ANALYSIS OF CORPORATE RISK FACTORS FOR LINER SHIPPING COMPANIES

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Abstract - Liner shipping industry plays an important role in world trade and is highly susceptible to many risk factors such as fluctuating oil price, uncertain ocean freight rate, changing in interest rate, depreciation and appreciation of currency, politics instability, economic downturn and unexpected accident risk. The purpose of this thesis is to discuss the degree of importance of potential risk factors encountered by liner shipping companies. Firstly, risk factors are classified into four major criteria and twelve risk sub-criteria by reviewing extant literatures. These four major risk criteria are operational risk, financial risk, strategic risk and accident risk. Secondly, questionnaire survey was conducted for the Analytic Hierarchy Process and the surveys' responses could let us realize the degree of importance of various risk factors for liner shipping companies and explore the possible strategies to control the potential risk. The result shows that the ranking of degree of importance of the four criteria are operational risk, financial risk, strategic risk and lastly the accident risk. The ranking of the top three sub-criteria are supply of tonnage risk, interest rate and human resources risk. To prevent risks and reduce losses, most of companies would choose to buy insurance or various derivative financial instruments.

Keywords - Liner shipping company, Risk management, AHP

I. INTRODUCTION

IMO (International Maritime Organization) indicated that shipping is one of the most globalized and dangerous industries in the world. Many factors are continue changing, and over the past 30 years, liner shipping market has dramatically changed, there are two main reasons, the first reason is the influence of the market potential power, also known as the dominant market power, which will affect the market price of commodities , different kinds of buyers and sellers with different degree of influence are also different, but the authorities tend to regulate more on sell monopoly of sellers; another reason is the change of laws and regulations, of which 1984, the United States enacted "The Shipping Act " and "Ocean Shipping Reform Act of 1998", before "The Shipping Act" was established, liner shipping industry was not bounded by the anti-trust law, the purpose of the "The Shipping Act" is to promote competition, and "The Ocean Shipping Reform Act of 1998" promotes the operation of U.S. routes, and any liner operating on U.S. routes has loosen restrictions on freight pricing and service agreement. (Tezuka, Ishii & Ishizaka, 2012).

Although negotiations could still be conducted, the pricing could not be fixed in forms of meeting. However, due to financial crisis in 2008, the global economy fell into an unprecedented downturn. Many enterprises faced operational crisis, and the shipping industry also suffered greatly.

The shipping industry is influenced by the prosperity of world economic, the international situation and the change of transportation structure. Since the development of economic globalization in the 1990s, international trade has grown rapidly, and the growth rate of global trade is about twice of the global GDP, which has driven the development of shipping industry. However, the growth rate of global trade has gradually moderated in recent years. Since 2012, the growth rate of trade can barely keep pace with GDP, which indicates that globalization has gradually stalled.

Takes the United States as an example, the total value of import and export trade in the United States in 2015 decreased by $200 billion compared with 2014, and by September 2016, it had dropped by another $470 billion, which also affected the shipping industry. The main reasons for the decline in the shipping market were the easing of trade growth and the oversupply caused by the upsizing of ships, which led to the decline in shipping prices.

In recent years, the shipping industry was in trouble, many liners have been impacted by the economic downturn and faced operational crisis. Therefore, risk management is increasingly important for enterprises, and the world's top liners also. Therefore, this study will discuss the potential risk factors faced by liners, as Ge (2011) has put forward the risk management strategy analysis of tramp shipping, this study will conduct research on liner shipping.

Start with Hanjin shipping as a case study, the seventh largest shipping company in 2016, Korea's Hanjin shipping filed for bankruptcy at the end of August, the global shipping industry fall into panic, Hanjin shipping cannot pay port handling fee, port charges and other fees, refusing to let ships berth in ports, cargo ships (about 70 container ships and 15 bulk ships) drift on the sea. And liners for response to low rate and to reduce the loss in the downturn, are taking measures, e.g. deceleration to minimize fuel

consumption or to conduct more extensive integration, such as restructuring new argued or merging, in order to improve the operating efficiency.

This study will focus on management of container shipping enterprise risk factors of liner shipping company to conduct analysis, due to the profit rate, exchange rate, external environment factors such as politics, economy, oil prices at any time everything is changing, the operation of the organization also no may be completely there is a problem, with high uncertainties and high degree of competition in the container shipping market, what are the risk factors faced by liners, and their degree of attention to the different risk factors, what are the different, and what measures will they take to deal with different risks.

