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중국과 한국 정기선사의 리스크관리 성과에 미치는 요인에 관한 비교연구

A Comparative Study on Factors Affecting Risk Management Performance between Chinese and Korean Liner Shipping Companies

지도교수 이 수 호

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한국해양대학교 대학원

무 역 학 과

張 篠 菱

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국문 초록

중국과 한국 정기선사의 리스크관리 성과에 미치는 요인에 관한 비교연구

張筱菱
韓國海洋大學校 大學院
貿 易 學 科

오늘날 해상 수송환경의 변화에 따른 화물 운송의 특성은 높은 자본 집약성을 가지며, 운임 요율의 변동, 벙커 가격, 환율 및 심지어 금리(이율)의 변동에 따라 정기선 사업의 이윤창출을 불확실성 하게 만들어 매우 불안정한 위험에 노출시키고 있다.

이에 따라, 보다 효율적으로 해운회사를 경영하려는 목적으로 리스크관리(RM)가 이루어 지고 있으며, 리스크관리는 해운회사를 운영함에 있어 총체적인 목적을 달성하기 하기 위한 키 포인트로 여겨져 왔다. 하지만, 리스크관리의 성과(RMP)는 리스크관리의 질을 반영하며, 모든 회사들에서 리스크관리가 잘 이루어 지고 있는 것은 아니다.

현재 중국 해운기업들은 리스크관리 측면에 있어 초기단계라고 할 수 있다. 최근 들어, “리스크관리” 라는 단어는 정기선사 내에서 흔히 들을 수 있는 일상적인 어휘가 되었지만, 대부분의 중국 정기선사들은 명확한 의미 규정 조차 하지 않고 있다. 이러한 모순된 기업 문화 속에서, 서구의 리스크관리 시스템을 그대로 중국 컨테이너 정기 선사에 적용시키는 것은 적절하지 않다고 본다. 따라서, 유사한 기업 문화를 가진 한국의 리스크관리를 분석하여 이를 중국 컨테이너 정기 선사의 리스크관리 시스템에 도입, 적용한다면 매우 유용할 것이며, 중국의 리스크관리 시스템에 기여할 수 있을 것이다.

이러한 해운산업의 환경 속에서 본 논문의 연구목적은

(1) 구조방정식 모델을 이용하여 선행연구에 근거한 리스크관리 성과(RMP)에 영향을 미치는 요소를 시험한다.

(2) 중국의 컨테이너 해운선사와 한국의 컨테이너 해운선사의 차이점을 파악한다.

(3) 중국과 한국, 양국의 컨테이너 정기선사의 리스크관리 성과(RMP)를 높이기 위한 몇 가지 제안을 하는 것이다.

본 논문은 선행연구에 근거하여 리스크관리 성과(RMP)와 경영진 지원, 규격화 관리, 정보 시스템, 안전관리, 및 협조의 관계에 관한 5 개의 가설을 제시하였다. 가설검정에 필요한 자료를 얻기 위해서 설문지 조사 방법을 이용하였으며, 설

문지는 중국 정기선사 23 곳 및, 한국 정기선사 20 곳에 답변을 요청하였다. 설문지가 회수되었을 때, 요인 분석, 신뢰도 분석, 및 구조 방정식 모델을 이용하여 자료를 분석하였다.

본 논문의 연구결과는, 중국의 정기선사는 안전관리, 정보 시스템 및 협조가 리스크관리 성과에 있어서 직접적이고 긍정적인 효력이 있다고 연구되었다. 한국의 정기선사에 대한 연구 결과 역시 중국의 정기선사와 동일하게 리스크관리 성과의 상호 관계 및 안전 관리, 정보 시스템, 협조에 긍정적인 효력이 있다고 연구되었으며, 경영자들의 리스크관리 활동에 대한 지원 또한 직접적이며, 긍정적인 효력이 있었다고 나타났다.

이러한 상대적인 연구 결과에 따라서, "강력한 사내(社內) 내부 조직 협조"와, "리스크관리의 중요성에 대한 경영자의 인식고취"를 강화시키고, "리스크관리에 관한 정보에 대한 주의를 기울여라" 등의 3 개의 제안을 중국 정기선 선사에 제의한다. 동시에, "규격화 관리의 확립"과 “리스크관리에 있어 국제 무게 안전규칙”을 제정 할 것을 한국 정기선 선사를 위해서 제의한다.

본 논문은 총 5장으로 구성되었다.

제 1 장에서는 본 논문의 연구목적과 배경, 방법, 연구내용을 소개하였다.

제 2 장에서는 첫번째로, 해운업의 리스크관리 선행연구 검토, 두번째로 리스크관리 성과 선행연구, 세번째로, 리스크관리 성과에 영향을 미치는 요인에 대한 선행연구를 하였다.

제 3 장에서는 연구 절차와 연구 과정에 있어 이용된 실증 연구 방법을 자세히 설명하였다. 첫번째로, 선행연구를 재검토 함으로써 선행연구를 기초로 한 본 논문의 연구방법을 만들었다. 두번째로, 본 논문에 이용될 변수를 정의하였다. 세번째로, 가설을 제시하였다. 네번째로, 논문에 이용될 설문지 내용 중 목표 모집단(target population), 척도(Scale)와 설문지 내용을 설명하였다. 마지막으로, 자료분석시에 이용 할 구조 통계학적인 방법을 소개하였다.

제 4 장에서는 설문지 응답을 구체적으로 비교 분석하였다. 확증 분석에는 아래의 2개 부분이 포함되었다.

(1) 중국 응답자로부터의 설문지 자료를 분석한 내용

(2) 한국 응답자로부터의 설문지 자료를 분석한 내용.

중국과 한국, 양국의 컨테이너 정기선 선사 모두를 위한 제언은 비교 분석 결과를 얻은 이후에 이루어졌다.

제 5 장은 본 논문의 개요와 연구의 한계 및 앞으로의 연구 방향을 기술하였다.

Chapter 1
Introduction

1-1 Background and Purpose of the Study

In international trade deals, more than 80% of the goods are transported by sea. The overall objective of a shipping operation might be defined as "to transport cargo safely and cost-effectively from origin to destination."[1] Contradictorily, it is well known that shipping is a high risky industry. As the main mode of seaborne transport trade, container liner shipping industry is somewhat risky not only because of its transportation environment but also of its unique characteristics. Firstly, due to its highly capital intensive nature, every liner shipping company must possess shipping systems including several container vessels needed to provide liner services, container boxes, and corresponding logistical systems. The present order price of new container vessel is increasing due to the booming shipping market, for instance, the order price of a 2,750TEU container vessel increased with the rate of 47% from 38 million US dollars in January 2003 to 55.8 million US dollars in November 2004.[2] Worldwide, the liner shipping industry has purchased or assumed responsibility for approximately 155 billion US dollars in direct operating assets, such as vessels, containers, chassis, and marine terminals.[3] Secondly, there are existing fluctuations in freight rates, bunker prices, exchange rates and even interest rates, which bring a lot of uncertainties. Thirdly, liner shipping companies are getting harder and harder because of the continually decreasing freight rates resulting from the gradually intense market competition. In view of these characteristics, losses of damage arising from the unexpected incidents, poor maintenance, or accidents will do great harm to the

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[1] W.A. O'Neil, "Why Risk Management in Shipping," *IMO Executive Session on Maritime Risk Management*, Malmö, Sweden, 9th October 2000.

[2] SSY, "Recent Developments in Commercial Shipping Markets," *OECD Workshop on Maritime Transport*, Paris, France, 4-5th November 2004.

[3] World Shipping Council "Liner Shipping: Facts and Figures: Partners in America's Trade," *An Online Paper*, 2005.
http://www.worldshipping.org/liner_shipping-facts&figures.pdf

shipping companies. In order to reach shipping operation's overall objective and to strengthen the competitive advantage in the fierce shipping market, risk management is called for in liner shipping industry.

Although many shipping companies have carried out risk management (abbreviated as RM) when recognizing its necessity, not all of them have sound effects. In other words, some have low risk management performance, which is a direct index to represent the quality of risk management in an organization.[4] Therefore, it is necessary to identify the factors affecting risk management performance (abbreviated as RMP) for any shipping company no matter implementing RM or not. The factors identification process is helpful for the companies without sound RM effects to examine where the problems are and for the companies without RM to avoid taking detours when carrying out RM in future.

Every organization should have performance indicators that allow them to monitor the key business, financial activities, and process toward objectives and to identify the development that requires intervention. However, at present, no specific indicators exist in the countries, widely accepted, to valuate directly the performance of risk management or other relevant issues that reflect what we want to measure as risk management. Since this type of measure has been considered subjective and arbitrary, properly determining the indicators becomes significant if the company tends to well define its RMP.

All players in the maritime industry are linked together through risk. The success in risk management enables to strengthen each player's competitive advantage in the booming shipping market by improving the performance and achieving more efficient, productive and profitable results as a sequence. However, except for several main liner shipping companies including COSCO, China Shipping, and Sinolines, most China's container liner shipping companies (abbreviated as CLSCs) are full of clouding of consciousness in RM. In addition, the lack of past loss data and professional RM department is another direct reflection of the problem. Moreover, the

[4] Y. L. Lu, "Assessment of Aviation Safety and Corporate Risk Management Using Systematic Risk Modeling Approach," *Doctoral Dissertation*, Taiwan, Nation Cheng Kung University, 2004, p.83.

RM of shipping company, if has, concentrates only on organization's financial risks. Obviously, the present situation of RM in China's shipping industry does not match the image of an important maritime country. At the same time, China's CLSCs' increases in the market share are liable to be impeded by such one-sided and insufficient RM. It is extremely urgent for China's CLSCs to realize their difficulties in implementing RM and take proper measures therefrom to improve the quality of RM.

There is enormous disparity in enterprise culture and development background between China and developed Western countries. Therefore, it is not practical for China's CLSCs to follow these countries' mature RM model. Instead, the well developing RM system of the proper country may contribute to the construction of their RM system. Thanks to the similar development background of RM and some results achieved through RM, Republic of Korea is the right choice.

Under such circumstances, this study aims to:

(1) Test the theory-based model concerning factors affecting risk management performance using structural equation models.

(2) Examine the differences between Chinese CLSCs' model and Korean CLSCs' structural model.

(3) Provide suggestions to improve RMP for both China's and Korea's CLSCs.

1-2 Scope of the Study

Since the global economy develops continually and communication & transportation technology advances rapidly, container shipping mode, depending on its features of speed, simplicity, convenience and economy, has become the main mode of seaborne trade transport. Liner service, which is provided on the basis of fixed schedules and itineraries, is dominated by large fleets of specialized container vessels operating on major trade routes around the world.

Generally speaking, RM in both China's and Korea's CLSCs is at the start-up stage.

Although China and Korea are respectively located the fifth and the eighth of the most important maritime countries in terms of their total merchant fleet hanging both national flags and foreign flags[5], neither correspondingly has the well-developed RM system. But Korea's CLSCs have paid higher attention to RM, which are reflected by the public statistical loss data provided by the department concerned, periodicals concerning RM, and more relevant studies on RM. Comparing the attitudes toward factors affecting RMP of China's and Korea's CLSCs enables to examine the disparity in RM from which we can discover each other's deficiency and, as a sequence, recommend the practical suggestions for both to improve the quality of present RM.

In summary, this study focuses on the RM in both China's and Korea's container liner shipping companies.

1-3 Research Methodology

(1) Literature-Based Hypotheses

This study is based on a literature review that provides a verbal description and explanation of many previous studies on the risk management in shipping industry. The preliminary idea of the object and structure of this paper are gradually ameliorated during the explorative research on existing materials. At last, this paper proposes five hypotheses of factors affecting risk management performance as the summary of literature review and as the start of research process.

(2) Questionnaire

To perform the objective of testing hypotheses and examining the different attitudes toward factors affecting RMP of China's and Korea's CLSCs, a questionnaire is

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[5] United Nations, "Review of Maritime Transport, 2004," *United Nations Conference on Trade and Development,* Geneva and New York, 2004, p.33.

designed to collect the data to be used in the statistical calculation. The questionnaire copies are dispatched to several departments including operating department, claim department, equipment control department, financial department, and general manager office of 23 China's CLSCs or branches and 20 Korea's CLSCs or branches.

(3) Statistics Package

Once the data are obtained from the answer sheets of the questionnaire, they are anglicized by utilizing statistics package including descriptive analysis, factor analysis and reliability analysis. The descriptive statistics analysis aims to find out the respondent's viewpoint and attitude toward each factor affecting the risk management performance of liner shipping company. Factor analysis and reliability analysis are used to reduce the number of variables and to ensure the internal consistence of the newly built hypothesized structure model.

(4) Structural Equation Modeling

Structural Equation Modeling (abbreviated as SEM) is a very general statistical modeling technique invented by geneticist Sewall Wright (Wright, 1921) and is widely used in the behavioral sciences. SEM provides a very general and convenient framework for statistical analysis that includes several traditional multivariate procedures, for example factor analysis, regression analysis, discriminate analysis. In this study, SEM approach, through which we can find whether there is a causal relationship between each factor and performance effect of risk management as well as whether there are correlations between each factors, is chosen to test the hypotheses.

1-4 Structure of the Study

Chapter 1 depicts the background, purposes and scope of the study and briefly introduces the research methodology and outline of the dissertation.

Chapter 2 focuses on the literature review of risk management in shipping industry, on which the preliminary idea and structure of the dissertation are based and goes further into the risk management performance (RMP). The literature background, on which the factors affecting RMP to be hypothesized and variables to be tested are based, is introduced here, too.

Chapter 3 dwells on the study procedure and on the empirical research methodologies applying to corresponding process. Firstly, build the structure of study on the basis of previous literature review. Secondly, define the variables pertaining to the study. Thirdly, propose the hypotheses to be test. Fourthly, design and explain the questionnaire including scale, target population, contents according to the purpose of the dissertation. Finally, introduce the statistical methods to be used in later data analysis.

Chapter 4 carries out the concrete comparative analysis of questionnaire answer sheets. This finally confirmatory analysis includes two parts: 1) analysis of data from Chinese respondents, and 2) analysis of data from Korean respondents. Suggestions for both Chinese and Korean liner shipping companies are provided after getting the comparative analysis results.

Chapter 5 is the summary, limitations and future studies.

Chapter 2
Literature Review

2-1 Researches Related to RM in Shipping Industry

Researches related to RM in shipping industry can be generally classified into two categories: studies on pure RM and studies on speculative RM. Pure risks exist when there is a chance of loss but no chance of gain, while speculative risks exist when there is a chance of gain as well as a chance of loss.

2-1-2 Studies on Speculative RM

Recognizing the risks emanating from fluctuations in freight rates, bunker prices, the price of the vessels, even from fluctuations in the level of interest rates and exchange rates, many studies have been made on speculative risk management of shipping industry.

i. Market risk management (Gwak, 1995; Chen and Wang, 2004)
ii. Financial risk management (Huang, 1995; Kim, 2001)
iii. Both financial and market risk management (Menachof and Dicer, 2001; Nomikos and Alizadeh, 2002)
iv. Political risk management (Lee, 1995)

Gwak (1995) reviewed the market risk from the viewpoint of shipping companies. According to his study, fluctuation in market risk has significant influence on the operation of risk companies. Although insurance is a key effective control method of risk management, it is necessary to prepare other strategic control techniques for more risks confronted by the shipping industry. Chen and Wang (2004) investigated an estimation of optimal hedge ratios by applying both random coefficient autoregressive (RCAR) and bivariate GARCH model to estimate time varying hedge ratios in bulk shipping market.

Huang (1995) analyzed the financial risk management of six listed shipping companies of Taiwan. With the help of the regression model, he found that paper interest rate, currency exchange rate, long-term interest rate, and the voyage charter rate are the main financial risk exposures in five of the six investigated companies. As described by Kim (2001), the risk of shipping companies is even higher than that of other industries because it is very uncertain for shipping companies to obtain stable revenue and sustain their growth rate. The study set six hypotheses and multiple regression analysis and T-test model to examine the shipping-related risk and those factors including fluctuation of vessel, fluctuation of debt, fluctuation of charter cost, fluctuation of operation profits, fluctuation of interest, and fluctuation of cash flow. The six hypotheses were the following: Four factors (fluctuation of vessel volume, fluctuation of debt, fluctuation of operation profits, and fluctuation of cash flow) had a negative correlation with the shipping risk whereas two factors (fluctuation of charter cost and fluctuation of interest) had a positive correlation with the shipping risk.

Menachof and Dicer (2001) pointed out that the strategic use of oil commodity futures contracts would be a much more effective method for hedging the risk arising from fluctuating bunker prices. By strategic use of commodity futures, the shipowner was able to better reduce his/her risk exposure transferring it to willing parties at the futures exchanges, thereby eliminating the need for the bunker surcharge. Besides discussing and analyzing different methods for hedging bunker prices risk including petroleum and petroleum product futures, forward, swap and option contracts on bunker oil, Nomikos and Alizadeh (2002) identified another unanticipated change in the level of freight rates in shipping operations.

Lee (1995) considered the international conventions or regulations that are made to reduce maritime casualties, such as SOLAS Convention to ensure ship’s structures and equipments, MARPOL Convention to prevent oil pollution form ships, and STCW Convention to establish standards of training, certification and watch keeping for seafarers. Lee drew his conclusion that safety policy is one of the factors positively correlating with the safety management.

