variables usually measure the amounts of resources used (such as money to be allocated to some purpose) or the level of various activities to be performed (such as the number of products to be manufactured, or the number of gallons of a chemical to be blended) [FrontlineSolvers (2014)]. This study concerned the suitable time of commencing the appropriate deepening work. In accordance with the scenarios applied to developed traffic model, there has considered three different deepening work assumptions of 0.5 meter deepening without allowing larger vessel, 1.5 meter deepening with allowing larger vessel and 2 meter deepening with allowing larger vessel. In this optimization model, it is assumed that the time of commencing each deepening is initially unknown and the model will investigate the most suitable time of commencing for optimal channel performance. Thus it is need to define the commencing time as decision variables. Because it is known from the traffic simulation model analysis that the physical condition of the channel is still suitable for next five years, the different times of commencing such as within 10 years, within 15 years and within 20 years are defined as decision variable. Decision parameter here is simply yes or no that is if should be commenced within the intended time interval the answer is yes and otherwise the answer is no. Mathematically it can simply represent with binary expression of “0” and “1”. If the answer is yes then the decision variable is “1” and otherwise “0”.

Because there has three different options of deepening work and three different time interval, totally there has nine decision variable of “Yes” or “No” and the following Table 5 represents the decision table.

Table 5. Decision variables table

Depth Assignment	Within 10 Year	Within 15 Year	Within 20 Year
0.5 m Deepen	0	0	0
1.5 m Deepen	0	0	0
2 m Deepen	0	0	0

4.2 Objective function

The goal of the optimization process is to find the parameter values that result in a maximum or minimum of a function called the objective function. Objective function is a mathematical expression describing a relationship of the optimization parameters or the result of an operation (such as simulation) that uses the optimization parameters as inputs. The optimization objective is the objective function plus optimization criterion. The latter determines whether the goal of the optimization is to minimize or maximize the value of the objective function [AnyLogic (2014)].

This study concerns the channel performance measures. In considering channel

performances, the volume of traffic that the channel can accommodate within a specific time is the most prominent factor. It can be regard that the more the traffic volume can accommodate, the higher the channel performance is. This study only concerns the depth of channel that influencing the channel performance. It is assumed that the different available channel depth will influence the ship waiting time for tide and navigation efficiency. In this regard, average port times of vessels in the channel will not be the same for all available depths and these are regarded as the important factors in measuring channel performance. Thus, it can be understand that by reducing average port times of vessels, the volume of traffic in the channel can be maximized. Accordingly the objective of this model can be explained as to minimize the total average port time for optimal channel performance.

To optimize the channel performance, it is need to minimize the grand total of port time for all assumed depths and assumed commencing years. Therefore the objective function of this optimization model can be regarded as the minimum of the product of Table 4 and Table 5, and it can be expressed in mathematically as:

4.3 Constraints

In formulation of optimization problem, constraints are also important factors and these represent some functional relationships among the variables and other parameters satisfying certain physical phenomenon and certain resource limitations. Constraints are logical conditions that a solution to an optimization problem must satisfy. Many constraints are determined by the physical nature of the problem. A special type of integer constraint specifies that a variable must be binary -- either 0 or 1 -- at the final solution. Binary variables can be used to model "yes/no" or "go/no-go" decisions and are very useful in a variety of modeling situations. In this study also, binary integer variable is used as constraints because the problem concerned is a decision problem and only one action can implement at a time. For example, while 0.5 meter deepening is applied to within 10 year time interval, the other two deepening actions of 1.5 meter deepening and 2 meter deepening cannot implement within the same time interval. Thus, demand for total depth assignments for each time interval is limited to “1” implementation so that within a specific time interval only one deepening assumption can be implemented. On the other hand, supply for total implementation of each deepening assumptions is also limited to “1” so that each deepening assumption can only be assigned once throughout the planning horizon of 10 year to 20 year. Tabulated representation of the constraint limitation idea is shown Table 6.

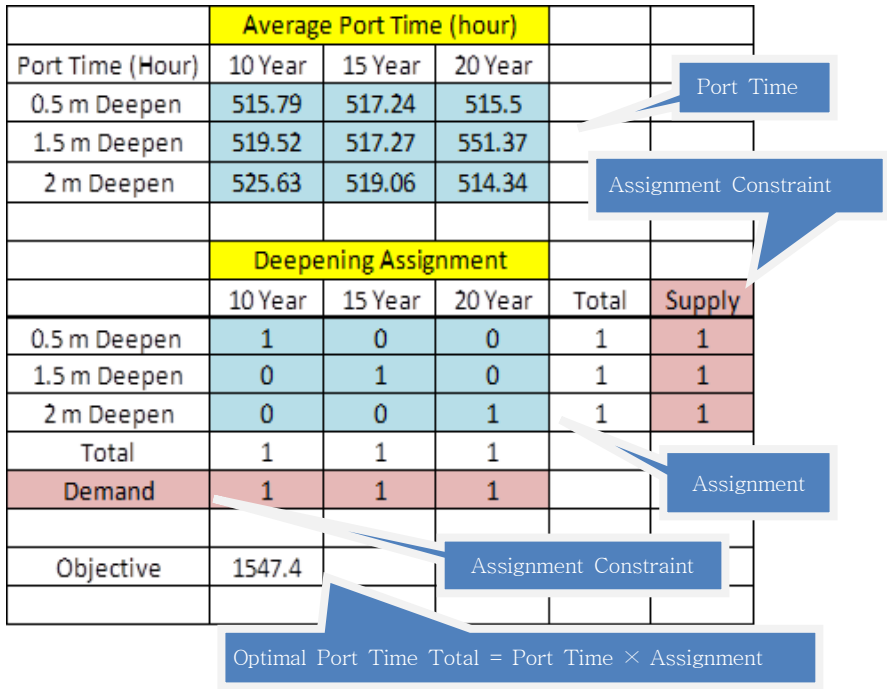
Table 6. Tabulated representation of constraint limitation

Depth Assignment	10 Year	15 Year	20 Year	Total	Supply
0.5 m Deepen	0	0	0	0	1
1.5 m Deepen	0	0	0	0	1
2 m Deepen	0	0	0	0	1
Total	0	0	0		
Demand	1	1	1		

4.4 Optimization

An optimization algorithm is a procedure which is executed iteratively by comparing various solutions till an optimum or a satisfactory solution is found. Problem has been formulated with the objective function, decision variables and constraints which have discussed in the above secessions and optimization process is carried out with the excel solver. The following Figure 7 depicts the optimization model.