1.1 Research methods

This study will examine the risks associated with liner shipping companies from the perspective of liners. In the literature review, discuss the risk factors encountered by liners in the liner shipping industry, which is full of market fluctuation and high uncertainty. The AHP method, which is one of the multi-criteria decision analysis methods, can be used to obtain the relative weight of the evaluation criteria concerned and to discuss the ranking of their importance.

II. LITERATURE REVIEW

This chapter is a review of relevant literature on risk management. The first section is literature review on risk management, the second section is literature review on liner shipping industry and analysis on possible risks faced by shipping companies, and the third section is literature review on classification of risks.

2.1 Risk management

2.1.1 Definition of risk

Due to the complexity of modern social activities, risks are in every corner of our daily life, and everyone and all walks of life faced different risks (Zheng and Tang, 2015). So far, the definition of "risk" has been widely debated by academic experts, who all hold their own opinions and theories.

Frank Knight was the first scholar to distinguish risk from uncertainty. In 1995, he proposed that risk is an uncertainty that can be measured, while uncertainty is risk that cannot be measured (Holton, 2004; Ritchie and Zsidisin, 2009), while Culp (2002) holds that risks are random and all factors that may have negative effects on individuals or enterprises can be summed up as risks.

2.1.2 Classification of risk

As for the classification of risks, there is no unified method in the academic circle. Some experts think that it is meaningless to classify risks because all risk factors are directly or indirectly related.Chen (2012) believes that enterprise risks include core risks and non-core risks. The core risk is divided into strategic risk and operational risk, while the non-core risk is divided into financial risk and accident risk, which respectively contain many different risks.. Borghesi and Gaudenzi (2013) divided risks into strategic risk, operational risk, financial risk and disaster risk.

2.1.3 Risk management procedures

In the process of risk management, enterprises should set a goal, and take the risk that will threaten the enterprise's strategies and objectives as the goal of management. Therefore, the risk management process must include different monitoring and management methods, including the integration of financial vision, business policies, strategies and operational methods (Borghesi and Gaudenzi, 2013).Zheng (2015) believes that there is (1) Risk Identification, (2) Risk Assessment, (3) Selection of Risk Management Strategies and (4) Implementation & Evaluation.

2.1.4 Purpose of risk management

In recent years, many large enterprises have experienced operation crisis, which has made risk management become a key factor for the sustainable operation of enterprises. All enterprises are actively looking for different methods to reduce the impact of accidents and risks, which has a significant impact on the major decisions of the company and is a difficult problem for all enterprises to face. All senior executives and employees should not be ignored (Chen, 2012).

2.2 Literature review of the liner shipping industry

The liner shipping industry is an oligopolistic market. The top 20 lines in the world account for 80% of the total transportation capacity. This section mainly introduces the characteristics of the scheduled shipping industry and the risks of the liner shipping industry.

2.2.1 Characteristics of liner shipping industry

Lin and Chang (2010) divided the characteristics of liner shipping into seven items: high financial risks, affected by fluctuations in the global economic climate and serious events, stable voyages, balanced supply and demand, and large-scale ships, difficult to increase freight rates, influenced by international standardization and government policies.From the above characteristics, it can be known that since the liner shipping industry is a capital-intensive industry with a large amount of investment, a long payback period and a high balance of assets and liabilities, it is affected by political and economic events, and it is necessary to constantly pay attention to the change of industrial structure, so it is necessary for shipping company to face many uncertainties in operation.

2.2.2 Risk factors for the shipping industry

scholar	Risk factor
Zhang (2005)	interest rate risk, exchange rate risk, commodity price risk, ship risk, operation risk, transportation supply risk, political risk and
Lee(2010)	strategic risk, market risk, financial risk, investment risk, human resources and risk management Risk Ship.
Alizadeh and Nomikos (2009)	price risk, credit risk and pure loss risk, which included freight risk, operating cost risk, profit risk and asset price risk
Chang, Xu, and Song (2015)	technical risks, market risks, commercial risks and operational risks

Table 2-4 Risk factors for the shipping industry scholar Risk factor

2.3 Risk factors for liner shipping company

Due to this study will take Analytic Hierarchy Process, AHP to conduct research, the AHP method will be introduced in Chapter 3. According to the previous chapter's risk and relevant literature review of the shipping industry, the risks faced by liners will be divided into four: operational risk, financial risk, strategic risk, and accident risk. For each main criteria contains several sub-criteria, then elaborates the meaning of each criterion.