2-1-2 Studies on Pure RM

Studies on pure RM include:

i. Pure operation risk (Shiau, 1996)

ii. Maritime risk (Nam, 2000; Yun, 2000; Xu et al., 2000; Huang, 2002; Liu, 2004)

iii. Documentation risk (Guo, 2003)

Shiau (1996) classified the pure operation risks that result from the maritime perils[6] confronted by container liners into three categories (See Figure 2-1):

(1) Property risk including risk exposures to losses[7] of container vessel, container itself, and other properties.

(2) Net income risk including risk exposures to losses of freight income and operating cost.

(3) Third Party Liability (TPL) risk including risk exposures to injury of crew and to losses of container vessel and container itself resulting from collision.

Yun (2000) and Nam (2000) discussed the risk management of oil tanker transport and container transport from the point of marine insurance cover. Xu et al. (2000), from the cargo owner's point of view, analyzed the risk factors of cargo transportation by sea through a post-loss analysis study that is based on the data collection from insurance companies. They concluded that the top three risk perils[8] of cargo were 1) wet damage, contamination. 2) Car accidents. 3) Operation failures of dockers. Huang (2002) went further into evaluating the factors affecting the pure risk management in liner shipping. The study of Liu (2004) analyzed the potential problems relating to the

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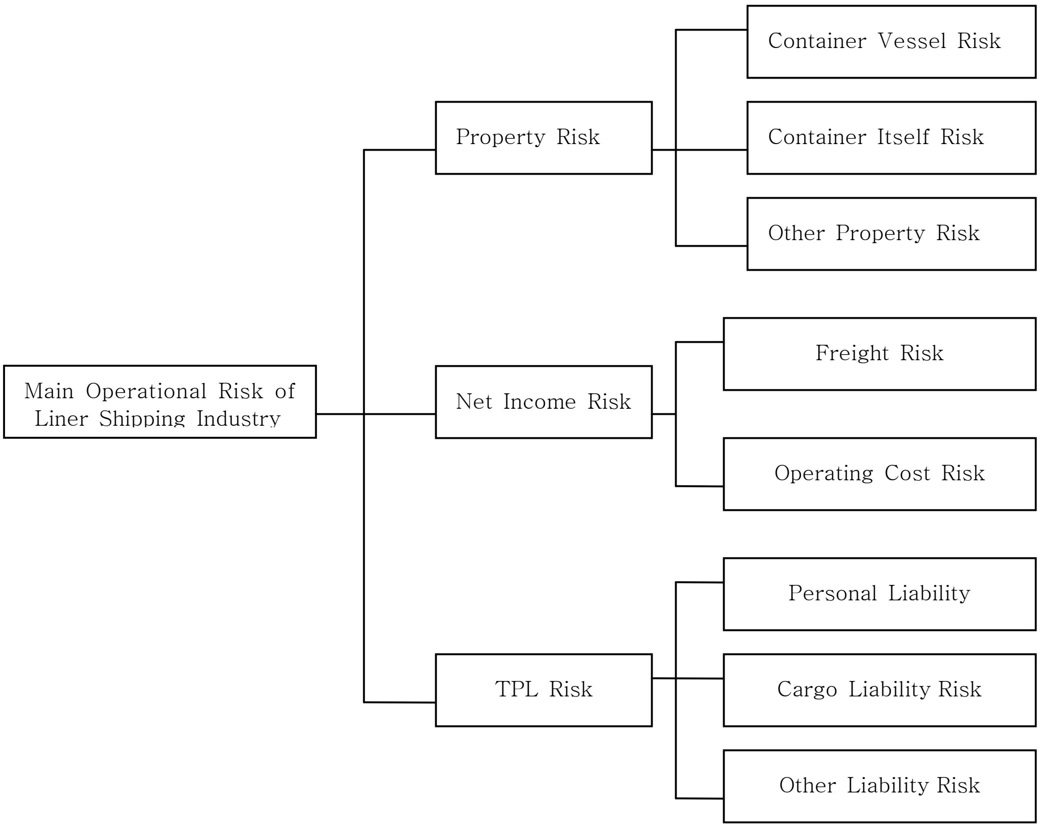
6 The Marine Insurance Act 1906, Article 3.
"Maritime perils" means the perils consequent on, or incidental to, the navigation of the sea, that is to say, perils of the seas, fire, war perils, pirates, rovers, thieves, capture, seizures, restraints, and detainments of princes and peoples, jettisons, barratry, and any other perils, either of the like kind or which may be designated by the policy.

7 Exposures to loss or gain are the objects or situations facing possible loss or gain.

8 Perils are causes of loss.

implementation of liner ship security and suggested liners establish a security system of container ships for reference in order to enhance maritime security.

<Figure 2-1> Main Operation Risks of Liner Shipping Industry



Source: Shiau (1996)

After examining mechanism of electronic transaction, Guo (2003) pointed out that the problem of risk management relating to the adoption of Electronic Bills of Lading resulted from the immature technology. As a necessary part in the shipping operation, any problems in electronic transaction of documentation or payment would have effect on the whole shipping operation.

(3) Studies on general RM

On the basis of an interview with ocean freight forwarders and literature review, Hsiao (2002) found most of ocean freight forwarders in Taiwan did not have risk management department and lack training of professional risk management. The same conclusion was drawn by Jang (2001) after he investigated the actual situation of risk management in container terminal by implementing a questionnaire and an interview with the four container terminals (HBCT, PECT, UTC, GCT) in the port of Busan. Jang recognized the shortage of general recognition on the risk management in container terminal and suggested the concept of RM should be attached great importance from the executives. In other words, executive's support in risk management was the key answer to improve the risk management in Korea's container terminal.

It is obvious that the necessity for risk management in shipping industry has been already recognized. All these previous studies contributed much help for the deep understanding of RM. However, not all companies have sound effects even if they carried out RM for a period of time. In other words, they are with low risk management performance, which is a direct index to represent the quality of risk management in an organization.

2-2 Researches Related to RMP

2-2-1 Definition of RMP

There is no consensus in the definition of RMP. The scholars defined RMP differently according to the specified circumstances. Table 2-1 concludes several common definitions of RMP.

<Table 2-1> Summary of RMP Definition

Representative	Definition of RMP
Head (1985)	RMP is the variance in the actual results from the pre-settled standards.
RMSTA (2005)	RMP is a mechanism that monitor and control risk management.
Carreno et al. (2005)	RMP provides a qualitative measure of management based on predefined “targets” or “benchmarks” that risk management efforts should aim to achieve.
Zhou (2003)	RMP is used to examine whether the highest level of safety is achieved by the least costs.
Lu (2004), Huang (2002), Kim (1994), This study	RMP represents the quality of risk management in an organization.

The risk management program must have a built-in mechanism of self-monitoring to determine if the program is meeting its objectives. A monitoring and control mechanism is accomplished by RMP that should be quantifiable and measurable.[9]

The process of RMP evaluation consists of three steps[10]:

(1) Determine performance standards
(2) Compare actual performance to the pre-settled standards
(3) Take actions to amend risk management activities or unrealistic standards.

In Carreno, Cardona and Barbat’s points of view, RMP provided a qualitative measure of management based on predefined “targets” or “benchmarks” that risk management efforts should aim to achieve[11].

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[9] What is Risk Management, *RMSTA*, Vol.1, Section Two, 2005, p.5.

[10] George L. Head and Stephen Horn II, *Essentials of the Risk Management Process*, Malvern, Pa.: Insurance Institute of America, 1985.

[11] M. L. Carreno, O. D. Cardona and A. H. Barbat, “Evaluation of the Risk Management Performance,” *International Conference of 250th Anniversary of the 1755 Lisbon Earthquake*, Lisbon, Portugal, 1-4th November 2005.

Zhou (2003) regarded RMP as the indicator showing whether the highest level of safety was achieved by the least costs.

Lu (2004) defined RMP as the quality of risk management in an organization. The evaluation of RMP aims at controlling the effectiveness of RM plan implementation.

Kim (1994) made an empirical study on the export credit risk management performance in Korean. By applying T-test, multiple regression, and path analysis to the study, Kim found the factors including enterprise characteristics, scale and experience of Export & Import; export trade features, direct export & indirect export; characteristics of credit risk management, recognition of credit risk & control method of credit risk had influence on the quality of credit risk management.

Huang (2002) indicated the degree of executive's support, organizational formalization and information system were found positively related to the performance of pure risk management. In other words, these three factors had significant influence on the quality of RM.

Holding the same view as Lu's, Kim's, and Huang's, this study defines RMP as the quality of RM, too.

2-2-2 Indicators of RMP

Every organization should have performance indicators that allow them to monitor the key business and financial activities, process toward objectives and identify development which require intervention[12]. However, at present, no specific indicators exist in the countries, widely accepted, to valuate directly the performance of risk management or other relevant issues that reflect what we want to measure as risk management. In all cases this type of measure has been considered subjective and arbitrary due to their normative character[13]. Table 2-2 is the summary of RMP indicators developed by previous studies.

[12] *A Risk Management Standard,* AIRMIC, ALARM, IRM, 2002, p.9.
[13] Carreno, Cardona and Barbat, *op.cit.,* p.1.

<Table 2-2> Summary of RMP Indicators

Representative	Indicators of RMP
Wang (2001), Huang (2002)	RM cost indicators, such as insurance premiums, retained losses, administrative costs, risk control and loss prevention expenses.
Kim (1994)	Ratio of credit RM cost and the sum of revenue and asset.
Wang (2001)	Result indicators, such as the variation in loss frequency and loss severity achieved through the regular loss analysis report.
Zhou (2003)	Ration of decreased risk losses and the sum of risk costs and opportunity cost.
Lu (2004)	Ratio of the detected risk and the residual risk.
Carreno et al. (2005)	Risk Management Index (RMI)
This study	Activity indicators, such as the quantity of RM meetings and publishing home RM periodical, quality of RM training, quality management.

The main three standards of RMP evaluation were summarized by Wang (2001):

(1) Result standard: Regarding the variation in loss frequency and loss severity achieved through the regular loss analysis report as the evaluation indicator of RMP. By comparing the result variation rate with the pre-supposed variation rate, it is easy to find out the level of RMP.

(2) Activity standard: Regarding the quality and quantity of RM activities as the evaluation indicator of RMP. RM activities include regularly hosting RM seminar, publishing home RM periodical, implementing safety inspection, providing RM training for employees, etc.

(3) RM cost standard: Regarding the economic cost of RM consisting of insurance premiums, retained losses, administrative costs, risk control and loss prevention expenses as the evaluation indicator of RMP. Since RM aims to secure the safety maximization with the minimum cost for the company, RM cost criterion is the best way to measure whether or not the present RM

plan is the most economical one.

Huang (2002) adopted the RM result criterion by comparing the loss frequency and severity of cargo, number of crew and non-crew injury, loss of assets, pollution in 2001 with those in 2002 to evaluate the RMP of container carriers in Taiwan.

Lu (2004) defined RMP as a fraction,

$$RMP = Risk_{detected} / Risk_{residual}$$

where detected risk is the numerator and the residual risk is the denominator. Therefore, it has direct relation to the nature of the organization, in other words, higher RMP value means this organization has better mechanism and potential to detect and correct their problems. On the other hand, an organization with lower RMP means that the residual risk still exists due to safety defense mechanism failure or inadequate experience feedback mechanism. Obviously, equation A indicates two possibilities for higher value of RMP, one is to enhance the effect of numerator, in other words, organization should make effects in problem finding; another way is to reduce the effect of denominator, or to make residual risks term lower. In this case, the organization should modify their policy, standard, procedure, etc. to eliminate the root causes or latent factors to avoid those risks.

Another ratio, RMP=Credit Risk Management Cost/ (Revenue + Asset), was defined as the performance of credit risk management by Kim (1994).

Zhou (2003) developed a formula as:

RMP=Decreased Losses of Damage / (RM Cost + Opportunity Cost),

when the value of ratio is over 1, Zhou regarded the RM plan as the good one and recommended to apply this plan; when the value of ratio is less than 1, Zhou regarded it as a failure plan. The opinion of Zhou fully manifested the core content of RM, i.e. to guarantee the highest level of safety by the least costs.

Carreno et al. (2005) chose the method of the Risk Management Index (RMI), which is developed to evaluate risk management performance and effectiveness of countries of Latin America and the Caribbean in the framework of the Disaster Risk Management Indicators Program in Americas of the National University of Colombia. RMI involved establishing a scale of achievement levels or determining the distance between current conditions and an objective threshold or conditions in a reference country.

It is known that the RMP indicators are subjective and arbitrary case by case[14]. Since this study aims at finding the factors affecting RMP in the liner shipping industry, the result standard suit for certain company is not available. Instead, I define six general risk management activities, which have common in the liner shipping industry, as the specific indicator in this study.

Firstly, the effect of risk control activities is under consideration. In liner shipping industry, many methods are used to control risks, such as selling container boxes or shipping spaces to reduce the risk or buying insurances covering Hull & Machinery, container itself, container owner's third party liability (TPL), and container operator's cargo indemnity[15] to transfer risks. Once a liner shipping company makes good use of different methods to control its risks, the loss of risk retained by the company itself will decrease. In this sense, the amount of risk retained is chosen to reflect the risk control effect.

Safety inspection and maintenance for the container vessel and relevant equipment is necessary to secure the seaworthiness. Since Article III of Hague-Visby Rules stipulates that the carrier shall be bound before and at the beginning of the voyage to exercise due diligence to make the ship seaworthy, the insurer is exempt from the loss caused by un-seaworthiness and, instead, the carrier himself has to undertake the loss. Therefore, this is very important indicator to decrease the potential risks for the carriers.

Punctuality, which means on-time departure and arrival in accordance with the fixed schedule, is an important management performance indicator of container shipping companies[16] as well as the fifth indicator of RMP in this study. The reason for choosing punctuality is that it directly reflects the quality of risk management.

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14 *ibid.*, p. 1.

15 Sang Gap Park, "A Study on Insurance Problems for the Development of International Multimodal Transport," *Doctoral Dissertation*, Korea: Kyungsung University, 1994, p.86.

16 XiaoLing Zhang, HanWon Shin, SooHo Lee, "On the Performance Evaluation of the Chinese Container Liner Shipping Companies: A Case Study on COSCON, CSCL, and Sinolines by Applying an AHP Model," *International Journal of Navigation and Port Research*, 28(9), 2004, pp.775-781.

High punctuality hints a sound RMP.

Staff mobility is another indicator of quality management. High staff mobility, especially the mobility of executives, may result in the work delay, information missing, secret divulgation, customer leaving, etc. and will bring unexpected loss to the organization[17].

<Table 2-3> Explanation of RMP Indicators of This Study

Indicator	Remark
Y_1: Loss amount caused by risk retaining	It reflects the effect of risk control of the organization. Fewer amounts, better RMP.
Y_2: Times of inspection and maintenance for the container vessel and equipment	This is the necessary process to secure seaworthiness. More inspection & maintenance, better RMP.
Y_3: Quality of RM training for the staff	Higher quality, better RMP.
Y_4:Times of meetings or seminars concerning RM hosted by the organization	More meetings, better RMP.
Y_5: Punctuality (sailing on time)	Punctuality reflects the quality management of liner shipping companies. Higher punctuality, better RMP.
Y_6: Staff mobility	High staff mobility, especially the mobility of executives, may result in work delay, information missing, secret divulgation, customer leaving, etc. Lower mobility, better RMP.

17 Fu Ping Zhou, *Enterprise Risk Management*, LiaoNing: LiaoNing Education Press, 2003, pp.113-114.

2-3 Researches Related to Factors Affecting RMP

2-3-1 Executives' Support (ES)

The executive should be responsible for the total risk management of the organizational so that Executives' support highly influences the RMP (Song, 1990; Jarvenpaa and Ives, 1991; Ye, 1995; Xu et al., 2000; Jang, 2001; Huang, 2002).

Based on a questionnaire and an interview implemented within the four container terminals (HBCT, PECT, UTC, GCT) in the port of Busan, Jang (2001) realized the shortage of general recognition on the risk management in container terminal and concluded that it was the most important and urgent thing for the executives of container terminal industry to recognize RM. The same conclusion was drawn by Hsiao (2002). She found there were few risk management specialists in the organization. Such phenomenon was imputed to the executives' lack of the high recognition of RM. Under such circumstance, that cooperation of different departments was hard to achieve resulted in the unsatisfied effect of RMP (Xu et al., 2000). Moreover, executives with insufficient knowledge of RM are liable to hold the risk aversion attitude, which may result in the wrong decision-making (Huang, 2002). On the contrary, the more the executives know about the RM, the more they will pay attention to RM. This logic is available in other industry. It is found that the more the CEO of an information technology company knows about information technology, the more support he is likely to contribute[18].

In the opinion of Zhou (2003), executives should actively participate in risk management activities. The board of directors and management are responsible for ensuring that adequate risk mitigation practices are in place for effective oversight and controlling other activities pertaining to risk management as well. In addition, the function of risk management department must be recognized by all the organization.