Figure 7. Optimization model



Minimum of average port time total is regarded as objective outcome and accordingly the object function is set as the product of assignment into port time. Total assignments are limited by demand and supply constraints and all the assignment decision parameters are set as binary integer of "0" and "1". "1" represents "Yes" and that shows the deepening assumption should commence in that time interval. Optimal dredging plan for the channel is solved out with this model in Excel Solver and the optimal results are as shown in figure. According to the results, the optimal port time of 1547.4 hours can be achieved by commencing 0.5 meter channel deepening work within next 10 years, 1.5 meter channel deepening work within next 15 years and 2 meter channel deepening work within 20 years planning horizon respectively.

5. Conclusion

With this study, a realistic traffic simulation model to investigate the conditions of the channel has been developed as an analysis tool for improvement planning strategy. With this developed traffic model, optimal dredging plan has been successfully solved out. The finding is hoped to be useful in actual implementation of Yangon River channel improvement works.

Actually the model is developed for multi-purpose. Thus, the most valuable product of this study is the simulation model itself. It can be used to support decision making process in various areas of interest and to answer "How-if" questions since it enables to analyze the channel with different assumptions in accordance with the desired upgrading plan.

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Projects Suggestion for Maritime Industry under Korea-Turkey FTA

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ABSTRACT

Korea and Turkey concluded FTA of goods trade in 2013 and service trade in 2014. Although both parties have taken liberal position in maritime sector in the international negotiations such as GATS, WTO-DDA, and TISA, Korea undertook commitment of 11 sub-sectors in maritime industry in Korea-Turkey FTA; Turkey 4 sub-sectors including passenger transportation, freight transportation, ship maintenance and management, rental of vessels. Therefore Korean related businesses obtained additional legal base for entering into maritime trade, chartering business, ship maintenance and management and cruise in the Mediterranean, the Black Sea and the Middle East. In addition, Turkish shipping companies can use potential of new business in North-east Asia and the Black Sea regions. Analysing each commitment schedule of maritime services of both countries in GATS, WTO-DDA and Korea-Turkey FTA, the present paper tries to find mutually benefitting points in which both parties can enjoy the fruits of FTA in maritime services. The present paper suggests some collaborative agendas of the maritime industry between the two countries under Korea -Turkey FTA, covering a joint venture of shipping for project cargoes between Asia and the Black Sea.

Keywords: FTA, WTO, Korea, Turkey, maritime industry

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1. Introduction

Turkey is a peninsula country encircled by the Black sea, the Aegean Sea and the Mediterranean. Though the spatial distance between Korea and Turkey is quite away, both countries have built adamant ties in economy, diplomacy, and other areas. Due to growing amounts of trade between them, Korea-Turkey free trade agreement (FTA) in goods was concluded in 2013 and Korea-Turkey service negotiations reached agreement in July 2014. Generally, free trade agreement is considered to facilitate trades among the participants by reducing trade costs or transport costs, and lowering trade barriers and improving connectivity (Pomfret and Sourdin, 2009; Itakura, 2014). Although some FTAs are concluded by neighbouring countries and provide new business markets in cargo transportation of trucking, shipping, railway and air, the free trade agreement in which the participants are geographically far away for each other would give us narrow opportunity for entering new cargo transportation businesses: shipping and air transportation. Nevertheless, implication and potential of free trade agreement on service, especially in shipping sector are rarely explored in the literature.

In this context, Korean related businesses obtained additional legal base for entering into maritime trade, chartering business, ship maintenance and management and cruise in the Mediterranean, the Black Sea and the Middle East. Considering the strategic geographical importance of Turkey as a gateway to the Black Sea and Central Asia, it is necessary to initiate and implement an investment cooperation road-map for Korea in order to create competitive edges in shipping and port industries of Korea.

The present paper aims at suggesting collaborative agendas of the maritime industry between the two countries. The paper tries to propose common strategy in an international negotiation on maritime industry for the mutual benefits. For this purpose, chapter 2 compares the present status of the maritime industry of Korea and Turkey, especially at shipping and port industries. Chapter 3 analyses the trade policy of Korea and Turkey. Through identifying the commitments of maritime sectors in international trade agreements and free trade agreements (FTAs), the paper deduces the strategic positions of the both. The commitments in the maritime sector of WTO-DDA give us the detailed liberalisation policy in maritime sectors of the both countries. The paper utilizes the method of SWOT (strength-weakness-opportunity-threat) in order to work out mutual benefits in the maritime industry. SWOT approach is a similar method to a strategy of negotiation which will enlarge its own benefits, reduce damage from market liberalisation, develop new chance for business and evade a threat from competitors in an international trade. Chapter 4 develops the collaborative agendas of maritime industry between Korea and Turkey. Chapter 5 concludes the paper and suggests some practical agendas.

2. Comparison of the Maritime Industry of Korea and Turkey

2.1 Shipping

While Korea records 5th in the world with 16 million tonnage of 710 vessels of national flag and 64 million tonnage of 898 vessels of foreign flag, Turkey ranks 13th with 9.5 million tonnage of 627 vessels of national flag and 9.5 million tonnage of 842 vessels of foreign flag as shown in Table 1. Average size of vessel of Korea is about 50 thousand tonnage; Turkey about 21 thousand tonnage.

Table 1. Fleet controlled by each nation (January, 2013)

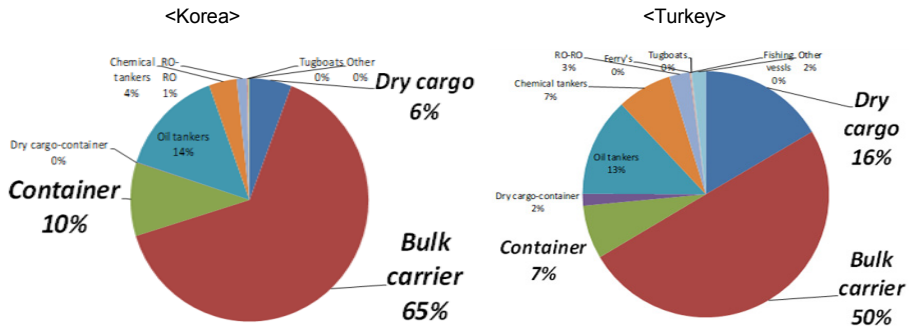
Nation	National flag		Non-national flag		Total	
	No.	1000DWT	No.	1000DWT	No.	1000DWT
Greece	815	71,889	2,949	188,549	3,764	260,438
Japan	698	16,897	3,410	213,045	4,108	229,942
China	1,905	59,632	2,185	101,273	4,090	160,905
Germany	378	16,820	3,649	114,159	4,027	130,979
Korea	710	15,859	898	63,845	1,608	79,704
Norway	521	15,366	1,071	43,150	1,592	58,516
Singapore	646	22,213	531	25,574	1,177	47,787
U.S.A.	201	4,550	781	42,413	982	46,963
Taiwan	88	3,328	710	42,099	798	45,427
Denmark	331	12,616	628	29,592	959	42,208
Italy	569	18,222	494	22,187	1,063	40,409
Hong Kong	386	24,647	264	7,919	650	32,566
Turkey	627	9,488	842	20,838	1,469	30,326

Source: ISL, Shipping Statistics Yearbook 2013, 2013. p.27.