main criteria,	sub-criteria
operational risk	Ship tonnage supply and demand risk 、Human resources risk 、Ship management risk
financial risk,	Interest rate risk 、Exchange rate risk 、Voyage income risk
trategic Risk	Political and economic risks, regulatory risks, strategic alliance risks
Accident risk	Maritime risk 、External risk 、Terminal operation risk

Table 2-5 Classification of risk factors
Source: Consolidation of this study

2.3.1 Operating risk

(Chang, Xu & Song2015) considered that operational risk is the risk that may affect the production of goods or services within the company. This study mainly divides it into the supply risk of tonnage, human resources risk and ship management risk.

1. Ship tonnage supply and demand risk

Liner shipping companies often confront with the situation of unbalanced supply of goods for the return voyage, and it is necessary to schedule vessels in order to establish an appropriate fleet. While, the composition of fleet requires considerable funds, and it takes plenty of time to build ships, plus the entry barriers is quite high. Furthermore, the fixed costs of ship lead to high exit barriers. On the other hand, liner shipping companies are not able to increase the supply of ship tonnages immediately when there is high demand. In the same way, when facing low demand, liner shipping companies are unable to reserves or reduce tonnages of ship supply. With little elasticity of supply, they can't make any changes in accordance with the requirements which causes unbalance between supply and demand, and even increase the risk of operation (Lee and Chang, 2010).

2. Human resources risk

International maritime organization (IMO) pointed out that "human factors is a very complicated problem, it will affect the maritime security and the protection of the Marine environment. Involving crew on board, shore-based management, regulators, recognized organizations, shipyards, lawmakers are measured, and other related participants, they all need solve related issues through the cooperation." (Tzannatos, 2010).

Britain's MAIB (Marine Accident Investigation Branch) also pointed out that most of the marine transportation accidents occur because of human error, and some are caused by the overload of the ship (Hetherington, Flin, & Mearns, 2006; Schröder-Hinrichs, Hollnagel, Baldauf, Hofmann, & Kataria, 2013)

3. Ship management risk

In recent years, due to upsize and enhanced engine efficiency of ships, the volume of marine transportation has increased significantly, but the safety quality of navigation has declined accordingly, and the occurrence rate of navigation accidents has increased. In order to minimize the probability of maritime accidents, it is necessary to perform the management of vessels (Zheng, Talley, Jin, & Ng, 2016).

Therefore, the international community began to pay attention to the safety of life and property, marine environment and other issues, in order to prevent navigation accidents and environmental pollution and formulate a convention, namely Port State Control (PSC).

2.3.2 Financial risk

Due to the shipping industry is capital intensive industry, huge investment, long payback period, and features affected by exchange rate, interest rate fluctuations in investment, need to be careful evaluation, if regulation is not when, can increase the operating costs, serious, even may cause the financial crisis, therefore, financial management and the operational performance of liner shipping companies have closely related (Lin and Chang, 2010).

1. Interest rate risk

Plus bank financing among different countries are different, if the bank interest rate is higher, financing is relatively more difficult (Yang and Lee, 2012).

2. Exchange rate risk

Hu, Zhen, Chen and Huang (2010) regard the exchange rate risk management of enterprises as a system. This system is composed of multiple elements that can be interdependent, related and differentiated, with specific structure and function. In an environment, to achieve the goal of a whole organic body, and each system has its own management cycle, firstly has to identify the risk factors, after the risk assessment, and then take countermeasures, and anticipate the possible sudden development of the situation, in advance Countermeasures should be taken to reduce the impact of the unexpected situation on the company itself.

3. Voyage income risk

The pricing principle of international transportation is a free competition, which depends on market conditions. It can be seen from the supply and demand curve that production and consumption are simultaneously operating in the market. Under the interaction, it will produce a market-balanced price(Zhong2014). When supply exceeds demand, liners will choose to reduce freight rates to attract customers, and when supply exceeds demand, the reverse is true. However, due to the decline in freight rates caused by the excess freight transportation, liners cannot easily increase freight rates, and it is very difficult to increase revenue through freight rates (Guo , 2016).

2.3.3 Strategic risk

In any operation process, no enterprise can avoid strategic risks. If the strategy is not appropriate and not implemented in practice, the company may make mistakes or take timely correction without the change of environmental trend, which may result in not reaching expected goals (Chen, 2012).