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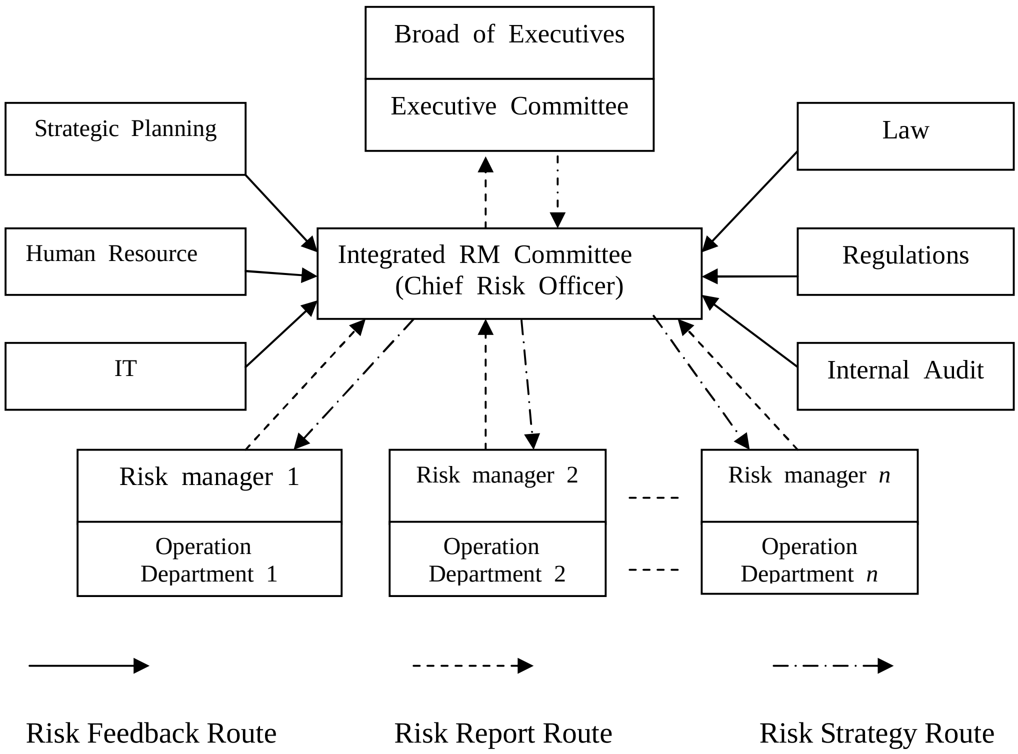
[18] D. Q. Lin, "A Study on the Factors Affecting Executives' Support to Information Management," *Journal of Information Management*, 6, 1997, pp.23-43.

(Please see Figure 2-2.) It is obvious that RM is a process from the top to the down, which means the decisions of RM are firstly made by the top management then are delivered to next section, so on and so forth. Therefore, RM process must be completely agreed and positively supported by the board of directors and executives, otherwise it is hard to achieve the organization's objectives.

<Figure 2-2>: Integrated Risk Management Structure: Top-down Style



Source: Zhou, Enterprise Risk Management, 2003

When evaluating executives' support factor, Lin (1997) and Huang (2002) selected four indicators including:

(1) Executives should actively learn the knowledge of RM.
(2) Executives should actively participate in RM meetings.
(3) Executives should actively carry out RM operations.

(4) The organization should provide strong financial support for RM.

Referring to all literatures stated above, the executives' support factor (abbreviated as ES) is broken down into three items as shown in Table 2-4.

<Table 2-4> Items of the Construct of Executives' Support Factor (ES)

Label	Items	Previous Literature Review
X1	CEO should be responsible for RM.	Jang (2001), Hsiao (2002), Zhou (2003)
X2	Executives should pay most attention to RM.	Jarvennaa and Ives (1991), Lin (1997), Huang (2002)
X3	Executives should actively participate in RM activities.	Lin (1997), Huang (2002)

2-3-2 Standardization Management (OS)

Organization management involves three core management functions: strategic management function, which consists of activities that seek to identify the organization's mission, its goals and objectives; operations management function, which is comprised of those activities that provide the goods or service; and risk management function, which consists of the activities that facilitate the most direct achievement of the organization's mission[19]. Huang (2002) found the organization formalization positively relates to the performance of pure risk management of liner shipping companies. In her study, Huang divided the organization formalization factor into three dimensions:

(1) Organization should have distinct stipulation on division of work of each department.

[19] C. A. Williams and R. M. Heins, *Risk Management and Insurance*, 6th Edition, New York, McGraw-Hill Book Co., 1989. Part 1, Chapter 2, p.27.

(2) Organization should have effective employee performance system.

(3) Conception of RM should be embedded in every department of the organization.

Song (1983) pointed out that the head of one shipping company should make efforts to work out a documented RM direction, which specifies the authorization and liability of each department and acts as the top criterion of the risk management decision. Such formalized document will bring much help for shipping companies to achieve satisfied RMP. Zhong (1998) agreed that a standard organization with formal objectives and rules & regulations, documented operation process and indications, and regular communication among all the sections contributes to the effective management performance.

YKEFM (2004) suggested that, when building its own management policy, the organization should develop a close link between its strategic objectives and management of risks.

Zhou (2003) paid more attention on the human resource of the organization. He pointed a successful performance of risk management was based on a reasonable pay system. Since the final objective of the stockholders is the profit maximization of the organization, while that of the executives is the utility maximization of themselves, there is always a Principle-Agent problem in the organization. To achieve the co-objective in improving the RMP of the organization, the equivalent key is a reasonable pay system consisting of both reward and penalty, which is able to impel executives to strengthen their enterprise risk management. Such flexible reward-penalty system works along both lines of improving RMP and lessening the possibility of dereliction of duty.

Yap (1990) found that one organization under standardization management, i.e. the organization has documented policies concerning organization objectives and different function of each department tends to equip itself with highly computerized information system.

With reference to the review of studies concerning standardization management, this factor is broken down into four items as shown in Table 2-5.

<Table 2-5> Items of the Construct of Standardization Management Factor (OS)

Label	Items	Previous Literature Review
X4	Organization should have clear documented RM policy.	Song (1983), Yap (1990), Zhong (1998), Huang (2002)
X5	Organization should develop a close link between its strategic objectives and management of risk.	YKEFM (2004), Williams and Heins (1989)
X6	Organization should have distinct stipulation on division of work of each department.	Huang (2002)
X7	Organization should have reasonable pay system.	Zhou (2003), Lin (2003)

2-3-3 Information System (IS)

The management of risk data and information is the key to the success of any risk management effort regardless of an organization's size or industry sector. Risk management information systems (RMIS) typically assists in consolidating property values, claims, policy, and exposure information and provide the tracking and management reporting capabilities to monitor and control overall cost of risk. The more developed the RMIS is, the better the RMP will be. But when we evaluate the information of cost and profit, the time factor and dynamic factor caused by the sudden change of the environment should be taken into consideration[20]. Since RMIS are typically computerized systems, there is the need of professionals for managing and maintaining the relevant equipment.

Gibson (1997) emphasized the importance of RMIS for the implementation of risk

[20] Ming Zhe Song, *A Study on the Enterprise Asset Risk Management,* Taiwan: Wu Nan Publish House, 1983.

management in financial firms. By building RMIS, the financial firms can meet the needs that:

(1) To better understand the risks including market risk (the sensitivity of a firm's value to financial market variables like interest rates, exchange rates, volatilities, etc.) and credit risk (the sensitivity of a firm's value to default by its counterparties) that a firm wants to measure.

(2) To provide better incentives to its business units and to individual employees, a firm wants to reward good risk-adjusted performance. The firm must measure its risk before it can adjust performance for risk.

(3) To provide its shareholders with a consistent and optimal risk-return tradeoff over time, a firm wants to accurately match the amount of capital it employs with the risks it takes.

Based on an investigation of the risk management in land, sea, and air transportation of Evergreen Marine Corporation, Chen (1994) drew a conclusion that computerization is an important factor in integrated risk management. With the help of computer system, it was easy for the risk management department to classify the reason of accident, loss frequency and severity and then to make a statistical analysis risk report that could not be provided by the insurance company. Generally speaking, computerized information system helped to develop a detailed risk data base.

The database-oriented system can provide ship managers with information management capabilities for maintaining, tracking, tabulating, and displaying large quantities of data. At the same time, applying computer-based support to the decision process helps ship managers to search for the best course of action out of the spectrum of possibilities, to analyze the complicated relationships quickly, and to build upon the qualitative insight of management experience in making the final choice[21].

Head (1986) summarized the key elements in a complete RMIS:

(1) Database Element: Include loss data, information of the risk unit,

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[21] K. B. C. Saxena and P. B. Joshi, "Motivating Ship Managers to Use Management Support Technology," *Maritime Policy and Management*, 19 (1), 1992, pp.55-62.

information relating with law, accounting, risk control, and administration, etc.

(2) Software Element

(3) Hardware Element

(4) Personnel Element

Information technology (IT) is a factor significantly affecting the management performance. IT involves the computer, internet, applied programs, engineers, office auto, and strategy supporting system (Olson, 1982; Leavitt and Whisler, 1985; Boynton and Zmud, 1985).

Information system had influence on the management performance[22]. Lin (1997) found the RMIS could be well improved if the manager of information department was good at keeping good relation with other departments, mastering the demands on information, proactively introducing the latest information technology to the executives and regularly providing practical information training for the staff. Huang (2002) went further in concluding the relation between information system and RMP as follows: "RMIS is able to provide the precise and timely information, which ensures the improvement of work efficiency and RMP. In addition, the ability to identify and assess risks makes RMIS helpful in adjusting risk management plan and decreasing the risk management cost of the organization. The level of information system has positive correlation with the RMP. "

At last, information system factor spans four items as shown in Table 2-6.

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[22] M. E. Porter and V. E. Millar, "How Information Gives You Competitive Advantage," *Harvard Business Review,* Jul-Aug, 1985, pp.149-160.

<Table 2-6> Items of the Construct of Information System Factor (IS)

Label	Items	Previous Literature Review
X8	Each organization must have a detailed risk data record.	Song (1990), Hsiau (1996), Huang (2002)
X9	Computer system should be used to gather information concerning risk.	Head (1964), Wang (1989), Gibson (1997), Chen (1994), Huang (2002)
X10	Not only business information but economical, political information should be always paid close attention to.	Lin (1997), Huang (2002)
X11	Organization should have specialist of information system.	Lin (1997), Su (2000), Huang (2002)

2-3-4 Safety Management (SM)

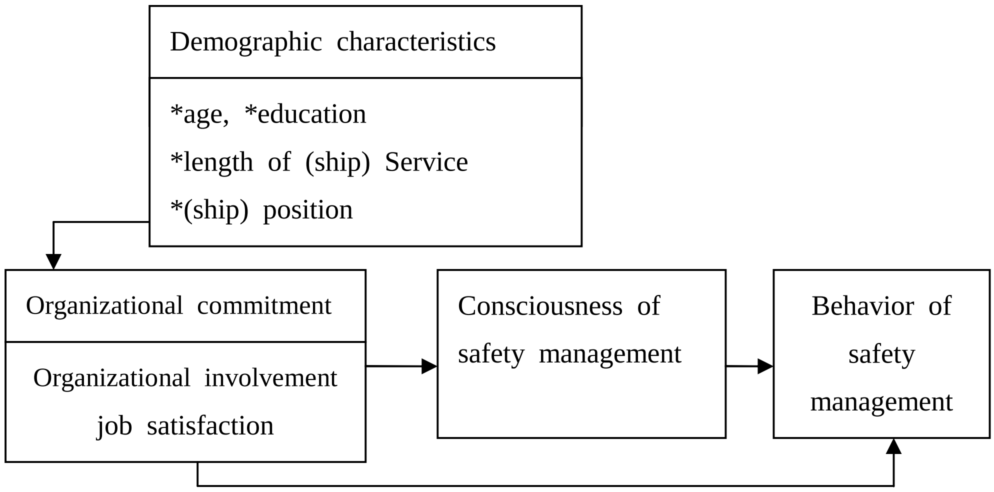
Lowrance (1976) defined safety as “a judgment of the acceptability of risk.” Braithwaite et al. (1997) indicated further that in order to achieve safety, risk must be quantified and balanced with appropriate safety measures. Wood (1996) indicated that a workable aviation definition of “safety” is based on the acceptability of risk, stating that, “if a particular risk is acceptable then we consider that thing or operation acceptable. Conversely when we say something is unsafe, we are really saying that its risks are unacceptable.” Risk management therefore appears to be an inherent characteristic of being safe.

It seems to be generally accepted that attitudes and perception affect one’s propensity to have accidents (Wigglesworth, 1978; Donald and Canten, 1993). Other papers indicate and claim that many safety problems have their origins in poor management attitudes toward safety and that unsafe attitudes almost always precede accidents (Jonson, 1982; Havold, 2000).

In a study made by Li and Wonhan (1999), the total loss rate of the world fleet in general has been steadily reduced from the highest point of 0.685% in 1978 to the lowest point of 0.212% in 1996, with a mean improvement rate of 6.28%. This was due to the development of technology, improvement of safety regulations worldwide.

Shin (1999) conducted a study on the safety management performance in shipping industry after a review of literature survey (Mowday et al., 1979; Liu, 1993; Lee, 1995). Using a questionnaire and statistical model, Shin verified that the organizational commitment, organizational involvement, job satisfaction, and demographic characteristics of the respondents of the questionnaire had influence on the consciousness of safety management, which finally influenced the behavior of safety management (as shown in Figure 2-3).

<Figure 2-3> Structure of Safety Management Performance



Source: Shin (1999)

Chen (2000) concluded that the consequences of non-compliance with ISM code could be used to establish want of due diligence in making the ship seaworthy under the Hague or Hague-Visby rules (Art. III r.1 and Art. IV, r.1), to either of the rules most bills of lading are subject. In other words, if the accidents take place, the liners undertake all losses no matter they were insured or not. Therefore, the complete understanding of the rules and regulations concerning shipping business is very important in the safety management.

Indicators used to evaluate the safety performance were arranged in Table 2-7.

<Table 2-7> Studies on Safety Performance

Author	Time	Indicators of Safety Performance
Lee	1995	Size of shipping company, characteristics of top management, politics for safety management of shipping company, characteristics of safety manager.
AIHA	1996	Loss of labor time, safety activity percentage, number of recent accidents, loss of labor compensation, exposures monitor results, level of accepting suggestions provided by the staff, other objective criteria.
Cooper	1998	Accidents statistics, number of recent accidents, accident cost, times of safety inspection, level of employee’s safety activities, safety attitude, safety training, times of inspection by the executives.
Lee	1998	Leader’s attitude toward safety, work ability of safety department, people-technology-environment condition and accident statistics.
Petersen	1999	Organization, management, hazard control, work environment hazard control, input and development, encourage, and accident report and record.
Shin	1999	Organizational commitment, organizational involvement and job satisfaction, consciousness of safety management, behavior of safety management, and demographic characteristics.
Wu	2001	Safety organization, safety culture, safety activities, safety equipment, safety training, and statistics of accidents investigation
Lin	2003	Leader’s attitude toward safety management, safety training, safety work environment, and safety regulation of the organization.

Source: Shin (1999), Lee (1995), and Lin (2003).

General speaking, safety, as one of the most important aspects in risk management, involves both people and technology. People are involved because they experience injury or make technology work. Technology produces risks from the design of the machine or the process itself. Technology involves safety of the procedure itself rather than the attitudes of the people carrying out the procedure. Thus safety can be considered from the perspective of the way people acts and from the equipment being used. The five indicators of safety management factor are listed in Table 2-8:

<Table 2-8> Items of the Construct of Safety Management Factor (SM)

Label	Items	Previous Literature Review
X12	All staff should keep positive attitude toward safety management.	Wigglesworth (1978), Donald and Canten (1993), Jonson (1982), Lee (1998), Cooper (1998), Havold (2000)
X13	Organization must ensure a safety working environment.	Zohar (1980), Wiegmann et al. (2002), French and Bell (1985)
X14	Organization should have a complete knowledge of international rules and conventions concerning safety management.	Lee (1995), Chen (2000), Liu (2004)
X15	Organization should make its own rules and regulations concerning safety management.	Li and Wonhan (1999), Liu (2004)

2-3-5 Cooperation (CS)

Several studies have thrown light on the importance of cooperation among parties. Kanafani (1984) and Janic (2000) emphasized that there was the need to consider the impact of policy on different impacted groups such as users, service operators (airlines, airport, and air traffic control), aviation and non-aviation professional, non-professional organizations, and public when we assessed the aviation safety and corporate risk management.

Customer relation management (CRM) is a process that helps bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness, and market trends. Its goal is to learn more about customers' needs and behavior in order to develop stronger relationships with them. Good customer relationships sit at the heart of business success. Businessmen realize they can reap value and minimize risk from CRM (CIO, 2003).

In professional shipping management, the most important "asset" is the client. Therefore, to achieve a relationship competitive advantage, it is imperative to have the capability and build stable and long-term relationship with clients[23]. Hunt (1997a) held the same opinion--The competencies that enable a firm to perform its activities better than competitors include information resources, such as knowledge about customer and competitors and relational resources, such as relationships with customers, suppliers and competitors.

Hunt (1997b) also noted that the neo-classical theory of competition customarily views firms' co-operating as constituting anti-competitive collusion.