Korean shipping companies tend to deploy their vessels in world-wide trade routes and in intra-Asian routes, and face severe competition in the world market. On the other hand, even though Turkish shipping companies tend to be protected by cargo reservation policy and strict cabotage, deploy their vessels in world-wide routes and even in intra-regional routes, however, they face severe competition in the world market (Yercan, 1988; Togan, 2007).

In both two countries, merchant fleets are mainly comprised of bulk carriers (<Figure 1>). Bulk carriers share 65% of controlled fleet in Korea in 2013; 50 % in Turkey. Nonetheless, Korean major liners are Hanjin Shipping and Hyundai Merchant Marine (HMM) which have world-wide shipping networks; Turkish major liner is ARKAS which focuses its fleets on the Mediterranean and the Black Sea routes.

Figure 1. Merchant fleet of two nations

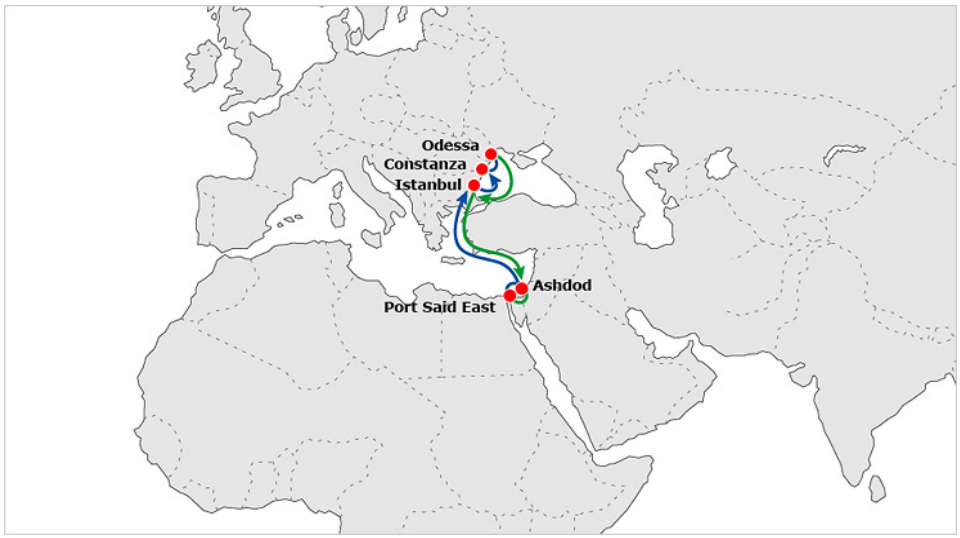


Source: ISL, Shipping Statistics Yearbook 2013, 2013.

Korean liners, Hanjin Shipping and Hyundai Merchant Marine are deploying their fleet at the Turkish ports(<Figure 2>). The Hanjin Shipping's service is going through Turkish ports: Izmir and Mersin. HMM's service is focusing on the Black Sea routes via Istanbul.

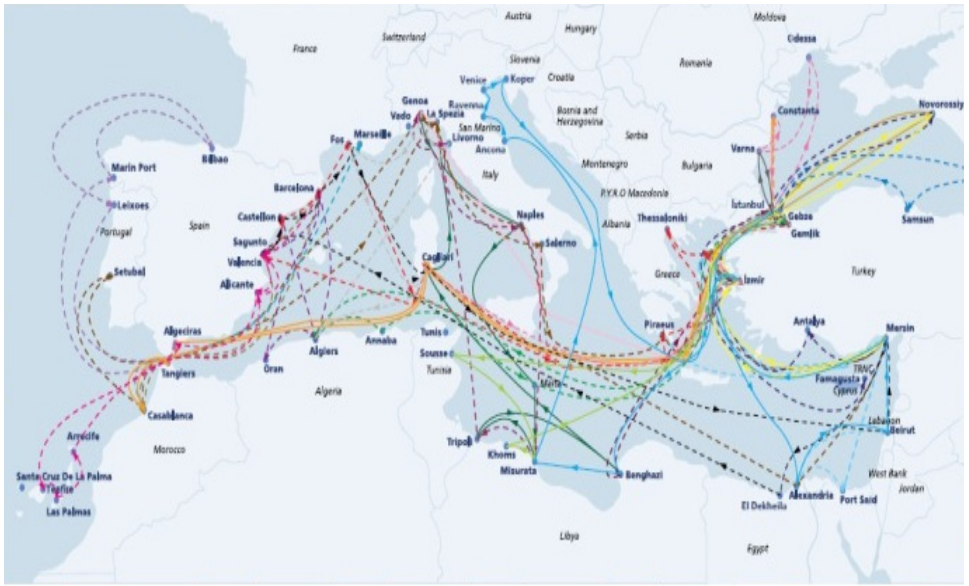
ARKAS Line and EMES feedering Services have jointly focused on the intra Mediterranean sea routes (<Figure 3>). The two shipping companies build hub and spoke network through servicing main ports in the Mediterranean such as Valencia, Marseille, Barcelona, Piraeus as hubs (<Table 2>). Nonetheless, Turkish shipping networks can be main routes for the countries in the Back Sea and the Caucasian areas.

Figure 2. Service of Hyundai Merchant Marine via Turkey



Source: www.hmm21.com (as of 15th April, 2014)
Note: the blue colour means westbound route; the red eastbound route.

Figure 3. Overview on the two Turkish liners' services



Source: www.arkasline.com.tr (as of 30th November, 2014)

Table 2. Main, intermediate, and Turkish ports of the services by ARKAS Line

Main ports	Intermediate calling ports	Turkish ports
Valencia, Marseille, Barcelona, Piraeus, Casablanca	Port Said, Genoa, Las Palmas	Istanbul, Izmir, Mersin

Source: www.arkasline.com.tr (as of 30 th November, 2014)

2.2 Ports

Major ports of the two nations are shown as in the figure 4. Busan is one of the busiest ports globally as well as locally. Busan port records the annual average growth rate (AAGR) of 6.1% from 2002 to 2012, handling 17 million TEU in 2012; Gwangyang 7.2%, serving 2.1 million TEU; and Incheon 9.9%, tackling 2.0 million TEU.