1. Political and economic risk

Political risk often occurs in international commercial litigation, but its significance is limited to the necessary consequences of the initiation of political activities. The most common political risk is government interference in business operations.

Political risks are caused by "non-market" factors. Political events are unpredictable, and changes in political conditions may have a negative impact on business operations and cause economic losses. National political stability is also one of the reasons for political risks. (Yang and Lee, 2012).

2. Regulatory risk

In order to operate legally, enterprises must abide by various relevant laws and regulations during their operations. However, in practice, companies often violate the law, mostly to reduce costs, increase profits, and enhance market competitiveness. Failure to comply with statutory norms, or violations of authority, omissions, irregularities, and regulatory changes may result in invalid contracts and consequent losses (Chen, 2010).

3. Strategic alliance risk

Lin, Chang and Zha (2012) believes that the main purpose of the strategy is argued for the complementary advantages, enhance their own competitiveness, but also accompanied by risk, during the period of cooperation, to effectively achieve their goals, learn from each other between members, to exchange opinions and experience, it may make the other side to enhance advantage, in addition, if during the strategy of frozen argued, liners neglect of self-management, argued view of dissolved under the status of may not be able to continue to survive in the market.

2.3.4 Accident risk

The risks involved in maritime transport are maritime risks and susceptibility risks. Maritime risks are also known as shipwrecks, including natural disaster risks and accident risks. Natural disaster risk refers to the risk of damage caused by force majeure such as climate, tsunamis, and volcanic eruptions. The risk of accidents is caused by accidents such as collisions, stranding, sinking, explosions, fires, etc. during the voyage, which causes the risk of loss. This study divides the risk factors of accidents into maritime risks, external risks and terminal operations risks.

1. Maritime risk

Sinking, stranding, fire and collision are the four most common accidents in maritime navigation, and the water area with heavy traffic has the highest probability of occurrence (Chu, 2011). During the accident, in addition to the damage of cargo, casualties and damage to the equipment on the ship may also be caused (Zheng, Talley, Jin and Ng, 2016).

2. External risk

External risk refers to the risk caused by external factors, which can be divided into general external risk and special external risk. In general, the risk of external damage is the risk of damage to the goods during transportation due to moisture, heat, rust, seepage, shortage, rain, theft, etc., special external risk refers to losses caused by strikes, wars, refusal to deliver, etc. (Xiao, 2012).

3. Terminal operation risk

As a result of container port operations require the use of many large-scale equipment, such as Rail Mounted Gantry Crane, gantry crane, straddle carriers, forklifts, trailers, plus wide variety of containers, there are many potential risks (Chen, 2001), The equipment of the terminal will be regularly maintained, so the equipment that is lost due to the failure is very small, but if it occurs, the loss will be quite significant.

III. RESEARCH METHODS

This research uses the Analytic Hierarchy Process (AHP) to discuss how liner shipping companies face the multiple risk factors, how to evaluate the importance of each risk to their operations, and how to propose countermeasures.

3.1 The introduce of AHP

(Analytic Hierarchy Process, AHP) is a decision method is proposed by Saaty, mainly used in decision making problems, when the decision-making problem stance more uncertainties and has a number of factors of scale of equilibrium or principles.

Through the complicated problem, it can be divided into multiple elements, establish Hierarchy analysis framework, after asking the opinions of scholars and experts, the Hierarchy of norms to conduct a series of attributes paired comparison, by paired comparison is used to assess the relative importance of criteria, obtained the relative weight of each level and criteria, to scheduled their priorities, The best decision is selected, but the paired comparison elements at each level must be independent. Therefore, AHP is selected as the research method in this study.

3.2 Practical Procedures of AHP

When implemented AHP, which was divided into seven main steps, determine the problem, issues related to the factors listed level established analytical framework, and a transceiver design questionnaire established pairwise comparison matrix, eigenvalue and eigenvector calculation of , consistent test, each step will next be described in detail:

1. Determine the problem:

The first step is to identify the purpose of the problem, take all the factors that may affect the decision into account, and clearly define the scope of the problem.

2. List problem-related factors

Through reviewing literatures and collecting experts' opinions, and not considering their relationships, list problem-related factors with decision marking fators.

3. Create a hierarchical analysis framework:

Hierarchy analysis framework can be divided into two kinds, one kind of complete hierarchical structure, on behalf of each of the upper level and lower level factors are related to stock, a complete continuum line, another is not complete level.