George (2003) discussed the relevance of collaborative commerce in the freight transportation industry and highlighted the potential upside of implementing risk management techniques in a collaborative environment. He pointed out "Since a carriers' operations and strategic decisions will be based upon the collaborative decisions taken amongst the supply chain partners, the risk associated with its capital investments and strategic decisions goes up considerably as its success depends directly on every partners in the value chain fulfilling commitments uncompromisingly."

Effective RM requires the enterprises proactive in cooperating with all the parties involving in operation system when identifying risks. Such cooperation exists not only among the parties outside but among all sections inside the organization[24].

The flowchart of international shipping operation shown in Figure 2-4 reflects shipping companies, as the service industry inevitably, cooperate with shippers,

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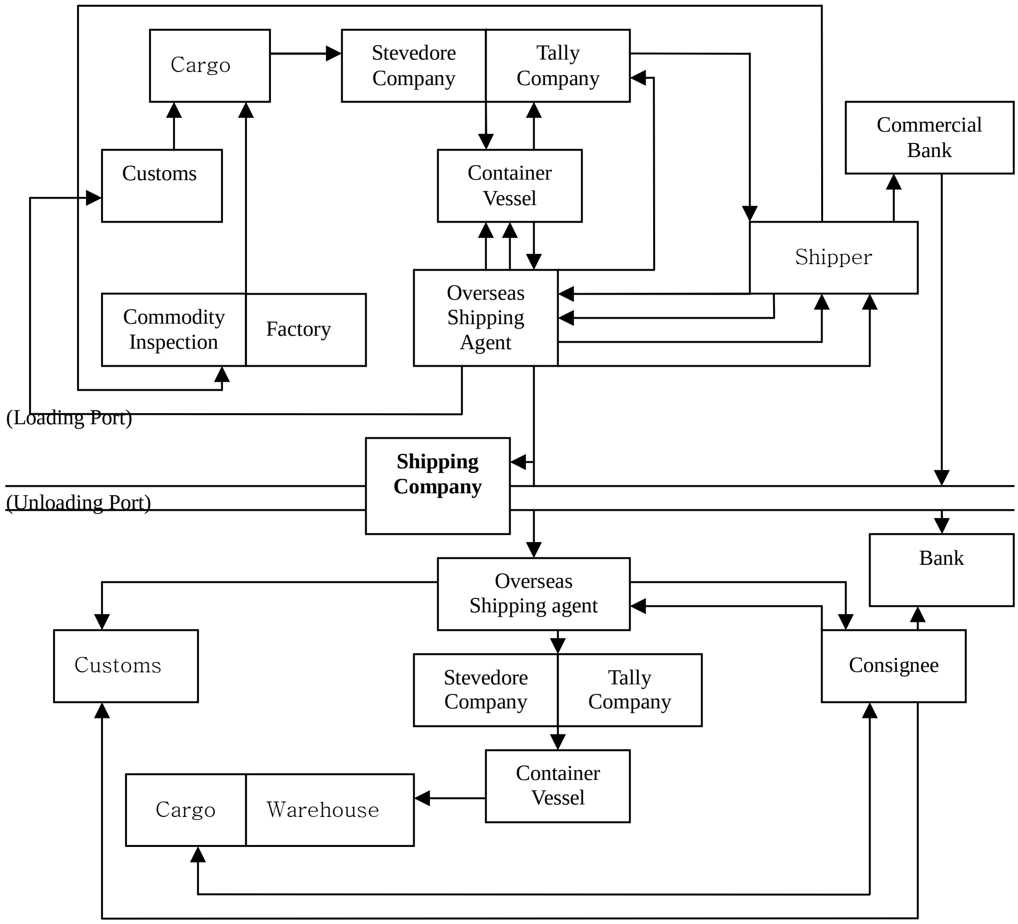
[23] Photis M. Panayides and Richard Gray, "An Empirical Assessment of Relational Competitive Advantage in Professional Ship Management," *Maritime Policy and Management,* 26 (2), 1999, pp.111-125.

[24] Fu Ping Zhou, *op.cit.*, p.24.

consignees, overseas shipping agents, customs, commodity Inspection, port authority, commercial bank, and other relevant parties all the time[25].

<Figure 2-4> Flowchart of International Shipping Operation



Source: Wang and Zeng (1997)

With seamless intermodalism looming large on the business horizon, most liner

[25] Y. Y. Wang and K. Zeng, *International Shipping Practice*, 3rd Edition, Beijing: People's Press of Communication, 1997, p.53.

shipping companies are spreading their wings across different modes of transportation, the common receiving and delivery system of cargo have changed from CY/CY (Container Yard to Container Yard) to Door/Door, which is able to provide the customers with more convenient and speedy service. However, the liners are facing more exposure units derived from the longer transportation route. In this sense, the RMP depends on the cooperation of all parties involved in the shipping operation system by which the more and more risk exposures can be identified in time.

Based on the literature mentioned above, the cooperation factor of this study is divided into four indicators as shown in Table 2-9.

<Table 2-9> Items of the Construct of Cooperation Factor (CS)

Label	Items	Previous Literature Review
X16	There should be close cooperation in different sections of the organization.	Williams and Heins (1989), Zhou (2000)
X17	Organization should have good relation with the stakeholders including customers and shipping agents overseas.	Kanafani (1984), Hunt (1997), Panayides and Gray(1999), CIO (2003)
X18	Organization should always keep in close touch with Customs and port authority.	Janic (2000), Wang and Zeng (1997)
X19	Organization should always have good collaboration relation with its business bank.	Wang and Zeng (1997), George (2003)

2-4 Summary

Risk management performance in this study is a direct index to represent the quality of risk management, which enables an organization to progress toward its goals and objectives (its mission) in the most direct, efficient, and effective path.

Six general risk management activities, which have common in the liner shipping industry, are selected as the specific indicator in this study. They are loss amount caused by risk retaining (Y1), times of inspection and maintenance for the container vessel and equipment (Y2), quality of RM training for the staff (Y3), times of meetings or seminars concerning RM hosted by the organization (Y4), punctuality (Y5), and staff mobility (Y6).

When deciding the factors affecting RMP, this study retains the factors derived from the conclusion of the similar studies made by Lin (2003), Huang (2002), Lee (1995) and, at the same time, expands the factors based on the literature review of previous studies on the RM in shipping industry. Table 2-10 displays the difference in factors selection between previous similar studies and this study. Although the significant position of CEO in RM has been widely recognized, no similar studies explicitly tested whether the CEO is responsible for RM has influence on the final RMP. Therefore, this study tends to verify its credibility. Apart from CEO's responsibility on RM, the cooperation factor is another innovation of this study.

After determining all items of each factor and RMP indicators with reference to the literatures, an empirical research methodology is to be introduced in next chapter.

<Table 2-10> Difference in Items Selection

Items \ Representative	Huang (2002)	Lee (1995)	Lin (2003)	This Study
X1: CEO should be responsible for RM.				V
X2: Executives should pay most attention to RM.	V	V	V	V
X3: Executives should actively participate in RM activities.	V	V		V
X4: Organization should have clear documented RM policy.	V	V	V	V
X5: Organization should develop a close link between its strategic objectives and management of risk.	V			V
X6: Organization should have distinct stipulation on division of work of each department.	V			V
X7: Organization should have reasonable pay system.			V	V
X8: Each organization must have a detailed risk data record.	V	V	V	V
X9: Computer system should be used to gather information concerning risk.	V			V
X10: Not only business information but economical, political information should be always paid close attention to.	V			V
X11: Organization should have specialist of information system.	V			V
X12: All staff should keep positive attitude toward safety management.		V	V	V
X13: Organization must ensure a safety working environment.		V	V	V
X14: Organization should have a complete knowledge of international rules and conventions concerning safety management.		V	V	V
X15: Organization should make its own rules and regulations concerning safety management.		V	V	V
X16: There should be close cooperation in different sections of the organization.		V	V	V
X17: Organization should have good relation with the stakeholders including customers and shipping agents overseas.				V
X18: Organization should always keep in close touch with Customs and port authority.				V
X19: Organization should always have good collaboration relation with its business bank.				V

Chapter 3
Empirical Research Methodology

3-1 Research Design

This study aims at finding out the factors that affect risk management performance (RMP). Based on the literature review stated in chapter 2 and chapter 3, five factors including Executive's support, Standardization management, Information System, Safety management, and Cooperation are picked out and five hypotheses are proposed.

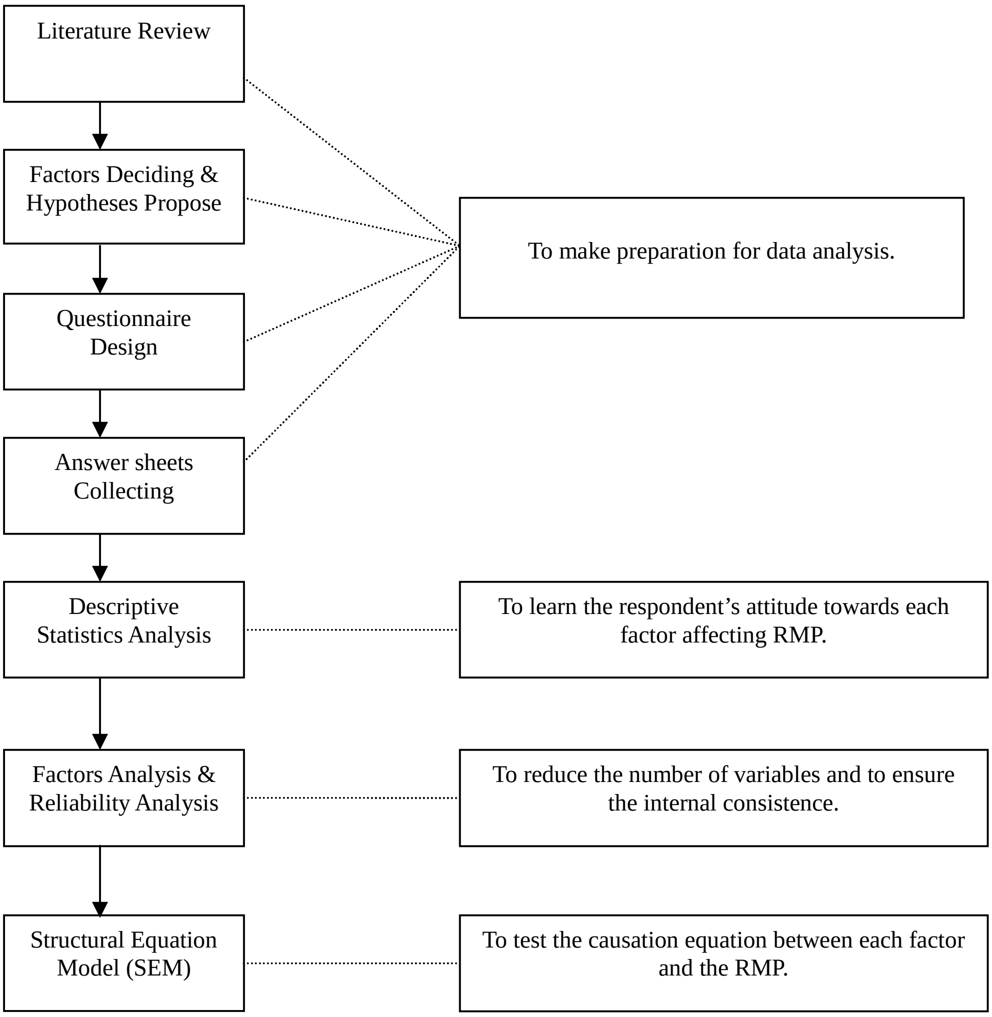
Then questionnaires consisting of these five factors are handed to the employees working in China's and Korea's liner shipping industry from whom the fundamental data to be analyzed can be got. In this study the correlation between these five factors and the RMP are to be studied.

After collecting the answer sheets from the respondents, the process of hypotheses testing are carried out following the sequence of descriptive statistics analysis, factor analysis, reliability analysis, and structural equation model (SEM).

The total data will be divided into two parts: data from the answer sheets of China's liner shipping companies and data from Korea's liner shipping companies. In accordance with these data, two hypothesized structural models respectively representing China and Korea are built to test the hypotheses. By comparing the final analysis results of two models, different attitudes toward factors affecting RMP correspondingly respectively made by China's liner shipping companies and Korea's liner shipping companies are to be examined.

Figure 3-1 shows the flow chart of concrete empirical research process.

<Figure 3-1> Empirical Research Process



3-2 Variables

3-2-1 Latent Variables and Observed Variables

Based on the indicators of each factor determined in chapter 2, the variables of the hypothesized model, including observed ones and latent ones that are very important in SEM are listed in Table 3-1.

Observed variables are actually measured, such as manifested performance on a particular test or the answers to specific items or questions on an inventory or questionnaire[26]. The term manifest variable is also often used for these to stress the fact that these are the variables that have actually been measured by the researcher in the process of data collection. In this study, the observed variables are classified into:

(1) X variables: X1~X19.

(2) Y variables: Y1~Y6.

In contrast, latent variables are the hypothetically existing constructs of interest in a study. For example, intelligence, organizational culture, social support, and socioeconomic status are all latent variables. The main characteristics of latent variables are that they cannot be measure directly (because they are typically unobservable directly) and, hence, only proxies for them can be obtained using specifically developed measuring instruments—tests, inventories, questionnaires, and so on[27]. In this study, such measurement is obtained through a questionnaire survey.

Executive’s support (ES), Standardization management (OS), Information system (IS), Safety management (SM), Cooperation (CS), and RM activity (RMPI) are the latent variables in this study.

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26 Tenko Raykov and George A. Marcoulides, *A First Course in Structural Equation Modeling*, Mahwah, New Jersey: Lawrence Erlbaum Associates Publishers, 2000,p.8.

27 *ibid.*, p.9.

<Table 3-1> Latent Variables and Observed Variables

Latent Variables	Observed Variables
Executives' Support **(ES)**	**X1**: CEO should be responsible for RM.
	X2: Executives should pay most attention to RM.
	X3: Executives should actively participate in RM activities.
Standardization Management **(OS)**	**X4**: Organization should have clear documented RM policy.
	X5: Organization should develop a close link between its strategic objectives and management of risk.
	X6: Organization should have distinct stipulation on division of work of each department.
	X7: Organization should have reasonable pay system.
Information System **(IS)**	**X8**: Each organization must have a detailed risk data record.
	X9: There should be a computer system to gather information concerning risk.
	X10: Not only business information but economical, political information should be always paid close attention to.
	X11: Organization should have specialist of information system.
Safety Management **(SM)**	**X12**: All staff should have positive attitude toward safety management
	X13: Risk should be identified by different methods.
	X14: Organization should have a complete knowledge of international rules and conventions on safety management.
	X15: Organization should make its own rules and regulations concerning safety management.
Cooperation **(CS)**	**X16**: There should be close cooperation in different sections of the organization.
	X17: Organization should have good relation with the stakeholders including customers and agents overseas.
	X18: Organization should always keep in close touch with customs and port authority.
	X19: Organization should always have good collaboration relation with its business bank

Risk Management Activities **(RMPI)**		**Y_1**: Amount of loss caused by risk retaining
		Y_2: Times of inspection and maintenance for the container vessel and equipment arranged by the organization
		Y_3: Quality of RM training for the staff provided by the organization
		Y_4: Volume of meetings concerning RM
		Y_5: Quality management effect--Punctuality (the situation of sailing on schedule)
		Y_6: Staff Mobility

3-2-2 Dependent Variables and Independent Variables

Dependent variables are variables that receive at least one path (one-way arrow) from another variable in the model. Independent variables are variables that emanate paths, but never receive them. Independent variables can be correlated among one another, i.e., connected in the path diagram by two-way arrows[28].

In the econometric literature, the terms exogenous variables (for independent variables) and endogenous variables (for dependent variables) are also frequently used to make the same distinction between variables.

<Table 3-2> Dependent Variables and Independent Variables

Dependent Variables	Independent Variables
Dependent Latent Variable: RMPI	**Independent Latent Variables:** ES OS IS SM CS
Dependent Observed Variables: X1-X19 Y1-Y6	

[28] *ibid.*, pp.11-12.

The dependent variables and independent variables of this study are listed in Table 3-2. From Figure 3-2, it is clear that dependent variables that receive one-way arrows are dependent observed variables including X1-X19 and Y1-Y6 and dependent latent variable RMPI. The independent variables that emanate one-way arrows and receive two-way arrows are independent latent variables including ES, OS, IS, SM, and CS.

3-3 Hypotheses

In order to make the further confirmation of the correlation of each variable, five null hypotheses are proposed according to the study in chapter 2.

Firstly, section 2-3-1 summarized that the executive should be responsible for the total risk management of the organization so that executive's support highly influences the RMP (Song, 1990; Jarvenpaa and Ives, 1991; Ye, 1995; Xu et al., 2000; Jang, 2001; Huang, 2002). Furthermore, if executives were qualified with the professional knowledge on RM and realize the significant position of RM in the organization, their support would improve the RMP of the organization. Therefore, the first hypothesis is proposed as:

H_1: Executives' support has a positive correlation with RMP. (i.e. The more executives' support, the better RMP.)