Turkey has planned to implement its vision of making its ports a hub in global shipping networks (Oral, 2007). Main ports in Turkey which can have potential in regional shipping and inland networks are Candari in the North Aegean, Mersin in the Mediterranean Sea, Izmir in the Eastern Mediterranean Sea, and Istanbul. The port of Ambarli is the busiest port in Turkey, showing AAGR of 18.4% from 2002 to 2012 and treating 3 million TEU in 2012 ; Mersin 13.3%; and Izmir 2.0% (<Figure 5>).

Figure 4. Throughputs of Korean major container ports (Unit: Thousand TEU)

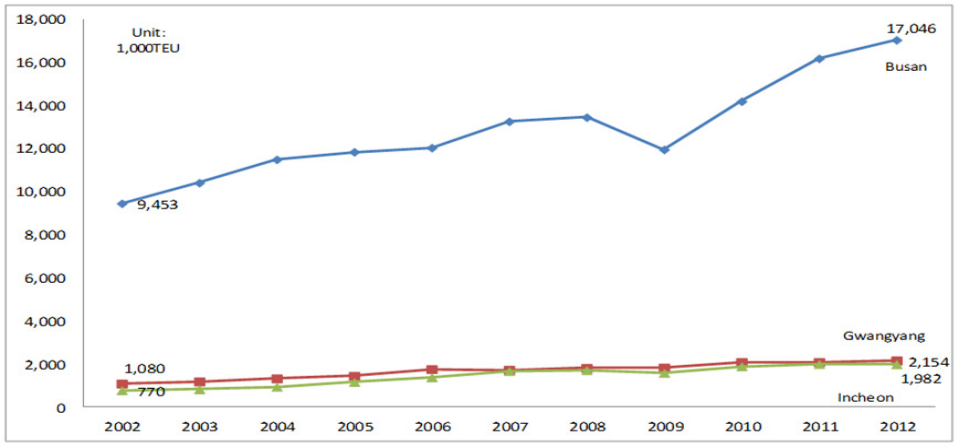
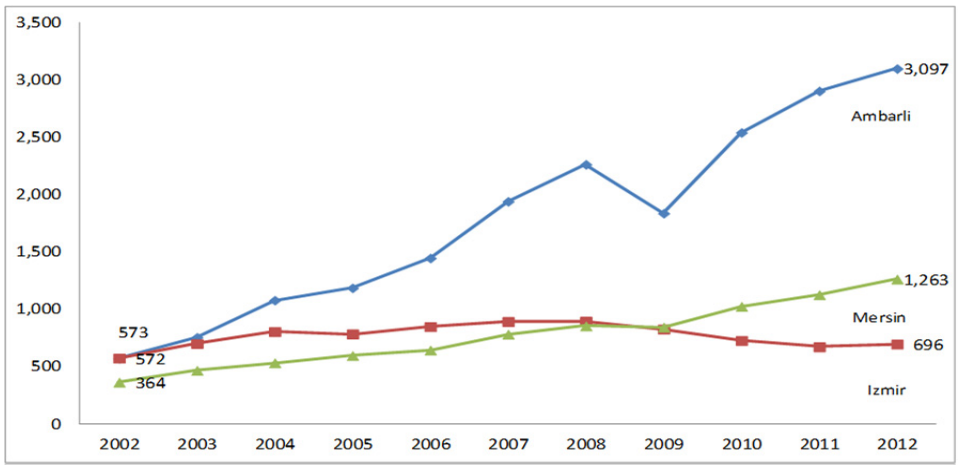


Figure 5. Throughputs of Turkish major container ports (Unit: Thousand TEU)



Source: IHS, C.I. Yearbook, each year.

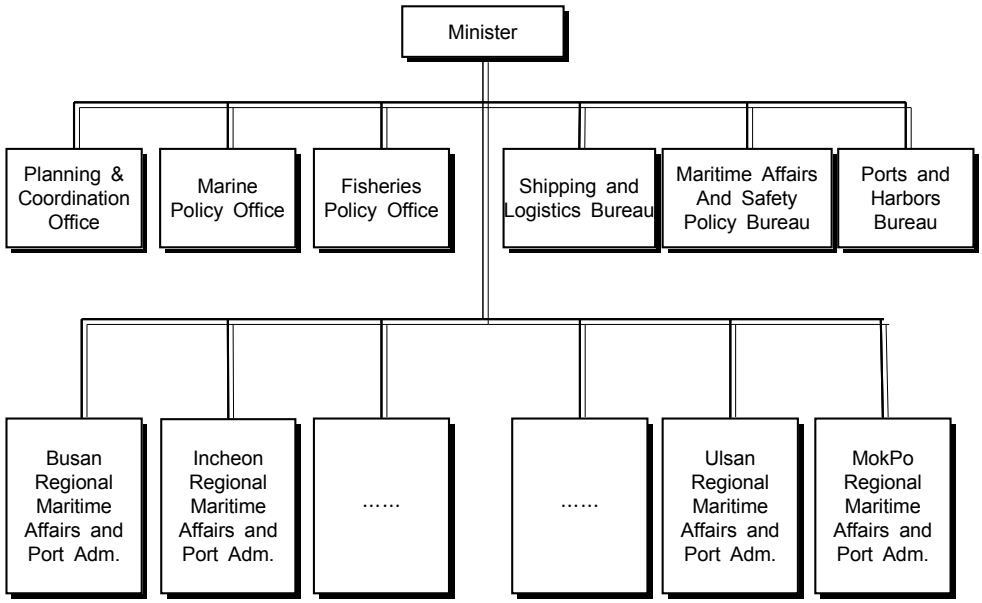
2.3 Governance and Maritime Policy

Korea

Both countries cultivated its marine power by aiding maritime companies in financial schemes and taxes (Choe, 2012). The Ministry of Oceans and Fisheries of Korea leads the policy on maritime sector (<Figure 6>). We can extract the historical trend of development of maritime industry in Korea as follows. Korean shipping companies built the foundation of fleet growth due to tax exemption and financial supports from the government during the 1960s. In the 1970s the Korean government began to build container terminals in order to handle export goods and import materials

in trading with foreign countries. The shipping industry and port industry grew in quantity and improved quality with the shipbuilding industry in Korea. The shipping industry in Korea faced the limitation of growth and experienced structural readjustment by the government. The Korean government adopted deregulation policy on shipping and port industry in the 1990s, and shipping companies and port operators tried to globalize and specialise management skills. In the 2000s the government enlarged international cooperation and endeavoured to conclude free trade agreements with major countries.