In reality, not complete hierarchical structure accounts for the vast majority of, because not each of the upper level and lower level factors are related to stock, and each alternative is not necessarily everything can be applied on each criterion, there is no complete order line, this research also is not a complete analysis framework.

4. Design and distribution of questionnaires

After determining the purpose of decision-making and the establishment of a hierarchy analysis structure, the next step is to design a questionnaire. The questionnaire needs to contain the connotations of the criteria, and is evaluated by the respondent. The questionnaire is filled by using the assessment rule.

The standards at the same level are compared with each other, and the relatively important process of each criterion is evaluated. The assessment scale is divided into five scales of 1, 3, 5, 7, and 9, which represent equally important, slightly important, and important, extremely important and absolutely important, and between the five basic sizes there are 2, 4, 6, and 8 evaluation values, which represent the median value of the adjacent size.

5. Build a pair comparison matrix

After the questionnaire is collected, it is divided into three steps to calculate the weight of each criterion and whether it conforms to the consistency test. In the process of calculation, some symbols are used to carry out the calculation.

The meanings of the symbols are shown in table 3-1.

symbol	Meaning of Representative
n	There are n criteria in the hierarchy
i	i th criterion
j	j th criterion
A	Pairwise comparison matrix
a_{ij}	Important process of "criterion i" relative to "criterion j"
w	Weights
λ_{max}	Maximum eigenvalue

Table 3-1 The meaning of arithmetic symbols

Source：Huang (2007)

First, according to the questionnaire data, the geometric average of the questionnaire answers of each subject was constructed into a pair comparison matrix. The upper triangle was the value of the questionnaire answers, the lower triangle was the inverse of the relative position of the upper triangle, and the main diagonal was the comparison of the criterion itself, which was 1.

$$A=\begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix}=\begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix}$$

$a_{ij}=1/a_{ij}$ ，$a_{ij}>0$ ，∀i, j=1,2,....,n ，a_{ij} represents the relative importance of criterion i to criterion j. Pairwise comparison matrix A is called the inverse matrix ，If $a_{ik}=a_{ij}$ x a_{jk} ，The experts' evaluations are very accurate. At this time, matrix A is called the consistency matrix. When matrix A is the consistency matrix, $a_{ij}=W_i/W_j$ ，i=1,2,…, n ；j=1,2,… ，Among them W_1, W_2 ,… W_n represents the weight of n evaluation criteria under a certain element belonging to the previous level in the hierarchy.

After the pairwise comparison matrix is established, the weight of each level of the criterion can be obtained. The higher the weight value, the higher the value of the process that the criterion is valued.

1. Calculation of characteristic value and characteristic vector

The purpose of this step is to find the relative weights between the criteria, by multiplying matrix A with the weight of each criterion, $w=(W_1, W_2, \dots W_n)^T$.

$$Aw=\begin{bmatrix} 1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & 1 & \cdots & w_2/w_n \\ \vdots & \vdots & 1 & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & 1 \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = nw$$

Because a_{ij} is the subjective judgment given by the subject during the evaluation, there is still a difference between the authenticity and the value of W_i/W_j, which may make Aw = nw untenable. Therefore, Saaty suggests replacing λ_{max} with n, that is, Aw = λ_{max} w

After establishing the paired comparison matrix, it is necessary to calculate the vector value in order to get the weight.

Saaty proposes four calculation methods. Decision maker can choose a more appropriate operation from them to obtain the vector value (Chu, 2009) :

(1) Average of normalized columns
(2) Normalization of the Row Average
(3) Normalization of column Reciprocal Average
(4) Normalization of the Geometric Mean of the Rows

AHP generates weights for each evaluation criterion based on the paired comparison of the criteria by the subjects. The higher the weight, the more important the criterion. The decision-maker then multiplies the weights and fractions according to the number of fractions the subjects gave to each alternative to determine which is the best alternative.

7. Consistence test

The consistency test has two purposes. One is to check whether the pairwise comparison matrix established by the decision maker or the subject during the evaluation is consistent with the consistency matrix.

The other is to check whether the hierarchical structure is consistent. Avoid inconsistent results from expert questionnaires, which will affect the accuracy of the analysis.