Secondly, section 2-3-2 listed many studies on the relation between standardization management and RMP (Song, 1983; Williams and Heins, 1989; Zhong, 1998; Huang, 2002; Zhou, 2003). They pointed out when the organization has standard rules and regulations on the business operation and human resource management, the performance of risk management will be improved. In this sense, the second hypothesis is proposed as:

H_2: Standardization management has a positive correlation with RMP. (i.e. The higher level of standardized organization, the better RMP.)

Thirdly, section 2-3-3 went on depicting the information system's influence on RMP (Olson, 1982; Leavitt and Whisler, 1985; Boynton and Zmud, 1985; Head, 1986; Chen, 1994; Lin, 1997; Huang, 2002). It was found that RMIS was an important tool in the risk management. And it was able to collect the precise and timely information, which ensured the improvement of work efficiency and RMP. So, the third hypothesis is proposed as:

H_3: Information system has a positive correlation with the RMP. (i.e. The higher level of information system, the better RMP.)

Fourthly, section 2-3-4 indicated the important of safety management in RMP (Lowrance, 1976; French and Bell, 1995; Braithwaite, 1997, Wood, 1996; Wiegmann, 2002; Lin, 2003; etc.). RM appeared to be an inherent characteristic of being safe. Shipping industry, as a typical case of high-risk industry due to its unique characteristics, considered safety management seriously when implementing risk management. Hence, the fourth hypothesis is proposed as:

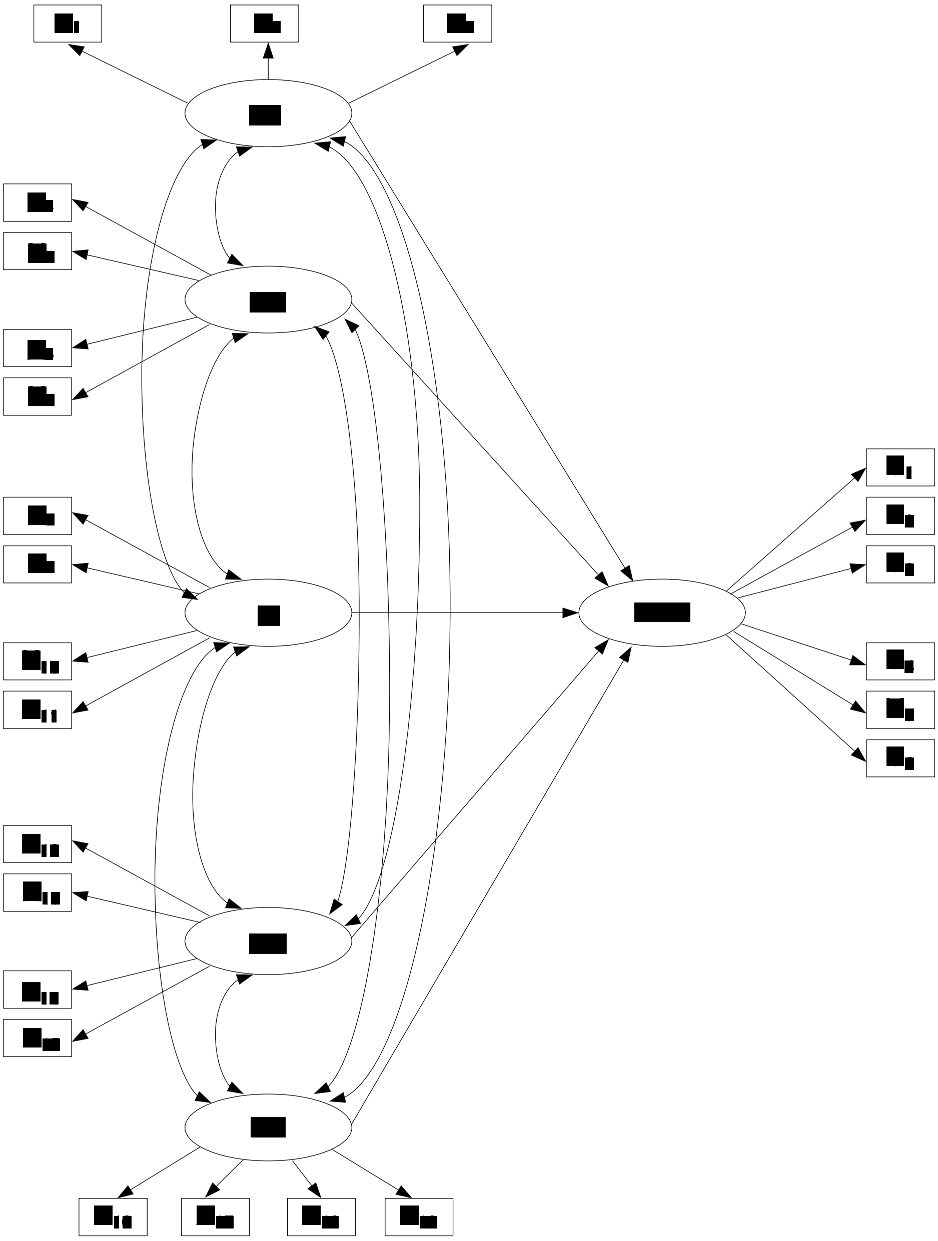
H_4: Safety management has a positive correlation with RMP. (i.e. The better performance of safety management, the better RMP.)

Finally, section 2-3-5 focused on the cooperation in the RM (Kanafani, 1984; Janic, 2000; CIO, 2003; George, 203; Zhou, 2003). We could find that effective RM required enterprises proactive in cooperating with all the parties involving in the operation system. Such cooperation existed not only among the parties outside but also within all sections of the organization. Under such circumstance, the fifth hypothesis is proposed as:

H_5: Cooperation has a positive correlation with RMP. (i.e. The higher degree of cooperation, the better RMP.)

Figure 3-2 embodies the initial five hypotheses mentioned above and clearly expresses the path diagram that integrates the latent correlations of all variables.

<Figure 3-2> Path Diagram of Initial Hypothesized Structural Model



3-4 Questionnaire Design

In order to get the quantitative data to be used when testing five hypotheses proposed in section 3-3, we design a questionnaire survey. The design process, rating scale, and contents are introduced in this section.

3-4-1 Design Process

Referring to the existing design process (Simon and Burstein, 1978), this questionnaire consists of 6 steps as follows:

(1) Begin with jotting down the topics about which I want information: Based on the literatures depicted in chapter 2, five hypotheses concerning the correlations of each factor and RMP in CLSCs are determined. Therefore, to serve the object of hypotheses-testing, questions should reflect the influence degree of each factor on RMP.

(2) Decide the question and survey type: Following previous questionnaires on risk management (Lee, 1995; Jang, 2001; Huang, 2002; Tsai, 2002), this questionnaire continues to use the closed questions where the respondents are given the option of five answers to choose from. In addition, considering the cost and the time of survey, an email questionnaire is accepted at last.

(3) Confirm the question wording: Use simple language and make each question as short as possible. At last, ensure all questions serve the object of the survey.

(4) Pretest the questionnaire: When the first draft is finished, several copies are sent to certain liner shipping company to check the answering time, the expression of the question, and the accessibility of the questionnaire.

(5) Rewrite ambiguous questions and reorganize the questionnaire where necessary, throw out unnecessary or unsuccessful questions.

(6) Write an introduction that will persuade potential interviewees to participate. In the Chinese and Korean version of the questionnaires delivered to the

China's and Korea's CLSCs, an introduction to the purpose and background of the questionnaire is inserted at the beginning.

3-4-2 Scale

A scale is the operational rule that one uses in a measurement.[29] Following Stevens[30] we distinguish four types of scale—nominal, ordinal, interval, and ratio. The interval scale, which takes the notion of ranking items in order one step further, since the distance between adjacent points on the scale are equal, is available in this survey. Since the scale is a very vague and subjective definition way, it could be changed to any numbers of personal or group preferences[31]. Here, the specific scale is derived from a Likert five-point scale, which is one major interval scale[32] and is commonly used in attitudinal measurements. The new Likert five-point scale ranges from not at all, slightly, neutrally, obviously, and significantly to rate each respondent's attitude toward the influence degree on the risk management performance caused by the factors listed in the questionnaire. The score becomes bigger as the degree of influence increases. When evaluating RMP by utilizing RM activities, I reset the five-point scale ranging from much less/ worse, less/worse, no change, more/better, and much more/much better. The score becomes bigger when the effect of risk management improves. However, taking the convenience for the responding into consideration, the scale sequences of variables Y1, Y6 in the questionnaire (shown in Appendix) is contract to that shown in Table 3-3.

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[29] Julian L. Simon and Paul Burstein, *Basic Research Methods in Social Science*, 3rd Edition, New York: Random House, 1978, p.206.
[30] S. S. Stevens, *Measurement, Psychophysics, and Utility,* New York: Wiley, 1959, pp.18-63.
[31] Yacov Y. Haimes, *Risk Modeling, Assessment, and Management,* University of Virginia, 1998, pp.177-179.
[32] Donald W. Myers, *2004 U.S. Master Human Resources Guider,* U.S.: CCH, 2004, p.127.

<Table 3-3> Explanation of Questionnaire Five-Point Scale

Scale / Variables	1	2	3	4	5
X1-X19	Not at all	Slightly	Neutrally	Obviously	Significantly
Y1, Y6	Much More	More	No Change	Less	Much Less
Y2, Y4	Much Less	Less	No Change	More	Much More
Y3, Y5	Much Worse	Worse	No Change	Better	Much Better

3-4-3 Sampling

(1) Target population

The target population includes the executive and the staff of Chinese and Korean container shipping companies. Among them the focus is laid on employees of ship management department, operating department, RM department/insurance department when there is no RM department or safety department, and financial department in the company.

(2) Sample size

Structural equation modeling is a large sample technique (Bentler, 1989; Kelloway, 1998). Both the estimation methods and tests of model fit are based on the assumption of large samples. In general, a sample size of at least 200 observations would be an appropriate minimum. Bentler and Chou (1987) suggested that the ratio of sample size to number of free parameters can go as low as 5:1 with normally or elliptically distributed data. Raykov and Marcoulides (2000) thought that regardless of free parameters, at least 150 copies of questionnaire are needed in a SEM testing. With reference to the Liner lists provided by MOC[33] and Korea Shipowner's Association, 23 Chinese CLSCs/ branches including 11 located in Shanghai, 2 in Ningbo, 6 in Qingdao, and 4 in Tianjing and 20 Korean CLSC/ branches including 10 in Busan and 10 in Seoul are randomly picked. Due to the time element, email survey was chosen to do in terms of Chinese CLSCs while direct mail survey was done in terms of Korean CLSCs. In all, 460 questionnaires (20 copies for each Chinese company) and 300 questionnaires (15 copies for each Korean) were dispatched.

(3) Contents

The questionnaire survey is made up of two parts. The first part is intended to investigate attitudes of employees working in container liner shipping companies toward factors affecting RMP. The second part seeks to examine the performance situation of RM through the effects of several RM activities.

3-5 Statistical Analysis

After the questionnaires are collected, the statistical analysis, utilizing statistical program SPSS 11.0 and LISREL 8.51, is carried out following the sequence as follows:

(1) Descriptive statistics analysis
(2) Factor analysis and reliability analysis
(3) Analysis of Variance
(4) Structural Equation Model

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[33] Ministry of Communications of the People's Republic of China.

3-5-1 Descriptive Statistics Analysis

The first stage is the descriptive statistics analysis that assigns quantitative stereotypes to variables be actually examined[34]. This stage is accomplished by calculating the mean and the standard deviation of each variable. Mean, as the most commonly used method of describing central tendency, tends to reflect the respondents' attitudes toward evaluating the importance-level of factors listed in the questionnaire, while standard deviation, as one of the most commonly used method of showing the relation of the each score to the mean, tends to accurately estimate the dispersion level of the respondents' attitudes. In brief, the descriptive statistics analysis aims to find out the respondent's viewpoint and attitude toward each factor affecting the risk management performance of liner shipping company.

3-5-2 Factor Analysis and Reliability Analysis

(1) Factor analysis

Factor analysis is a technique used to investigate the relationship between theoretical dimensions and empirical variables, and to construct scales; it is widely used in psychology, sociology, political science, and other social sciences. It was developed to help construct good indicators of abstract concepts.[35]The purpose of factor analysis is to discover simple patterns in the pattern of relationships among the variables. In particular, it seeks to discover if the observed variables can be explained largely or entirely in terms of a much smaller number of variables called factors[36]. Factor analysis reserves the majority information of the original data structure after condensing an original large number of variables into smaller, more manageable

[34] Earl Bogdanoff, *Introduction to Descriptive Statistics: A Sequential Approach*, California: Dickenson Publishing Company, Inc., 1970, p.357.
[35] Simon and Burstein, *op.cit.*, p.220.
[36] Richard B. Darlington, *Factor Analysis*, New York: Cornell University, 1997.

number of variables.[37] To discover how many factors are in a set of items, a basic concept is that items that are highly correlated with each other will be part of the same factor, and items that are correlated weakly or not at all will be on different factors.

Confirmatory factor analysis, an application of SEM, is used in this study to reduce the theoretical dimensions of the risk management activities and factors affecting risk management performance. The steps of factor analysis are:

(1) Extract eigenvalues over 1. (Principle of variables selection)

(2) Maximize the variance of each variable with the help of varimax rotation method.

(3) Extract absolute value of factor loading[38] over 0.5.

(2) Reliability analysis

The advantages of SEM methodology can only be used with variables that have been reliably assessed. If the data are poor, in the sense of reflecting substantial unreliability in the analyzed data, the results will be poor, regardless of the quality of the model.[39] Reliability is the correlation of an item, scale, or instrument with a hypothetical one that truly measures what it is supposed to. Since the true instrument is not available, reliability is estimated from high correlation among the variables comprising the scale or from the correlation of two equivalent forms of the scale.

Within the popular category of reliability as internal consistency, Cronbach coefficient alpha has gained considerable acceptance as the reliability index of choice. Cronbach alpha is basically a correlation coefficient measuring item versus total-test intercorrelations: the higher these intercorrelations, the higher the test reliability and

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37 J. Y. Huang, *Research Methodology for the Corporation*, Donghua Publishing House, 1996.

38 M. G. Danielson and J. M. Karpoff, "On the Uses of Corporate Governance Provisions," W*orking Paper*, 1998, p.11.
A factor loading can be interpreted as the proportion of the provision's use that is explained by that factor.

39 Raykov and Marcoulides, *op.cit.*, pp.19-30.

vice versa. By convention, α should be 0.70 or higher to retain an item in a scale[40]. The formula used to calculate alpha is (Cronbach, 1951):

$$\alpha = \left[k / (k-1) \right] \left\{ 1 - \left[\left(\sum \sigma_i^2 \right) / \left(\sigma_t^2 \right) \right] \right\} \qquad (1)$$

where k =number of items

σ_i^2 =the variance of the item scores, and

σ_t^2 =the variance of the test scores.

3-5-3 Structural Equation Model (SEM)

(1) Model Structure

Structural Equation Modeling (SEM) is a statistical methodology used by biologists, economists, educational researchers, marketing researchers, and a variety of social and behavioral scientists. The structural model specifies the hypothesized causal structure among latent variables, which is indicated as a path or arrow connecting the two variables.

Following the matrix notation form of Mueller (1996), a general structural equation model in which all variables are observed can be written:

$$\mathbf{Y} = \beta Y + \tau X + \zeta \qquad (2)$$

where **Y** is a (N_Y x 1) column vector of endogenous variables (N_Y is the number of endogenous variables), **X** is a (N_x x 1) column vector of exogenous variables (N_x is the number of exogenous variables), β is a (N_x x N_Y) matrix of structural coefficients representing the direct effects of endogenous on other endogenous variables, **τ** is a (N_Y x N_x) matrix of structural coefficients representing the direct effects of exogenous on endogenous variables, and ζ is a (N_Y x 1) column vector of error terms.

40 J. C. Nunnaly, *Psychometric Theory*, 2nd Edition, New York: McGraw Hill, 1978.

(2) Analysis Process

SEM analysis includes six steps[41].

Step 1: Model Specification It is the act of stating a model by describing the relationships among the variables that will be analyzed. The hypothesized relationships are depicted in a path diagram by arrows, or paths, connecting the latent factors in ways that represent the hypothesized directions and magnitudes of the causal relations.

Step 2: Model Identification In Figure 3-2, rectangles are used for observed variables labeled sequentially and ellipses are used for latent variables. The one-way arrows, also called paths, signal that a variable at the end of the arrow is explained in the model by the variable at the beginning of the arrow. Two-way arrows are used to represent covariation between two variables and signal that there is an association between the connected variables that is not assumed to be directional. At the same time, all parameters to be estimated are listed in order to write the equation. According to the hypotheses of this study, there are nineteen X (X1~X19) observed variables and six Y (Y1~Y6) observed variables, five latent independent variables (ES, OS, IS, SM, CS), and one latent dependent variable (RMP).

Step 3: Model Estimation The estimation method iteratively minimizes a function of the discrepancy between the observed (co)variance and those reproduced by a substitution of iteratively changing parameters estimates into the model implied relations (Hancock and Mueller, 2001). The maximum likelihood estimation procedure selects parameter estimates so as to maximize the likelihood of the observed data and is robust to violations of normality. Therefore, all parameter estimation in the study estimation in this study will be conducted using the maximum-likelihood method of estimation.