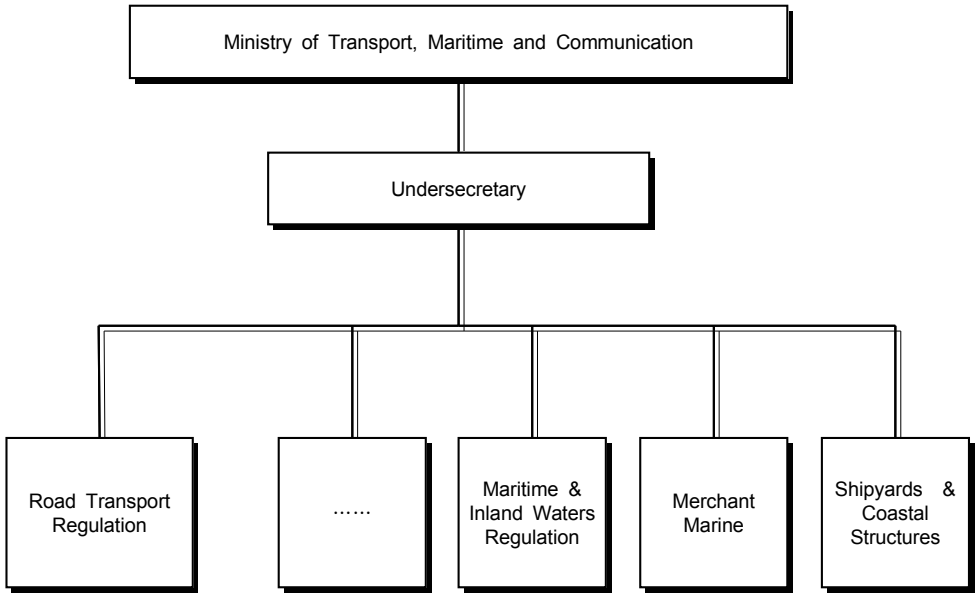
Figure 6. Organization of the Ministry of Oceans and Fisheries of Korea



Turkey

The Ministry of Transport, Maritime and Communication, and the Undersecratariat of Maritime Affairs govern shipping and port activities in Turkey. The Ministry directs mainly maritime sector and encourages maritime activities and maritime, related industries such as shipbuilding, ship-repairing, maritime tourism, and R&D activities. Maritime activities in Turkey are regulated mainly by Turkish Commercial Law, Cabotage Law, Ports Law and international conventions such as the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers of 1978 (Togan, 2007).

Figure 7. Organization of the Ministry of Transport, Maritime & Communication of Turkey



Turkey has developed the maritime industry since the 1980s when the government initiated financial aids scheme to shipping companies in order to promote the formation of Turkish flag fleets. In the 1990s Turkish maritime industry grew in accordance with the development of steel manufacturing industry which ranks 12th in the world (Neser et al., 2008; Choe, 2012). A few deep-sea going shipping companies commenced their liner services in the 1990s. In the port industry, the main ports are owned and operated by the Turkish State Railways under the Ministry of Transport, Maritime and Communication (Yercan, 1988). Port governance in Turkey can be classified into three categories and periods: nationialization, both public & private operation, and privatization (Oral et al., 2007). The Undersecratariat of Maritime Affairs of Maritime Affairs governs ports in Turkey, as national maritime administration. While port operation in Korea tends to be privatized, port operation entities in Turkey are four types: public, municipal, affiliated and private owned ports (Oral et al., 2007).

3. Trade policy on Maritime Industry of Korea and Turkey

In this section, we analyse the trade policy on maritime industry of Korea and Turkey.

3.1 Korean Policy in WTO-DDA and FTAs

Korea has taken position of market liberalisation in the WTO-DDA negotiation. In the WTO-DDA negotiation, maritime negotiation was led by EC delegate who asserted liberalization of maritime transport and listed Maritime Commitment Schedule including international maritime transport services, maritime auxiliary services, port services, repositioning of empty containers and feeder services of foreign trade cargoes. WTO-DDA has targeted to be suitable with the General Agreement on Trade in Services (GATS)[1](WTO, 2001). GATS assists the principles of progressive liberalisation through binding commitment in schedules, non-discrimination and transparency, regulations that are reasonable, objective, impartial, and not more burdensome than necessary, competition safeguards aimed at the realization of obligations and commitments, and flexibility in recognition of national sovereignty and economic development needs (Tuthill, 1997; Park and Cho, 2013).

Korea as a member of Maritime Trade Service Friends Group[2] in WTO-DDA has taken liberal position in maritime transport services which include international transport excluding cabotage, maritime auxiliary services containing maritime cargo handling services, storage and warehouse service in ports, customs clearance service, maritime agency services, container station services, maritime freight forwarding services, shipping brokerage services and other services as shown in Table 3 (Ministry of Land, Transport and Maritime Affairs, 2011). In the international maritime transport services, Korea committed liberalization of the markets to foreign shipping companies excluding international maritime passenger transport. In addition it showed liberal policy on maritime auxiliary services.

Korea concluded the first free trade agreement with Chile in 2004 and it expanded its partner of FTA to Singapore in 2006, ASEAN in 2007, India in 2010, EU in 2011, Peru in 2011, USA in 2012, Columbia in 2012 and Turkey in 2013 as shown in Table 4. FTAs of Korea with Canada, Mexico, Australia, New Zealand, Indonesia, China and Vietnam are under negotiation in 2014.

Korea lists policy reservation on the right to adopt or maintain measure with respect to inland waterways transportation, international maritime passenger transportation services, maritime cabotage, and the acquisition of Korean vessels at maritime industry in Korea-Turkey FTA as in the Appendix 1 (Ministry of Oceans and Fisheries of Korea, 2014). Korea listed commitment schedule of two additional sub-sectors in accordance with Turkey's request in 2014: pushing and towing services, and tally, measuring and survey services (<Table 3>). .

1) GATS is one of the three pillars of WTO: the others are Multilateral Agreements on Trade in Goods and Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Ministry of Justice of Korea, 2000).

2) The member countries are Korea, Australia, Canada, Hong Kong, China, EU, Iceland, Japan, Mexico, New Zealand, Norway, Singapore, Switzerland, Taiwan, and Panama.

Table 3. Sub-sector of Maritime and Commitment at Korea-Turkey FTA

Item	Korea	Turkey
Sub sector	International Transport Excluding Cabotage Maritime Cargo Handling Services Storage and Warehouse Services in Ports Customs Clearance Services Maritime Agency Services Container Station & Depot Services Maritime Freight Forwarding Services Shipping Brokerage Services Maintenance and Repair of Vessels Pushing and Towing Services Talley, measuring and survey services	Passenger Transportation Freight Transportation Maintenance and Repair of Vessels Rental of Vessels with Crew

Source: Government of Turkey (2014 b). Ministry of Oceans and Fisheries of Korea(2014)

Table 4. FTAs of Korea and Turkey

Item	Korea	Turkey
Countries	Chile, Singapore, ASEAN, India , EU, Peru, USA, Columbia, Turkey	Korea, EFTA, Israel, Bosnia-Herzegovina, Palestine, Tunisia, Morroco, Syria, Egypt, Albania, Georgia, Montenegro, Serbia, Chile, Jordan, Mauritius

Source: www.economy.gov.tr (28th November 2014).