Saaty will convert λ_{max} and n into a consistency indicator to understand whether the evaluation made by the subjects is reasonable, or whether there are contradictions, so that the decision-maker can make timely corrections to avoid improper decision making. (Chen et al., 2009), Consistency test contains two representational measures, consistency ratio, C.R. and consistency index, C.I.. If the C.R. is less than 0.1, it means that the matrix is consistent.

If the value of C.R is greater than 0.1, it is necessary to re-evaluate it. Because sometimes contradictory phenomena may occur in people's mind, Saaty believes that there may be some deviation.

$$C.R.=\frac{C.I.}{R.I.}\quad,\quad C.I.=\frac{\lambda_{max}-n}{n-1}$$

$$C.R.=\frac{C.I.}{R.I.}\,,\ C.R.\leq 0.1$$

The value of the random index (C.R.) is different according to the order, as shown in Table 3-2

factorial Order	1	2	3	4	5	6	7	8	9	10
R.I.	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Table 3-2 Stochastic Index Table

IV. RESEARCH RESULTS AND ANALYSIS

In this study, the risk factors encountered in the liner shipping company operation were discussed, and the risk factors proposed by many scholars were collected and summarized through literature review, which were divided into four main criteria (" operational risk ", "financial risk", "tactical risk" and "accident risk") and twelve sub-criteria of the lower layer. The hierarchical analysis framework (figure 4-1) was built, and questionnaires were designed and sent and received. In this chapter, effective questionnaires collected will be analyzed to find out the degree of attention paid by regular carriers to various risk factors and the corresponding strategies adopted