Step 4: Assessment of Model Fit The main task of SEM is “to determine the

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41 Jie Li, “An Examination of a Structural Equation Model of Readiness to Use Complementary and Alternative Medicine among Australian University Students”, *Doctoral Dissertation*, USA: University of Maryland, 2005, pp.30-36.

goodness of fit between the hypothesized model and the sample data"[42]. A good fit suggests that the hypothesized relations among constructs are plausible; a bad fit suggests the rejection of the theorized relations among constructs in the model. There are three categories of fit indices including Chi-Square value, Descriptive-Fit indices, and Residual measures [43].

Chi-Square value (x^2) represents a test statistic of the goodness of fit of the model. The lower the Chi-Square, the better the model fits. It is recommended that the ratio of Chi-Square to its degree of freedom (x^2 / df) should be less than 3[44].

The first descriptive-fit index proposed is called goodness-of-fit index (abbreviated as GFI), which can be considered to be a measure of the proportion of variance and covariance that the proposed model is able to explain. If the number of parameters is also taken into account in computing this measure, the resulting index is called the adjusted goodness-of-fit index (abbreviated as AGFI). The GFI and AGFI are usually fairly close to 1 for well-fitting models.

As SEM is based on the goodness of fit between the sample data and the hypothesized model, eliminating residuals is the most useful method for locating sources of mis-specification and improving the model fit. The larger the value of standard residuals, the less accurately the model is explained. The Root Mean Squared Error of Approximation (abbreviated as RMSEA) is one of the commonly used residual measures. RMSEA value of less than 0.05 indicates a very good fit; between 0.05 and 0.08 a moderate fit; and above 0.08 a poor fit[45].

Table 3-4 summarizes the benchmarks of goodness of fit available in this study.

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42 B. M. Byrne, *Structural Equation Modeling with EQS and EQS/Windows, Basic Concepts, Applications, and Programming,* Thousand Oaks London New Delhi: SAGE Publications, 1994, p.7.

43 Raykov and Marcoulides, *op. cit.,* pp.35-43.

44 Jie Li, *op. cit.,* p.34.

45 R. C. MacCallum, M. W. Browne, and H. M. Sugawara, "Power Analysis and Determination of Sample Size for Covariance Structure Modeling," *Psychological Methods,* 1, 1996, pp.130-349.

<Table 3-4> Benchmarks of Goodness of Fit

Name of fit indices	x^2 / df	GFI	AGFI	RMSEA
Benchmark	<3	>0.9	>0.9	<0.05

Step 5: Model Modification and Respecification Once a model has been estimated and its fit tested, the next phase is model modification and respecification, if necessary. New models can be developed as a refinement based on analysis results from the Lagrange Multiplier (LM) test, a test that provides ‘post hoc theory’ dictates as determinants of the model respecifications. Covariances between two error residuals or a new path between two latent factors might be added into the new models. The models should be retested again with the adjustments included the same steps should be repeated in determining whether or not to add more residual error covariances or paths.

Due to the mathematical complexities of estimating and testing the proposed assertions, computer programs are a must in applications of structural equation modeling methodology. To date, numerous computer programs are available for conducting structural equation modeling analyses. Programs such as LISREL (Jŏreskog and Sŏrbom, 1993), AMOS (Arbuckle, 1995), EQS (Bentler, 1995), and so on, are likely to contribute to a further increase in the coming years of the popularity of this relatively new methodology. Although all these programs have somewhat similar capabilities, this study applies LISREL program to carry out the SEM.

The empirical analysis results following the research sequences mentioned above will be detailedly explained in Chapter 4.

Chapter 4
Empirical Results

4-1 Empirical Analysis

In order to get the data to be tested in the SEM, a questionnaire survey was conducted in October 2005. As of 30th November 2005, 218 valid questionnaire answer sheets from Chinese CLSCs and 149 valid ones from Korean CLSCs were received. Table 4-1 shows the final valid response results of questionnaire answer sheets. The responding data is classified into two parts—Part 1: data from Chinese container liner shipping companies. Part 2: data from Korean container liner shipping companies. The next analysis in this chapter focuses on the difference between Chinese model and Korean model correspondingly based on these two parts of data.

<Table 4-1> Response Result of Questionnaire Answer Sheets

Cluster / Item	Container Liner Shipping Companies (CLSC)		
	Chinese CLSC	**Korean CLSC**	**Total**
Number Distributed	460	300	760
Number Returned	228	166	394
Valid Population	218	149	367
Valid Response Rate	47.39%	49.67%	48.29%

4-1-1 Descriptive Statistical Analysis

The mean value and standard deviation of each variable are listed in Table 4-2, which clearly displays the general comparative results of the attitudes toward each factor between Chinese CLSCs and Korean CLSCs.

<Table 4-2> Comparative Result of Descriptive Statistics Analysis

	Chinese CLSCs				Korean CLSCs			
	Mean V.	**S. D.**	**Rank of Importance**	**Mean V. of Factor** (Rank of Importance)	**Mean V.**	**S. D.**	**Rank of Importance**	**Mean V. of Factor** (Rank of Importance)
X1	4.2890	.7461	2	**ES 4.3960** (2)	4.4094	.5929	2	**ES 4.4698** (1)
X2	4.7569	.5175	1		4.5772	.5475	1	
X3	4.1422	.8656	3		4.4228	.6171	3	
X4	4.3486	.7844	3	**OS 4.2649** (4)	4.1879	.6715	2	**OS 3.9849** (5)
X5	4.5459	.7121	1		4.1141	.7026	3	
X6	4.3991	.7320	2		4.3154	.7079	1	
X7	3.7661	.8176	4		3.5168	.6638	4	
X8	4.2982	.7669	2	**IS 4.2156** (5)	4.3490	.6568	1	**IS 4.1110** (4)
X9	4.1560	.6744	3		4.0537	.8446	3	
X10	4.3211	.7666	1		4.1812	.7076	2	
X11	4.0872	.8240	4		3.8591	.8465	4	
X12	4.3945	.7376	4	**SM 4.4220** (1)	4.2483	.5801	2	**SM 4.1661** (2)
X13	4.4266	.7290	2		4.3221	.5844	1	
X14	4.4495	.6580	1		3.9799	.8658	4	
X15	4.4174	.6957	3		4.1141	.6423	3	
X16	4.2018	.6114	4	**CS 4.2982** (3)	4.4698	.5642	1	**CS 4.1380** (3)
X17	4.2982	.7964	2		4.3624	.5601	2	
X18	4.4037	.7326	1		3.8792	.5802	3	
X19	4.2890	.7940	3		3.8389	.7358	4	
Y1	3.1330	.7157	1	**RMPI 3.0031**	3.4027	.8213	4	**RMPI 3.3591**
Y2	3.0459	.6705	4		3.4497	.8174	3	
Y3	3.0688	.8423	3		3.5235	.5994	2	
Y4	3.0872	.7839	2		3.3490	.6465	5	
Y5	3.0459	.9920	4		3.5436	.6523	1	
Y6	2.6376	.7323	6		2.8859	.7309	6	

From Chinese CLSCs' point of view, the safety management factor (SM), with the highest mean score of 4.4220, has the most significant influence on RMP. Then comes the executives' support factor (ES), with a score of 4.3960. The remaining three factors in a descending sequence in terms of scores are cooperation factor (CS) scoring 4.2982, standardization management factor (OS) scoring 4.2649, and information system factor (IS) scoring 4.2156.

From Korea's CLSCs' point of view, the executives' support factor (ES), with the highest mean score of 4.4698, has the most significant influence on RMP. The remaining four factors in a descending sequence in terms of scores are safety management factor (SM) scoring 4.1661 cooperation factor (CS) scoring 4.1380, information system factor (IS) scoring 4.1110, and standardization management factor (OS) scoring 3.9849. Among five factors, only the standardization management factor scores less then 4, which means it is influential, but not to an obvious degree, in RMP.

In terms of executives' support factor, the ranks of variables from X1 to X3 are completely the same. Both Chinese and Korean CLSCs regard that the variable X2 "Executives should pay most attention to RM" has the most obvious influence on the final RMP.

In terms of standardization management factor, while data of Korean CLSCs shows that variable X6 "Organization should have distinct stipulation on division of work of each department" scores highest, Chinese CLSCs consider variable X5 "Organization should develop a close link between its strategic objectives and management of risk" has the most obvious influence on RMP.

In terms of information system factor, Korean CLSCs score variable X8 "Each organization must have a detailed risk data record" highest, while Chinese CLSCs give the highest score to variable X10 "Not only business information but economical, political information should be always paid close attention to."

In terms of safety management factor, X14 "Organization should have a complete knowledge of international rules and conventions on safety management" scores highest in the opinion of Chinese CLSCs. However, it turns to be X13 "Risk should be identified by different methods" in the opinion of Korean CLSCs.

In terms of cooperation factor, Chinese CLSCs think it is most important to keep close relation with customs and port authority. However, Korean CLSCs take the close cooperation within different section of the organization more seriously

As far as RMPI is concerned, the scores of all variables in this section belong to the interval from 2 to 4. Generally speaking, there is little change in the RMP in most companies, but both Chinese and Korean CLSCs have higher staff mobility in 2004. Indicator Y1 “Risk retaining” scoring 3.1330 ranks first in the data of Chinese CLSCs, while indicator Y5 “punctuality” scoring 3.5435 ranks first in the data of Korean CLSCs.

4-1-2 Factor Analysis and Reliability Analysis

This part utilizes factor analysis to confirm whether the results of factor choosing are the same as those derived from the literatures. At first, measure of Sampling Adequacy (MSA) is in use. Kaiser-Meyer-Olkin (KMO), the indicator of MSA, should be greater than 0.50 for a satisfactory factor analysis to proceed.[46]

The factor scales are examined for their internal consistency reliability using Cronbach’s alpha. Cronbach alpha is basically a correlation coefficient measuring item versus total-test intercorrelations: the higher these intercorrelations, the higher the test reliability and vice versa. By convention, α should be 0.70 or higher to retain an item in a scale.

Table 4-3 combines the final results of factor analysis and reliability analysis, which are based on the data provided by all 367 copies of answer sheets. The KMO measure is 0.821 exceeding the 0.50 required value for factor analysis. The factor structure reflected in Table 4-3 shows the questionnaire in this study has exactly the same structure as that derived from the literatures. Factors 1 to 5 are therefore respectively named as IS, CS, SM, ES, and OS.

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[46] Y. Y. Chiu, Bob Stewart and Mark Ehlert, “The Validation of a Measurement Instrument,” *Working Paper*, USA: University of Missouri-Columbia, 2003.

<Table 4-3> Univariate Statistics of Constructs and Variables

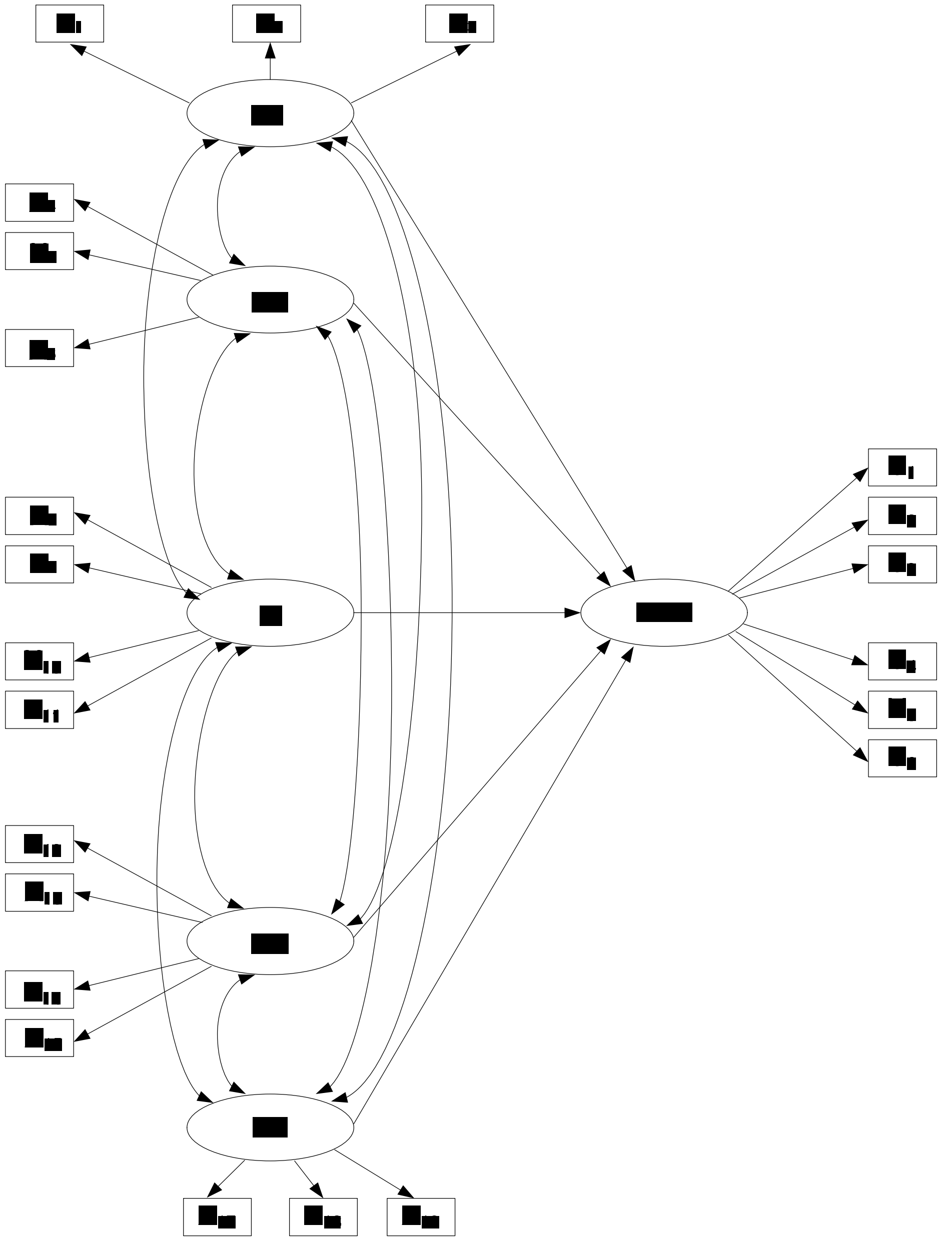
Factor Measured indicator variable	Initial Eigenvalues			Factor Variable	Factor Loading	Cronbach Alpha if Item Deleted
	Total	% of Variance	Cumulative			
1 (IS) α= .771	5.789	30.469	30.469	X8	.787	.690
				X9	.776	.711
				X10	.564	.735
				X11	.646	.729
2 (CS) α= .657	1.606	8.455	38.924	X16	.559	.734
				X17	.646	.518
				X18	.697	.546
				X19	.748	.493
3 (SM) α= .761	1.465	7.713	46.637	X12	.673	.716
				X13	.548	.721
				X14	.619	.724
				X15	.767	.657
4 (ES) α= .595	1.382	7.274	53.911	X1	.734	.556
				X2	.624	.414
				X3	.690	.529
5 (OS) α= .532	1.101	5.796	59.707	X5	. 698	.234
				X6	.584	. 379
				X7	. 652	. 637

Extraction Method: Principal Component Analysis,
Rotation Method: Varimax with Kaisa Normalization.

Factors IS and SM have an acceptable reliability coefficients (.771 and .761 respectively). However, CS, ES, and OS yield reliability coefficients under .700 (.657, .595, and .532 respectively). It should be taken into consideration when the research interprets the results related to these three factors. To check the contribution of each item to the factor reliability, the "Cronbach alpha if one certain item is deleted" are also calculated. We can find some variables (X16 and X7) are responsible for lowering the construct reliability. Thus, the variables in dark gray are deleted to improve the better reliability.

According to the results of factor analysis and reliability analysis, the new hypothesized structural model is rebuilt (see Figure 4-1).

<Figure 4-1> Final Hypothesized Structural Model



4-2 Confirmatory Analysis of Hypotheses

4-2-1 Model 1: Chinese CLSCs

Maximum Likelihood (ML) technique shows dissatisfied data-model fitness result from the test of the initial measurement model (see Table 4-5). All fit indices yielded by the original structural did not match the benchmarks, which indicated the model must be adjusted. Both GFI (.620) and AGFI (.511) are less than .90. In addition, RMSEA (.170) and ration of Chi-square to the degree of freedom (7.247) do not meet the criteria of fitness evaluation, either.

Based upon the priori, it is suggested that subscale measures with extremely low standardized factor loadings be dropped from the latent factor measurement. And cross-loading items, those that have significant loadings on more than three factors simultaneously, also are recommended to be deleted. X9, an item of IS factor, is found to be crossly loaded on ES, IS, and CS. And X5, an item of OS factor, crossly loaded on OS, IS and SM (see Table 4-4). To further improve the fitness of the model, a final respecification is made by dropping five items with low loadings on their targeted latent factors. Of the five items, three variables, X4, X1, and X6 are with loadings of 0.21, 0.27, and 0.36 respectively. The decision to drop these items with low factor loading is also supported by the internal consistency reliability tests using Cronbach alpha (see Table 4-3). These respecification efforts eventually make the measurement model meet joint criteria of data-model fit.