3.2 Turkish Policy

Turkey represents also liberal attitudes to commitment of the maritime industry at GATS negotiation. In the international maritime transport services, Turkey applied liberalization of the markets to foreign shipping companies including international maritime passenger transport. However Turkey draws some limitation of cargo preference policy of strategic raw materials and puts also limitation on national treatment in port charges which have differences between Turkish vessels and foreign vessels. In fact Turkish regulation required that all imports of public enterprises and public entities should be transported by Turkish flagged vessels till 1983. In 1983, after the Turkish government loosened the regulation, foreign operators can handle imports of public enterprises and public entities on the condition that the freight rate of Turkey flagged vessel is more than 10 percent above their foreign competitors(Togan, 2007). In maritime auxiliary services of Korea-Turkey FTA, Turkey committed only two services: rental of vessels with crews and maintenance and repair of vessels. Turkey has strong cabotage policy on the areas of domestic coastal shipping and cargo handling in Turkish ports (Yercan, 1988; Choe, 2012). Furthermore no more than 49 percent of equity participation by foreigners in national flag carriers is allowed. According to the Law on Turkish International Flag Registration enforced in 2000 there are two different types of ships registry: National Ship Registry (NSR) and Turkish International Ships Registry (TISR) (Togan, 2007). Shipping companies under the Turkish flag on the NSR must be 51 percent owned by Turkish nationals.

After establishing Customs Union with EU in 1996, Turkey ameliorated legal institutions of foreign trade and customs. Turkey has concluded FTAs with 32 countries

and has 17 FTAs in force with Korea, EFTA, Israel, Bosnia-Herzegovina, Palestine, Tunisia, Morocco, Syria, Egypt, Albania, and other countries (the Ministry of Economy of Republic of Turkey, 2014).

Schedule of Specific Commitments filed by the Turkish government include four sub-sectors which Turkey undertakes as in the commitment of schedule of GATS (< Appendix 1>): maritime passenger transport, maritime freight transport, rental of vessels with crew, and maintenance and repair of vessels (Government of Turkey, 2014b). Nevertheless the phrase that foreign operators can handle imports of public enterprises and public entities on the condition that the freight rate of Turkey flagged vessel is more than 10 percent above their foreign competitors is deleted in the commitment of Korea-Turkey FTA. Since Turkey has broader concept of cabotage (Government of Turkey, 2014a), Turkey tends to narrow the areas of commitment at maritime industry such as maritime passenger transport, maritime freight transport, rental of vessels with crew, and maintenance and repair of vessels without subsectors of port activities.

3.3 Implications of Trade Policy on Maritime of Korea and Turkey

Trade of services has become more important due to growing share of services in world trade. 22[3)] members of WTO initiated new negotiation of service trade in 2013: Trade in Service Agreement (TISA) (Sauve, 2013). Korea and Turkey have participated in negotiation meetings of TISA. European countries in TISA are so ambitious that they have been striving to encompass cabotage issues such as domestic coastal feeder services in commitment schedule of TISA. Korea and Turkey present protective position on cabotage issues. Nevertheless in GATS and Korea-Turkey FTA, Korea demonstrates more liberal commitment in maritime industry through enlisting 11 sub-sectors containing the two sub-sectors which Turkey requested to include.

The paper extracts positioning of the two countries in SWOT analysis by observing commitment schedule of the both countries in GATS and Korea-Turkey FTA. Turkey represents also liberal attitudes to commitment of the maritime industry in GATS. In the international maritime transport services, Turkey applied liberalization of the markets including international maritime passenger transport to foreign shipping companies.

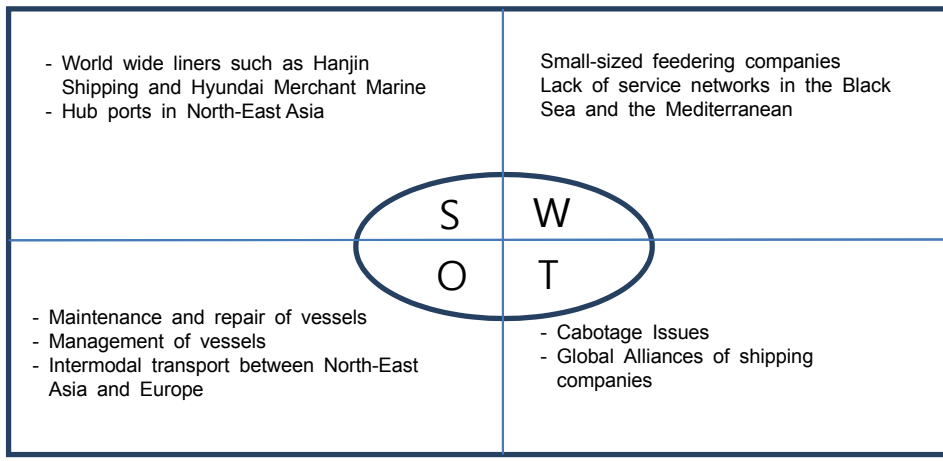
3.4 SWOT Analysis of Korea and Turkey

We can conclude the SWOT analysis of Korea as follows (<Figure 8>). Korea has strength in having world-wide liners and a few hub ports in North-East Asia; weakness in domestic feedering services by small sized shipping companies and lack of service networks in the Black Sea and the Mediterranean. Utilizing FTA agreement between Korea and Turkey, Korea can launch new businesses in maintenance and

3) EU, Australia, Canada, Chile, Chinese Taipei, Colombia, Costa Rica, Hong Kong China, Iceland, Israel, Japan, the Republic of Korea, Mexico, New Zealand, Norway, Panama, Paraguay, Pakistan, Peru, Switzerland, Turkey and the USA.