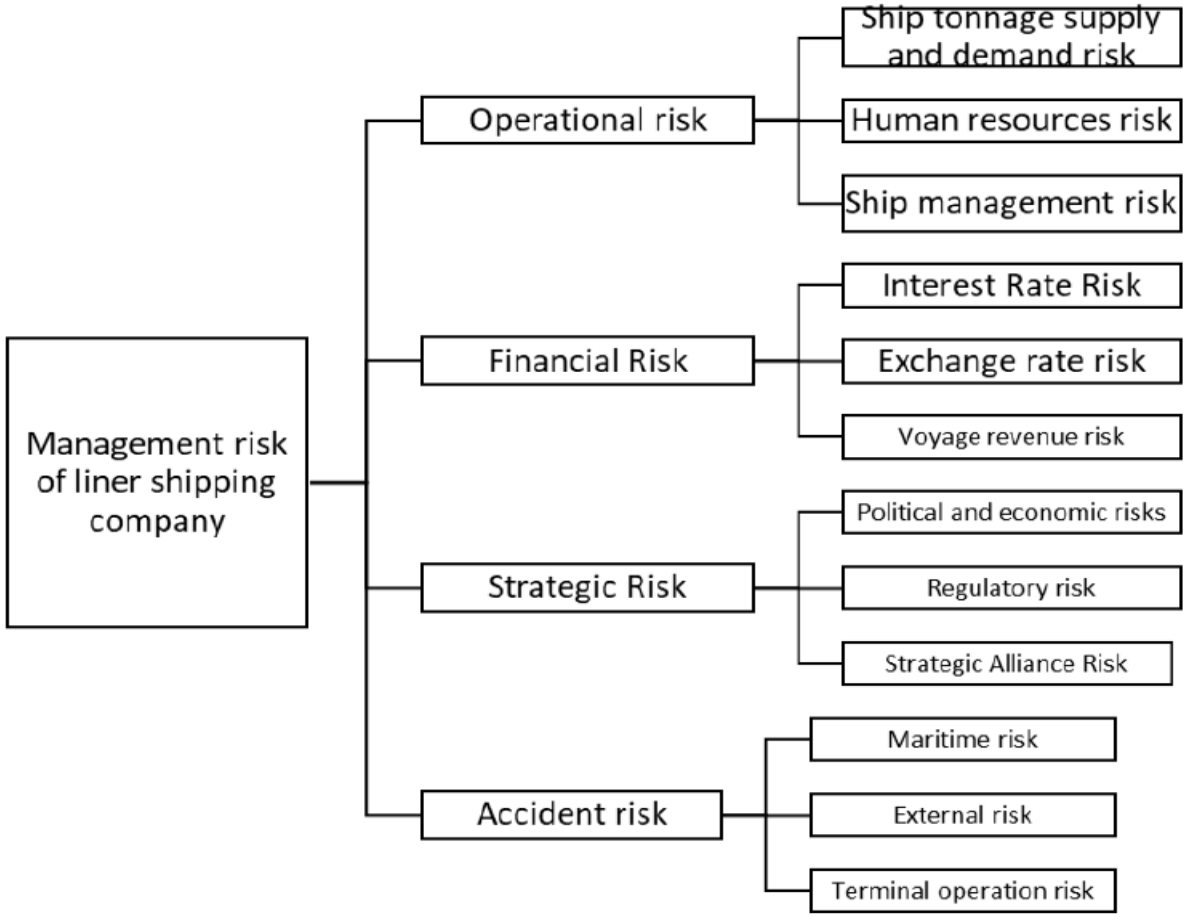


Figure 4-1 Hierarchical architecture diagram
Source: This study consolidation

4.1 The questionnaire of transceiver and orientation are the basic data analysis

The questionnaire is divided into three parts. The first part is the basic data of the respondents, including gender, age, position and time in the shipping industry; the second part is the explanations and examples of the respondents to help them understand how to use the 1-9 evaluation scale to evaluate the paired comparison of risk factors; the third part is the formal answer, including the importance ranking and paired comparison matrix of the criteria. This questionnaire is issued to employees of the domestic liner shipping companies and the Taiwan branch of foreign liner shipping companies.

Table 4-2 is the statistical data for sending and receiving questionnaires. A total of 22 questionnaires were distributed, of which 8 were returned.

It was 36%. After the consistency test, 1 questionnaire was found to be invalid, 7 valid questionnaires, and 32% were valid.In addition to analyzing the overall results of the 7 valid questionnaires, this study also divided the collected questionnaires into eastern and western liners, in order to understand the different views of eastern and western liners, on risk factors.

Respondents		age	Time engaged in shipping-related industries
Eastern shipping company	1	41~50 years	15~20 years
	2	51~60 years	More than 21 years
	3	Over 41 to 50 years	More than 21 years
Western shipping company	4	31~40 years	5~10 years
	5	41~50 years	11~15 years
	6	41~50 years	More than 21 years
	7	51~60 years	More than 21 years

Table 4-2 Basic Resources of Respondents

4.2 Analysis results of all valid questionnaires

This study through the Expert Choice software obtained valid questionnaires of weights of each criterion, the analysis of various risk factors on the important degree of liner shipping company , this section will be divided into three sections, the first section is the results of the analysis for the four main criteria, four major principles contained in the second section as a child of the rule of the results of the analysis, the third section is borrowed by the former two summary analysis of the results and analysis of integrated weight value.

4.2.1 Analysis results of the main criteria

The weights of the first two categories, "operational risk" and "financial risk", have reached nearly 75%, which means that if the "operational risk" and "financial risk" are properly managed, they can greatly reduce the difficulties in shipping company operation.

The main criterion	Weights value	Ranking
operational risk	**0.484**	**1**
financial risk	0.264	2
Strategic risk	0.162	3
Accident risk	0.090	4

Table 4-3 weight value and sorting of the main criteria Right

4.2.2 Analysis results of sub-criteria

Table 4-4 is the weight value and ranking of the sub-criteria under the four main criteria. According to the data in the table, the degree of importance that the subjects think each sub-criter ia is as follows:

The main criterion	Sub-criteria	Weights value	Ranking
operational risk	Ship tonnage supply and demand risk	0.544	1
	Human resources risk	0.264	2
	Ship management risk	0.191	3
financial risk	Interest Rate Risk	0.551	1
	Exchange rate risk	0.294	2
	Voyage revenue risk	0.155	3
Strategic risk	Political and economic risks	0.470	1
	Regulatory risk	0.384	2
	Strategic Alliance Risk	0.146	3
Accident risk	Maritime risk	0.649	1
	External risk	0.187	2
	Terminal operation risk	0.163	3

Table 4-4 Weighting and ranking of sub-criteria

4.2.3 Comprehensive weight analysis results

After multiplying the weight values of the main criterion and the sub-criteria, the comprehensive weight can be obtained, as shown in Table 4-5.