<Table 4-4> Summary of Cross-loading Items Dropped from Chinese Measurement Model

Number	Item	Factor	Cross-loading Factor
1	X9	IS	ES, IS, CS
2	X5	OS	OS, IS, SM

To this point, the final measurement model is shown in Table 4-5. In total, seven items are dropped due to low factor loadings or cross-loading. Since all variables of factor OS are deleted through the steps of factor analysis and respecification, the factor OS does not belong to the structural model.

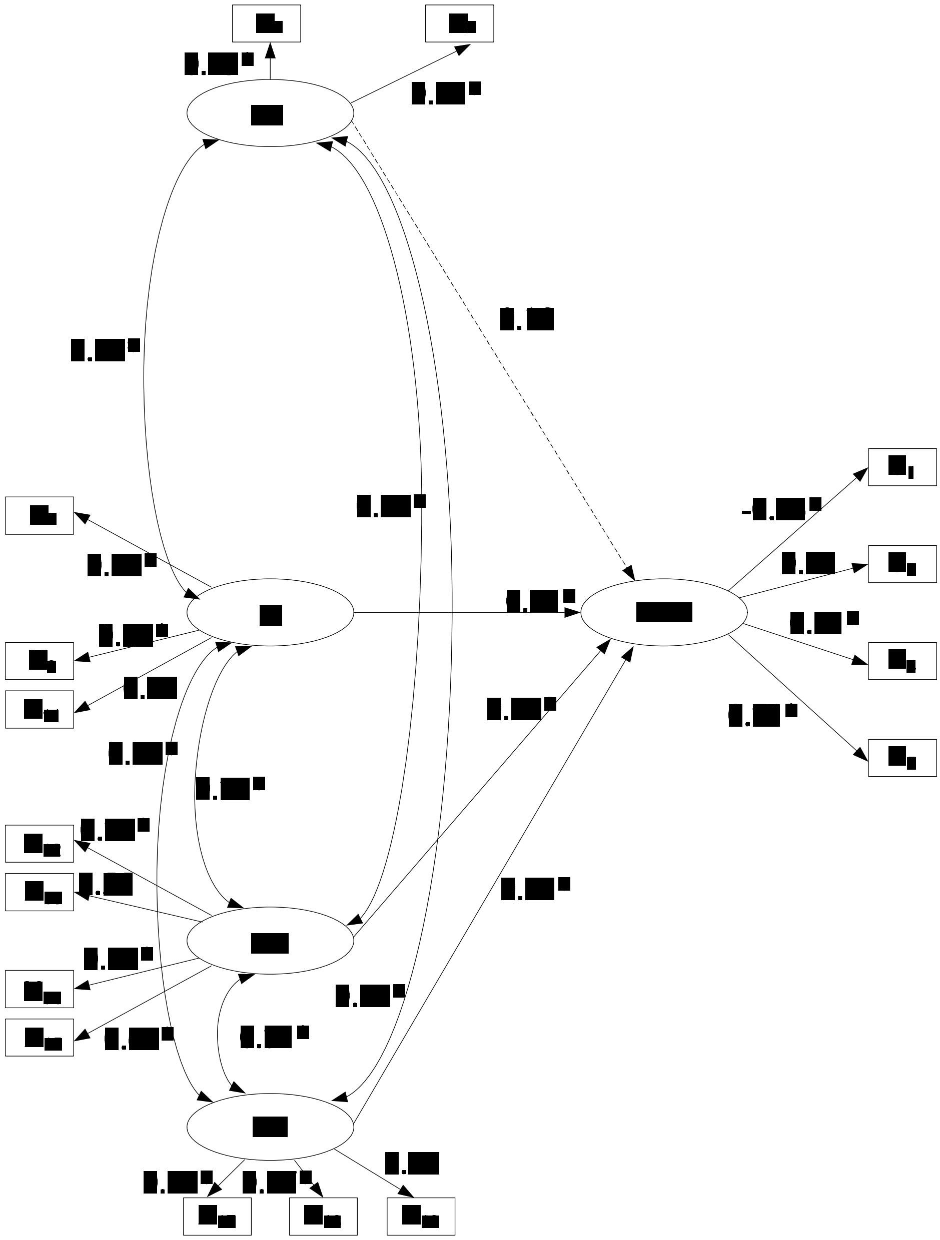
<Table 4-5> Fit Indices of Structural Model—Chinese CLSCs

Measurement Mode	**Variable Deleted**	x^2 / df	**GFI**	**AGFI**	**RMSEA**
Original Mode	-	7.247	.620	.511	.170
1st specified	X9 (IS)	4.425	.789	.701	.048
2nd specified	X5 (OS)	3.688	.805	.732	.046
3rd specified	Y3 (RMPI)	2.873	.848	.823	.044
4th specified	Y6 (RMPI)	2.654	.874	.850	.039
5th specified	X4 (OS)	1.931	.905	.884	.038
6th specified	X1 (ES)	1.425	.908	.892	.037
7th specified	X6 (OS)	1.280	.911	.901	.037
Benchmark	-	<3	>0.9	>0.9	<0.05

From the ML estimate results of the structural model, the pathway coefficients and their associated t-scores (a t-score of 1.96 or greater was considered to be significant at the 0.05 level) are examined to draw conclusion about the specific model relations. The higher a path coefficient is the stronger effect the causal factor has on the variables.

A review of Figure 4-2 reveals the path coefficients of all variables existing in the final structural model. Standard path coefficients represents, from Chinese liner shipping companies' point of view, the strength of the relationships among latent factors (see Table 4-6). At the same time, the contributions of subscale measures to each latent factor also reflected by pathway coefficients (see Table 4-7) are embodied in Figure 4-2. The higher value the path coefficient is the stronger effect the independent latent variable (causal factor) has on the dependent latent variable.

<Figure 4-2> Final Structural Model—Chinese CLSCs (*t>1.96 and P<0.05)



<Table 4-6> Standard Path Coefficients—Chinese CLSCs

From	To	Path Coefficient
Coefficients between Independent and Dependent Latent Variable		
ES	RMPI	0.18
IS	RMPI	0.21*
SM	RMPI	0.67*
CS	RMPI	0.33*
Coefficients among Independent Latent Variable		
Between	**And**	**Path Coefficient**
ES	IS	0.52*
ES	SM	0.66*
ES	CS	0.62*
SM	IS	0.75*
SM	CS	0.71*
CS	IS	0.66*

*****Path Coefficient is significant at P<.05

1. Correlations between dependent and independent latent variable

Of 4 paths between each independent latent variable and dependent latent variable, 3 are found to be statistically significant. These significant pathway coefficients reflect:

(1) ES has no significant influence on RMPI. Therefore, the first null hypothesis **H1** is ***rejected***.

(2) IS has a direct, positive effect on RMPI, in other words, the higher level of information system the company processes, the better RMP it will achieve. Therefore, the third null hypothesis **H3** is ***accepted***.

(3) SM has a direct, positive effect on RMPI, in other words, the better safety management a company performs, the better RMP it will achieve. Therefore, the fourth null hypothesis **H4** is ***accepted***.

(4) CS has a direct, positive effect on RMPI, in other words, CS factor has positive correlation with RMP. Therefore, the fifth null hypothesis **H5** was ***accepted***.

With the highest path coefficient scoring 0.67, safety management factor has the most significant influence on the performance of risk management than both cooperation factor and information system factor.

In summary, the final structural equation is written as follows:

$$RMPI=\underset{(1.26)}{0.18ES}+\underset{(2.11)}{0.21IS}+\underset{(3.41)}{0.67SM}+\underset{(2.67)}{0.33CS} \qquad R^2=52\%$$

where factor SM has the highest pathway coefficient that implies the improvement of safety management of the liner shipping company is the most significant shortcut for the company to achieve satisfied risk management performance.

2. Correlations among independent latent variables

Of six paths among four latent factors, all are found to be statistically significant. This phenomenon draws the conclusion that every two independent latent variables have mutual influences on each other.

Standardized factor loadings listed in Table 4-7 indicate the strengths of the contribution of each observed variable to the measurement of the latent construct based on data from the sample. The larger a factor loading is, the more variances of the observed variable the latent construct explains, and the more the observed variable contributes to the construct measurement (Li, 2005).

Two measures X2 and X3 load well on ES with a factor loading of 0.45 and 0.58 respectively. As for factor IS, X8 and X9 have significant loadings of 0.76 and 0.77. Of four items of factor SM, X14 loads highest on SM, then comes X12 with a score of 0.70. X15 has relatively lower loading of 0.60. As far as factor CS is concerned, X17 and X18 have high factor loadings of 0.69 and 0.87. In terms of factor RMPI, Y5 (Punctuality) contributes most with a loading of 0.71. Y4 (volume of meetings concerning RM) has the second highest loading of 0.51. Y1 (amount of risk retaining) has a low negative loading of 0.23.

<Table 4-7> Contributions of Subscale Measures to Latent Factors—Chinese CLSCs

From	To	Factor Loading
ES	X2	0.45*
	X3	0.58*
IS	X8	0.76*
	X9	0.77*
	X11	0.45
SM	X12	0.70*
	X13	0.55
	X14	0.92*
	X15	0.60*
IS	X17	0.69*
	X18	0.87*
	X19	0.40
RMPI	Y1	-0.23*
	Y2	0.08
	Y4	0.51*
	Y5	0.71*

*****Path Coefficient is significant at P<.05

4-2-2 Model 2: Korean CLSCs

It is known from Table 4-8, of four fit indices yielded by the initial structural model, two have already well met the benchmarks. They are the ration of Chi-square to the degree of freedom (1.007) and RMSEA (0.007). The fact that remaining fit indices of GFI and AGFI are very close to the benchmarks hints the structural model of Korean CLSCs is very similar to the model derived from the literatures. The initial model needs to be adjusted and respecified until all fit indices meet the joint criteria of data-model fit. The process of respecification is explained in Table 4-8.

<Table 4-8> Fit Indices of Structural Model—Korean CLSCs

Mode	Variable Deleted	x^2 / df	GFI	AGFI	RMSEA
Original Mode	-	1.007	.872	.823	.007
1st specified	X11 (IS)	1.002	.884	.841	.000
2nd specified	X13 (SM)	1.142	.902	.878	.000
3rd specified	Y6 (RMPI)	1.334	.918	.882	.000
4th specified	Y1 (RMPI)	1.026	.925	.907	.000
Benchmark	-	<3	>0.9	>0.9	<0.05

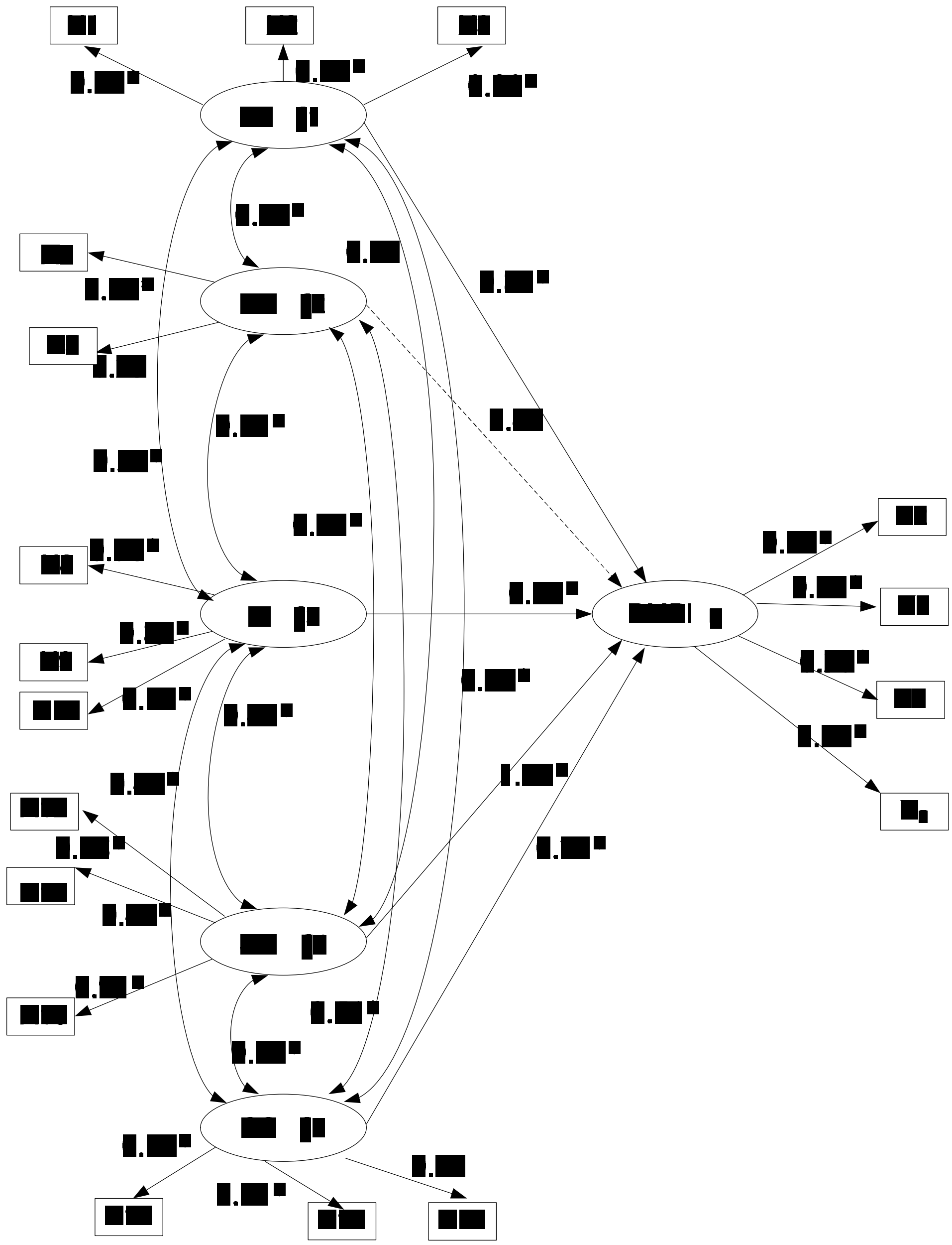
As mentioned before, subscale measures with extremely low standardized factor loadings and cross-loading items, those that have significant loadings on more than three factors simultaneously, are suggested to be dropped from the latent factor measurement. X11, an item of IS factor, is found to be crossly loaded on ES, IS, and CS. And X13, an item of factor SM, crossly loaded on ES, OS, IS and SM (see Table 4-9). To further improve the fitness of the model, a final respecification model is made by dropping two items with low loadings on their targeted latent factors. They are Y6 and Y1 with loadings of -0.08 and 0.20 respectively. By doing so, the GFI finally increases to 0.925, and the AGFI to 0.907.

<Table 4-9> Summary of Cross-loading Items Dropped from Korean Measurement Mode

Number	Item	Factor	Cross-loading Factor
1	X11	IS	ES, IS, SM
2	X13	SM	ES, OS, IS, SM

According to the results of respecification, the structural model concerning Korean CLSCs' attitudes toward factors affecting on RMP is rebuilt as shown in Figure 4-3.

<Figure 4-3> Final Model—Korean CLSCs (*t>1.96 and P<0.05)



The path coefficients of all variables revealed in structural model represent not only the strength of the relationships among latent factors (see Table 4-10) but also the contributions of observed variables to their corresponding latent factor (Table 4-11).

<Table 4-10> Standard Path Coefficients—Korean CLSCs

From	To	Path Coefficient
Coefficients between Independent and Dependent Latent Variable		
ES	RMPI	0.83*
OS	RMPI	0.45
IS	RMPI	0.92*
SM	RMPI	1.24*
CS	RMPI	0.78*
Coefficients among Independent Latent Variable		
Between	**And**	**Path Coefficient**
ES	OS	0.27*
ES	IS	0.57*
ES	SM	0.25*
ES	CS	0.42*
OS	IS	0.83*
OS	SM	0.45*
OS	CS	0.51*
IS	SM	0.75*
IS	CS	0.46*
SM	CS	0.67*

*****Path Coefficient is significant at P<.05

1. Correlation between dependent and independent latent variable

There are total 5 pathway coefficients existing between each one of the five independent latent variables (ES, OS, IS, SM, and CS) and the dependent latent variable RMPI. Of these 5 paths, 4 are found to be statistically significant, in other words, 4 proposed hypotheses are accepted.

(1) ES, with a score of 0.83, has a direct, positive effect on RM activities, in other words, the more executives' support a company can get, the better RMP it will achieve. Therefore, the first null hypothesis **H1** is ***accepted***.

(2) Although factor OS has a positive score of 0.45, the t value of OS (1.58) is less than the critical value of 1.96. It is concluded that OS has no significant influence on RMPI. Therefore, the second null hypothesis **H2** is ***rejected***.

(3) IS, with a score of 0.92, has a direct, positive effect on RMPI, i.e. the higher level of information system the company possesses, the better RMP it will achieve. Therefore, the third null hypothesis **H3** is ***accepted***.

(4) SM, with a highest score of 1.24, has a direct, positive effect on RMPI. In other words, the better safety management a company performs, the better RMP it will achieve. Therefore, the fourth null hypothesis **H4** is ***accepted***.