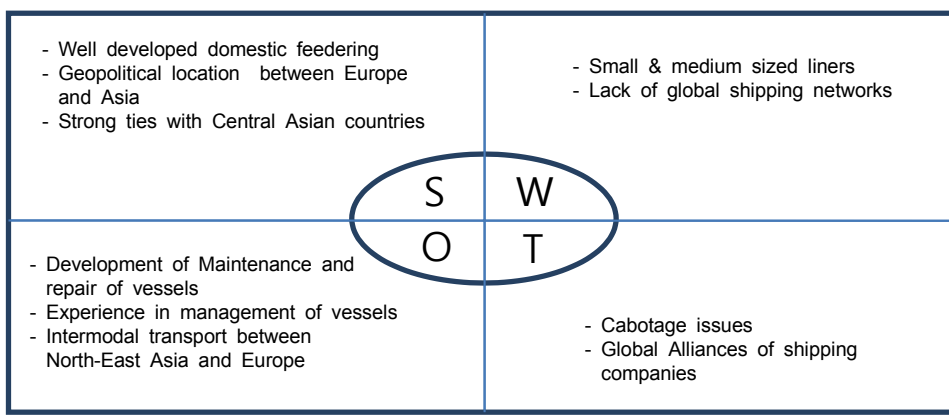
repair of vessels, management of vessels, and intermodal transport services in the Black Sea. Korean shipping companies can enhance their competitiveness by enlarging their service networks into Central Asia and Eastern Europe using the Korea-Turkey FTA agreement.

Figure 8. SWOT analysis of maritime industry of Korea



Turkey has strength in well developed domestic feedering and located at a gateway between Europe and Asia; weakness in spatial limitation of shipping services by small and medium sized shipping companies, and lack of global services networks (<Figure 9>). Turkey can establish a venture for the business of maintenance and repair of vessels, management of vessels, and intermodal transport services in the Black Sea under the FTA between Korea and Turkey. Turkish shipping companies can elevate their competitiveness by enlarging their service networks into Asia and other regions in the world by cooperating with Korean shipping companies.

Figure 9. SWOT analysis of maritime industry of Turkey



4. Projects of Maritime Sector

4.1 Shipping

The two nations' shipping sectors have a little similarity but it is not hard to present the cooperation projects (<Figure 10>). Most likely, the two nations should develop joint shipping networks. The potential sea routes are Northern Sea, intra Black Sea, and Mediterranean feeder services. Thus the future study could be weighted on the priorities of potential projects. Secondly, investing in joint venture projects is relatively important. There might be following questions: where to play and how to play? Thus, acquiring strategic location is more important than acquiring trust between two nations. Thirdly, creating knowledge based maritime hub providing shipbuilding, ship repair, and ship management corporations could be proposed as one of cooperation projects.

We would like to exemplify a joint venture carrier between two nations. German and Dutch shipping companies, Rickmers Lines, Biglif, Jumbo, and SAL have led the shipping markets for project cargo, and heavy and bulky cargoes between Asia and Europe. They acquired benefits of transporting project cargoes from the nation to the other nations. Between Korea and Turkey, there are a lot of project cargoes transported by Germany and Chinese shipping lines. So, it is needed to create a joint venture of shipping to share mutual benefits.

Figure 10. Cooperative Projects of Maritime Sector

4.2 Port

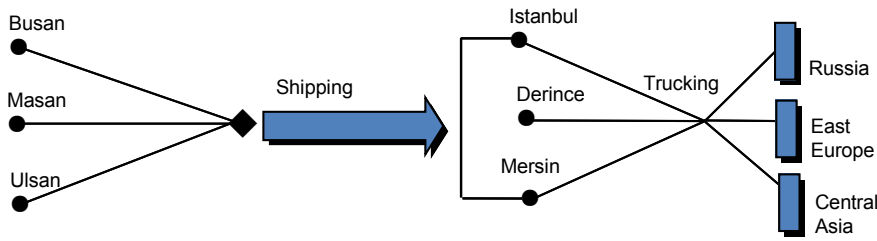
While Korea plays a gateway in North-East Asia and has a few hub ports, Turkey locates at the cross-road of Asia and Europe, and has feeder ports which connect the main ports in the Mediterranean such as Algeciras and Gioia Tauro. Turkish ports handle mainly national cargoes and experience insufficiency in the port facility and connected transport infrastructure (Oral et al., 2007). Central Asian countries including Georgia and Azerbaijan which have been facing steadily growing economy

are planning to build new port facilities to handle containers, liquid cargoes and general cargoes. Hence, the present paper would suggest that a venture of Korea and Turkey investors participates in the public tender of development projects of port facilities in the Black sea, the Mediterranean, and the Caucasian region. Joint venture at a newly planned container terminal and inland container depot in the Mediterranean region can be another collaborative project.

4.3 Intermodal Transport and other areas

Bulky cargoes such as project cargo between North-east Asian countries and countries around the Black Sea and the Mediterranean are transported by Germany lines and Chinese lines which are specialised in shipping of project cargoes as drawn in Figure 11. Establishing a joint venture for bulk cargoes can be a cooperative agenda in Korea-Turkey maritime cooperation.

Figure 11. Flow of heavy or Project cargo between Korea and Central Asia



5. Conclusion and Policy Recommendations

Settlement of Korea-Turkey FTA in goods in 2013 and services in 2014 would give Korean related businesses a new legal base for entering into the maritime trade, chartering business, ship maintenance and management, and cruise in the Mediterranean, the Black Sea and the Middle East. Korea has strength in having world-wide liners and a few hub ports in North-East Asia; weakness in domestic feedering services in the Black Sea and the Mediterranean. Turkey has strength in well developed domestic feedering in the Black Sea and the Mediterranean and is located at a gateway between Europe and Asia; weakness in lack of global shipping networks. Korea can launch new businesses in maintenance and repair of vessels, management of vessels, and intermodal transport services in the Black Sea. Turkish shipping companies can revamp their competitiveness by enlarging their service networks into Asia and other regions in the world by cooperating with Korean shipping companies.

Turkish bilateral channels such as an implementation committee of Korea and Turkey FTA may develop and share a cooperative road-map and action plan. Both

countries may develop cooperation projects including shipping and port industries and a policy cooperation road-map and implementation plan should be established in order to support such projects. First of all, pilot projects such as ship repair and maritime enterprises of transportation of heavy materials in the Black Sea area should be explored, and if they are proved to be viable, other business opportunities may be expanded according to their business feasibility. Bilateral outreach in port development and construction of logistics facilities in the Black Sea and Central Asia may be promoted and both parties may share policy cooperation road-map for facilitating the projects. In a way, a shipping and port cooperation organization may be pursued among Korea, Turkey, Georgia and Azerbaijan in the Black Sea and Caspian Sea.