(5) CS, with a score of 0.78, has a direct, positive effect on RMPI. That is to say, the higher level of cooperation a company has, the better RMP it will achieve. Therefore, the fifth null hypothesis **H5** is ***accepted***.

The extent to which the four factors influenced the RMPI is reflected by means of the path coefficient as well. With the highest path coefficient scoring 1.24, factor SM has the most significant influence on the performance of risk management.

The final structural equation is written as follows:

$$RMPI=0.83ES + 0.92IS + 1.24SM + 0.78CS \qquad R^2=61\%$$

$$(3.50) \quad (2.67) \quad (6.55) \quad (2.59)$$

where factor SM has the highest pathway coefficient of 1.24, and factors IS, ES, and CS have coefficients in a descending sequence as 0.92, 0.83, and 0.78.

2. Correlations among independent latent variables

Of 10 paths among latent factors, 9 were found to be statistically significant. Similar to the results of Chinese model, all independent latent variables in the Korean structural model have mutual influences on each other.

<Table 4-11> Contributions of Subscale Measures to Latent Factors—Korean CLSCs

From	To	Factor Loading
ES	X1	0.70*
	X2	0.97*
	X3	0.80*
OS	X4	0.56*
	X5	0.25
IS	X8	0.76*
	X9	0.82*
	X10	0.58*
SM	X12	0.68*
	X13	0.47*
	X15	0.91*
CS	X18	0.61*
	X19	0.56*
RMPI	Y2	0.36*
	Y3	0.32*
	Y4	0.37*
	Y5	0.62*

***Path Coefficient is significant at P<.05

All loadings of X1, X2 and X3, within the interval between 0.70 and 1.00, indicate that they load quite well on factor ES. Especially, X1 (CEO should be responsible for RM) scoring 0.97 greatly contributes to the degree of executives' support factor. As for factor OS, only X4 (documented RM policy) has the significant loading of 0.56. Items X8, X9 and X10 contribute to the degree of information system. Among them, X9 (a computer system gathering RM information) ranks first with a loading of 0.82, and then comes X8 of 0.76 and X10 of 0.58. As far as factor SM is concerned, X15 (Organization's own safety management rules and regulations) loads best on SM with score of 0.91, X12 (staff's positive attitudes toward safety management) loads relatively lower on SM with score of 0.68, and X13 (risk identification method) loads lowest with score of 0.47. Two measures of factor CS (X18 and X19) have significant load significantly on CS. In terms of RMPI, Y5 (punctuality) contributes most with a loading of 0.62, Y2 (times of inspection and maintenance) of 0.36, Y3 (RM training quality) of 0.32 and Y4 (times of RM meetings) of 0.37 load relatively lower on RMPI.

4-2-3 Comparative Results

Firstly, from the results of hypotheses testing, it is obvious that Chinese CLSCs consider only safety management (SM), information system (IS), and cooperation (CS) as the factors that have significant influences on the performance of risk management. Compared with Korean CLSCs, Chinese liners have not yet taken the weight of executives' support (CS) in risk management performance seriously. It is worth noticing that all path coefficients of Korean structural model are higher than those of Chinese structural model. Therefore, I draw the conclusion that SM, IS, and CS factors have relatively stronger causal effect on the risk management performance in terms of the values of path coefficients.

Secondly, Chinese CLSCs think X12 (the staff's attitudes toward safety management), X14 (the complete knowledge of international rules and conventions concerning safety), as well as X15 (organization's own safety management regulations) are significant in factor SM; while Korean CLSCs focus on X12, X15, and X13 (risk identification method). Such result is also derived from the descriptive analysis, as shown in Table 4-2, the mean value of X14, i.e. a complete knowledge of international rules and conventions on safety management, scores less than 4, which means Korean CLSCs don't think this variable has significant influence on the performance of risk management. Instead, it ranks first, scoring 4.3221 in the safety management factor. In addition, Korean CLSCs realize that risks should be identified by different methods, i.e. X13, which is not reflected in the final result of Chinese model.

Thirdly, in terms of information system factor, both parties hold the same opinion that a computerized system should be applied to gather information concerning risks, i.e. X9 and regard X8 (loss data record) as the other important indictor of information system. Besides, Korean CLSCs take X10 (the scope of information to be gathered) as another significant indicator, which is not significant in the result of Chinese structural model.

Fourthly, in terms of cooperation factor, result of Chinese CLSCs shows the cooperation with stakeholders (X17) including customers and agents overseas is the other significant indictor besides the cooperation with customs and port authority (X18). Instead, result of Korean model reflects the cooperation with relative business banks (X19) is the other answer.

Fifthly, among the indicators of RMP, Chinese CLSCs relatively improved best in Y1 “amount of risk retaining”, while Korean CLSCs relatively improved best in Y5 “punctuality”.

Sixthly, there are some obvious differences in factor loadings between the two subgroups. For example, X2 (executives’ attention on RM) loads much lower in Chinese model than that in Korean model (0.45 vs. 0.97). So does X3 (executives’ participation in RM activities). These lower loadings of items on factor ES hints executives’ of Chinese CLSCs might not think highly of their own positions in RM.

Seventhly, referring to the result of descriptive analysis, mean value of X16, i.e. the cooperation among the internal sections of the organization is scored lowest in the cooperation factor by Chinese CLSC, while it is scored highest of this factor by Chinese CLSCs.

In accordance with the comparative results, several suggestions for both Chinese and Korean liner shipping companies are provided in the next section.

4-3 Implications

4-3-1 For Chinese CLSCs

(1) Strengthening Inter-Organization Cooperation

It is urgent for Chinese CLSCs to strengthen the inter-organization cooperation. There are several reasons. Firstly, one voyage of shipment involves from contracting with cargo owners for shipment, issue of documentations, receiving and delivering of cargoes to be shipped, loading and discharging cargoes, arrangement of clearance and cargo inspection when requested, to after-sale service. The smooth operation of this whole process needs the participation and support of many departments. Secondly, since risks exist everywhere, the regular contact among departments in the organization helps to discover the risk exposures. Thirdly, frequent inter-organization cooperation provides the employees with the chances to get to know each other, which contributes to warm the working atmosphere.

The inter-organization cooperation should be carried out not only within departments in one organization but also in the operation with partner company, who, to some degree, is also a competitor.

(2) Raising Executive's Image in RM

Among all indicators listed in the questionnaire survey, the mean value of variable X2 "Executives should pay most attention to RM" scored highest (4.7569). Such result implied that most respondents realized the weight of executives in RM, but they were not satisfied with executive's present attitude toward RM. Many Chinese shipping companies have not yet establish a formal RM system because the top management has never realized the importance of RM. In addition, although some liner shipping companies invested a lot in marketing investigation and estimation, the plans of opening a new service line or changing scheduling were often vetoed by the executive who is a risk aversor. It is strongly recommended here executives themselves should pay high attention to RM in the organization. Executives should make great efforts to raise their image in RM through being proactive in RM studying and training and play a good role of RM supervisor in the organization. When they indeed know something about RM, they will undoubtedly encourage the implementation of RM.

(3) Paying Attention to Various Information Concerning Risks

It is well known that risks exist everywhere. Exposure identification is critical to the elimination of risks. To timely identify risks, various manifestations of information concerning risks, such as political affairs, slight change of financial policies, or even an accident of the port are needed to be paid attention to. But final analysis results of section 4-2-3 showed China's CLSCs did not regard the scope of information as one significant indicator of information system. China's CLSCs have suffered a lot owning to their neglect of useful information. For instance, during the Block Port Strike in America in October 2002, the failure of timely collecting the relative information and the lack of preventive steps therefrom resulted in a big loss of the three biggest CLSCs. In order to avoid repeating the same mistake, Chinese shipping companies should draw a lesson from the past accident and strengthen the collecting capacity of information. In addition, the information exchange within the enterprise needs to be vigorously promoted.

4-3-2 For Korean CLSCs

(1) Establishing Standardization Management

Contrary to the conclusion reached by many scholars, this study found both Chinese and Korean liner shipping companies did not regard standardization management as the significant factor that affect RMP. It could be explained such result accounted for the immaturity of RM. As RM in most Asian countries is at its start-up stage, there are neither systematical loss data nor professional department in charge of RM. However, so many experiences derived from the successful examples as well as the failures of RM in Western companies are available for reference. One of the helpful experiences is that the standardization management was considered to be significant factor affecting the quality of risk management. Therefore, both Chinese and Korean shipping companies should follow this short-cut and manager to establish standardization management step by step.

(2) Focusing on Weight of International Safety Rules in RM

From Korean CLSCs' point of view, the degree of knowledge of international safety rules has no correlation with the final RMP. But, as stated before, the consequences of non-compliance with ISM code could be used to establish want of due diligence in making the ship seaworthy under the Hague or Hague-Visby rules to either of the rules most bills of lading are subject. In other words, if the accidents take place, the shipping companies undertake all losses no matter they insured or not. Therefore, the complete understanding of the rules and regulations concerning shipping business is very important in the safety management, which has been tested to be a factor significantly affecting the final RMP. From 1978 to 1996, Korea averagely ranked in top 5 of countries with most maritime accidents. Moreover, when setting up organization's own safety regulations, there must be the fundamental structure coming from accepted international rules and regulations combining the specific operation characteristics of the organization. In this sense, international safety rules had better be deeply studied to avoid the preventable risks.

Chapter 5
Conclusion

5-1 Summary of the Study

The transportation environment and unique characteristics including highly capital intensive nature and uncertainties in making profit resulting from the fluctuations in freight rates, bunker prices, exchange rates and even interest rates make container liner shipping industry somewhat risky. Risk management has been regarded as the key to achieve shipping operation's overall objective. However, not all companies have sound risk management performance, which stands for the quality of risk management.

Risk management in Chinese shipping industry is at the start-up stage. Although RM is the term quite often heard within CLSCs, most of them have no clear idea of exactly what is involved. Owing to the enormous disparity in enterprise culture, it is not practical for Chinese CLSCs to follow Western countries' mature RM model. Instead, thanks to the similar development background of RM, the experience of Korean CLSCs' well developing RM system may contribute to the Chinese CLSCs. That is the reason for choosing Korean CLSCs as the comparative object in this study.

Under such circumstances, this study aims to:

(1) Test the theory-based model concerning factors affecting risk management performance using structural equation models.

(2) Examine the differences between Chinese CLSCs' model and Korean CLSCs' structural model.

(3) Provide suggestions to improve RMP for both China's and Korea's CLSCs.

The completion of this dissertation relies on the existing literature. With reference to previous studies, 5 hypotheses respectively concerning the correlations between RMP and executives' support, RMP and standardization management, RMP and information system, RMP and safety management, and RMP and cooperation are proposed. To obtain the data needed for hypotheses testing, a questionnaire survey is dispatched to 23 Chinese CLSCs/branches and 20 Korean CLSCs/branches. When the answer sheets arrive, we analyze the data with the help of a statistics package consisting of factor analysis, reliability analysis, and structural equation model.

The empirical analysis is separated into three parts: analysis of Chinese data, analysis of Korean data, and the comparative analysis.

China's CLSCs consider that safety management, information system, and cooperation have direct, positive effect on RM activities. Korea's CLSCs hold the same attitudes toward the correlations of RMP and safety management, information system, and cooperation. Besides this, they think executives' support has a direct, positive effect on RM activities as well. Both groups get the same result that factor SM has the highest pathway coefficient that implies the improvement of safety management of the liner shipping company is the most significant shortcut for the company to achieve satisfied risk management performance.

Compared the results of two models, it is found that Chinese CLSCs have not yet taken the weight of executives' support in risk management performance seriously. In addition, they have not been able to bring enough attention to the inter-organization cooperation and various magnifications of information concerning risks. Having realized the deficiencies, corresponding suggestions including raising executive's image in risk management, strengthening inter-organization cooperation, and paying attention to various information concerning risks are provided for China's CLSCs.

As far as Korea's CLSCs are concerned, the rejection of the second null hypothesis that standardization management has a direct, positive effect on RM activities indicates the immaturity nature of Korean CLSC's RM. Like Chinese CLSCs, most Korean shipping companies have neither systematical loss data nor professional department in charge of RM. Moreover, from Korean CLSCs' point of view, the degree of knowledge of international safety rules has no correlation with the final RMP. This may be one of the reasons why Korea continuously ranks in top 10 of countries with most maritime accidents. In accordance with the analysis results, establishing standardization management and focusing on weight of international safety rules are put forward for Korean CLSCs.

From the answers given by each Chinese and Korean container liner shipping company, we find there was little change in each risk management activities in 2004. Although the weight of risk management in the shipping industry has been deeply recognized and great efforts have been made to improve the quality of risk management, it still has a long way for both China's and Korea's CLSCs to go. In brief, this study wishes to show the right direction for both to keep ahead.

5-2 Limitations and Future Studies

There are several limitations of this study needs to be discussed. Firstly, time factor was not under careful consideration. In this study, when evaluating the performance of risk management, a period of one year (In part 2 of questionnaire, the respondents were asked to examine the effect of RM activities in 2004 comparing that of 2003.) was randomly determined. Actually, time is an inevitable criterion when we deal with risks of losses. For instance, the frequency of loss is directly related to the time.

Secondly, the generalizability of the study is limited in the insufficient sample size used in the study. Structural equation model is a large sample technique (Kelloway, 1998). Both estimation methods and tests of model fit are based on the assumption of large samples. In general, a sample size of at least 200 observations would be an appropriate minimum (Li, 2005). There are only 49 registered Chinese container shipping companies[47] and 15 registered Korean container shipping companies[48]. To solve the contradictory problem of large sample against limited companies, 20 or 15 copies of the questionnaire are sent to each company or branch. The large amount of questionnaire answer sheets from limited company can not stand for the general idea of the liner shipping industry so that the bias may be caused in the computing of SEM.

Thirdly, since this model is directed against the whole liner shipping industry, all the questions raised in the survey are general ones. Especially when determining the

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[47] MOC, *List of Chinese Container Shipping Companies*, MOC, November 2005.
[48] Korea Shipowners' Association, *Member List*, Korea Shipowners' Association, 2005.

indicators of RMP, the “general” principle is taken seriously. So the results of the hypothesized structure model are available only for the whole industry, not for a specific shipping company.

In future, an empirical study on the factors affecting RMP for certain company is worth carrying out. Instead of liner shipping industry, the tramp shipping industry, which has distinctive difference in the characteristics with liner shipping, can be under consideration. The different attitudes toward factors affecting RMP of liner shipping industry and tramp shipping industry may attract the attention of researches too.

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<Appendix>

Questionnaire—Factors Affecting Risk RMP

About the Questionnaire

This questionnaire, based on 5-point scale, is made to analyze the factors that affect risk management performance (RMP) in liner shipping industry. All the questions have only one answer. Please input the alphabet “V” where fits your situation.

5-point-scale Explanation (1)

Numerical Values	1	2	3	4	5
Definition	Not at All	Slightly	Neutrally	Obviously	Significantly

Q_1: To what degree does each factor listed below influence risk management performance?

Factor/ Variable	Scale				
1. . Executive’s Support	**1**	**2**	**3**	**4**	**5**
X1 The Chief Executive Officer should be responsible for the risk management (RM).					
X2 Executives should pay most attention to RM.					
X3 Executives should actively participate in RM activities.					

Factor/ Variable	Scale				
2. Standardization Management	**1**	**2**	**3**	**4**	**5**
X4 Organization should have clear documented RM policy.					
X5 Organization should develop a close link between its strategic objectives and management of risk.					
X6 Organization should have distinct stipulation on division of work of each department.					
X7 Organization should have reasonable pay system.					

Factor/ Variable	Scale				
3. Information System	**1**	**2**	**3**	**4**	**5**
X8 Each organization must have a detailed risk data record.					
X9 There should be a computer system to gather information concerning risk.					
X10 Not only business information but economical, political information should be always paid close attention to.					
X11 Organization should have specialist of information system.					

Factor/ Variable	Scale				
4. Safety Management	**1**	**2**	**3**	**4**	**5**
X12 All staff should keep positive attitude toward safety management					
X13 Risk should be identified by different methods.					
X14 Organization should have a complete knowledge of international rules and conventions on safety management.					
X15 Organization should make its own rules and regulations concerning safety management.					

Factor/ Variable	Scale				
5. <u>Cooperation</u>	**1**	**2**	**3**	**4**	**5**
X16 There should be close cooperation in different sections of the organization.					
X17 Organization should have good relation with the stakeholders including customers and agents overseas.					
X18 Organization should always keep in close touch with customs and port authority.					
X19 Organization should always have good collaboration relation with its business bank.					

Q_2: Comparing year 2004 with year 2003, does your organization make any improvement in risk management in the fields listed below?

5-point-scale Explanation (2)

Numerical Values	1	2	3	4	5
Definition	Much Less/ Much Worse	Less / Worse	No Change	More / Better	Much More/ Much Better

Factor/Variable	Scale				
6. <u>Risk Management Performance Standard</u>	**1**	**2**	**3**	**4**	**5**
Y1 Risk retaining: Amount of loss caused by risk retaining					
Y2 Times of inspection and maintenance for the container vessel and equipment arranged by the organization					
Y3 Quality of RM training for the staff provided by the organization					
Y4 Volume of meetings concerning RM					
Y5 Quality management effect: punctuality (the situation of sailing on schedule)					
Y6 Staff Mobility					