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Appendix 1. Commitment schedule of international shipping transport of Korea and Turkey in GATS negotiation

Sector : MARITIME TRANSPORT SERVICES[5]							
Korea				Turkey			
Sub-setor	Limitations on Market Access	Limitations on National Treatment	Additional Commitments	Sub-setor	Limitations on Market Access	Limitations on National Treatment	Additional Commitments
International Transport Excluding Cabotage [7211*,7212*]	1) a) Liner shipping: None b) Bulk, tramp, and other international shipping: The cargo preference system applies to 8 items, which are crude petroleum, iron ore, raw materials for fertilizer, grain, coal, raw materials for petrochem, iron ore, raw materials for fertilizer, grain, coal, raw materials for petrochemical products,	1) None	The following services at the port are made publicly available to international maritime transport suppliers on reasonable and non-discriminatory terms and conditions. 1. Pilotage 2. Towing and tug assistance 3. Provisioning, fuelling and watering 4. Garbage collecting and ballast waste disposal 5. Port Captain's services	Passenger transportation (CPC 7211)	1) None except cabotage 2) None 3)[6] InordertoflytheTurkishflag,the shipping companies must have the majority of 51 per cent Turkish shareholders. 4) Captain and crew of the Turkish flag vessels should be Turkish residents.	1) Charges taken for port services from foreign and Turkish ships may differ in favour of Turkish flag vessels according to the tariffs on port charges which are determined by the port administrations. 2) None 3) None 4) Turkish nationality is required for captain and crew.	

5) Refer to Attachment concerning Maritime Transport Services.

6) All Turkish ships shall fly the Turkish flag. A ship shall be regarded as Turkish only if its owner (or owners) is/are Turkish. However, the following ships shall also be considered as Turkish: i) Ships which belong to legal persons such as bodies, institutions, associations and foundations set up in accordance with Turkish Law, the majority of whose Board of Directors are of Turkish nationality. ii) Ships which belong to the trading companies the majority of whose managerial staff and representatives are of Turkish nationality and are registered on the Turkish Trade Register.

Sector : MARITIME TRANSPORT SERVICES							
Korea				Turkey			
	liquified gas and steel products. 2) None 3) a) Establishment of a registered company for the purpose of operating a fleet under the national flag of Korea: Unbound b) Other forms of commercial presence: None 4) a) Ship's crew: Unbound b) Shore personnel: Unbound except as indicated in ALL SECTORS	2) None 3) a) Unbound b) None 4) a) Unbound	6. Navigation aids 7. Shore-based operational services essential to ship operations, including communications, water and electrical supplies 8. Emergency repair facilities 9. Anchorage, berth and berthing services	Freight transportation (CPC 7212)	1) None except cabotage 2) None 3)[7] In order to fly the Turkish flag, the shipping companies must have the majority of 51 per cent Turkish shareholders. 4) Captain and crew of the Turkish flag vessels should be Turkish residents.	1) The vessels flying Turkish flag either bidding for public cargoes to be shipped to overseas countries or carrying strategic raw materials are benefited from the preference given in favour of them (i.e.they are entitled to be awarded the bids even though their quotations are up to 10 % higher than the lowest foreign flag vessels quotations) The Undersecretariat of Treasury and Foreign Trade is authorized to permit the public entities to have their imported goods transported by foreign flag vessels. Charges taken for port services from	

7) All Turkish ships shall fly the Turkish flag. A ship shall be regarded as Turkish only if its owner (or owners) is/are Turkish. However, the following ships shall also be considered as Turkish: i) Ships which belong to legal persons such as bodies, institutions, associations and foundations set up in accordance with Turkish Law, the majority of whose Board of Directors are of Turkish nationality. ii) Ships which belong to the trading companies the majority of whose managerial staff and representatives are of Turkish nationality and are registered on the Turkish Trade Register.

Sector : MARITIME TRANSPORT SERVICES							
Korea				Turkey			
		b) Unbound except as indicated in ALL SECTORS				foreign and Turkish ships may differ in favour of Turkish flag vessels according to the tariffs on port charges which are determined by the port administrations. 2) None 3)None 4)None	
Maritime Cargo Handling Services [741*]	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					
Storage and Warehouse Services in Ports Excluding Services for Agricultural, Fishery and Livestock Products [742*]	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					

Sector : MARITIME TRANSPORT SERVICES							
Korea				Turkey			
Customs Clearance Services	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					
Maritime Agency Services [748*][8]	1) None 2) None 3) A joint venture or a 100% foreign ownership must be incorporated as a Chusik Hoesa(a joint stock company). 4) Unbound except as indicated in ALL SECTORS	1) None 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					
Container Station Services [741*][9]	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					

8) 748*: Agency services on behalf of maritime passenger transport businesses or maritime cargo transport businesses(including foreign transport businesses) under CPC 748.
9) 741*: Container station services provided in port areas under CPC 741.

Sector : MARITIME TRANSPORT SERVICES							
Korea				Turkey			
Maritime Freight Forwarding Services [748*][10]	1) None 2) None 3) A joint venture or a 100% foreign ownership must be incorporated as a Chusik Hoesa(a joint stock company). 4) Unbound except as indicated in ALL SECTORS	1) None 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					
Shipping Brokerage Services [748*, 749*][11]	1) None 2) None 3) A joint venture or a 100% foreign ownership must be incorporated as a Chusik Hoesa(a joint stock company). 4) Unbound except as indicated in ALL SECTORS	1) None 2) None 3) None 4) Unbound except as indicated in ALL SECTORS					

10) 748*: Freight forwarding services by vessels in the name of the forwarder(including any foreign forwarders under contract)under CPC 748.

11) 748*, 749*: Brokerage services for maritime cargo transport or for the chartering, leasing, purchasing or selling of vessels under CPC 748 and 749. Unbound*: Unbound due to lack of technical feasibility.

Sector : MARITIME TRANSPORT SERVICES							
Korea				Turkey			
Maintenance and Repair of Vessels[12]	1) Unbound* 2) None 3) A joint venture or a 100% foreign ownership must be incorporated as a Chusik Hoesa(a joint stock company). 4) Unbound except as indicated in ALL SECTORS	1) Unbound* 2) None 3) None 4) Unbound except as indicated in ALL SECTORS		Maintenance and repair of vessels (CPC 8868)	1) None 2) None 3) None 4) None	1) None 2) None 3) None 4) None	
E. Rental/Leasing Services without Operators a. Relating to Ships [83103]	1) Unbound 2) Unbound 3) None 4) Unbound except as indicated in ALL SECTORS	1) Unbound 2) Unbound 3) None 4) Unbound except as indicated in ALL SECTORS		Rental of vessels with crew (CPC 7213)	1) None 2) None 3) None 4) None	1) Vessels rented by foreigners may not operate inside the Turkish coastal waters. 2) This kind of vessels are considered as foreign vessels and do not have to fly the Turkish flag. 3) None 4) None	

12) Services, such as repair and management of vessels, management of crew, and marine insurance, provided on behalf of a maritime passenger transport business, maritime cargo transport business, or vessel leasing business.
Unbound*: Unbound due to lack of technical feasibility.