The main criterion	Main criteria weights (c_1)	Sub-criteria	Sub-criteria Weight (c_2)	Comprehensive Weight ($C= c_1 X c_2$)	Ranking
operational risk	0.484	Ship tonnage supply and demand risk	**0.544**	**0.264**	**1**
		Human resources risk	**0.264**	**0.128**	**3**
		Ship management risk	0.191	0.093	4
financial risk	0.264	Interest Rate Risk	**0.551**	**0.145**	2
		Exchange rate risk	0.294	0.078	5
		Voyage revenue risk	0.155	0.041	9
Strategic risk	0.162	Political and economic risks	0.470	0.076	6
		Regulatory risk	0.384	0.062	7
		Strategic Alliance Risk	0.146	0.024	10
Accident risk	0.090	Maritime risk	0.649	0.058	8
		External risk	0.187	0.017	11
		Terminal operation risk	0.163	0.015	12

Table 4-5 liner shipping companies ' s total weight (all 7 copies)

4.3 Analysis results of east-west shipping company

Based on the employed companies of the seven respondents in the survey, this study divided them into Eastern liners (3) and Western liners (4), Research on the influence of the risk factors on liners in Eastern countries and Western countries. What are the differences in ideas?

4.3.1 Analysis results of the main criteria

Table 4-6 shows the analysis results of the main criteria of the East and West .

Main risk facet	Eastern shipping companies		Western shipping companies	
	Weights	Ranking	Weights	Ranking
operational risk	0.313	2	**0.615**	**1**
financial risk	**0.400**	**1**	0.176	2
Strategic risk	0.190	3	0.132	3
Accident risk	0.097	4	0.077	4

Table 4-6 Analysis results of the main criteria of East and West

4.3.2 Analysis results of sub-criteria

According to the analysis results in Table 4-7, it can be known that the subjects of the East and West liners believe that the sub-criteria under the four main risk criteria, the degree of importance of the liner shipping companies, and whether the latter's views are different.

Criterion		Eastern shipping		Western shipping	
		Weights	Ranking	Weights	Ranking
operational risk	Ship tonnage supply and demand risk	**0.537**	**1**	**0.550**	**1**
	Human resources risk	0.269	2	0.261	2
	Ship management risk	0.194	3	0.189	3
financial risk	Interest Rate Risk	0.333	2	**0.699**	**1**
	Exchange rate risk	**0.359**	**1**	0.221	2
	Voyage revenue risk	0.308	3	0.080	3
Strategic risk	Political and economic risks	0.217	2	**0.679**	**1**
	Regulatory risk	**0.588**	**1**	0.226	2
	Strategic Alliance Risk	0.195	3	0.095	3
Accident risk	Maritime risk	**0.587**	**1**	**0.693**	**1**
	External risk	0.221	2	0.164	2
	Terminal operation risk	0.191	3	0.143	3

Table 4-7 Weight value and rank of the sub-criteria of Eastern and Western liners

4.3.3 Comprehensive weight analysis results

As shown in Table 4-8, after multiplying the weights of the main criterion and the sub-criteria, the comprehensive weight of Eastern liners is obtained.

Strategic Risk	0.190	Political and economic risks	0.217	0.041	9
		Regulatory risk	0.588	0.112	5
		Strategic Alliance	0.195	0.037	10
Accident risk	0.097	Maritime risk	0.587	0.057	8
		External risk	0.221	0.021	11
		Terminal operation risk	0.191	0.018	12

10	Main critia Weights (c_1)	Sub-criteria	Sub-criteria Weight (c_2)	Comprehensive Weight ($C = c_1 X c_2$)	Ranking
operational risk	0.313	Ship tonnage supplyand demand risk	**0.537**	**0.168**	**1**
		Human resources risk	0.269	0.084	6
		Ship management risk	0.194	0.061	7
financial risk	0.400	Interest Rate Risk	**0.333**	**0.133**	**3**
		Exchange rate risk	**0.359**	**0.144**	**2**
		Voyage revenue risk	0.308	0.123	4

Table 4-8 Comprehensive weight of Eastern liners

Calculate the comprehensive weight of western liners according to Table 4-9

The main criterion	Main criteria weights (c_1)	Sub-criteria	Sub-criteria Weight (c_2)	Comprehensive Weight ($C = c_1 X c_2$)	Ranking
operational risk	0.615	Ship tonnage supply and demand risk	**0.550**	**0.338**	**1**
		Human resources risk	**0.261**	**0.160**	**2**
		Ship management	0.189	0.116	4
financial risk	0.176	Interest Rate Risk	**0.699**	**0.123**	**3**
		Exchange rate risk	0.221	0.039	7
		Voyage revenue risk	0.080	0.014	9
Strategic risk	0.132	Political and economic risks	0.679	0.089	5
		Regulatory risk	0.226	0.030	8
		Strategic Alliance Risk	0.095	0.012	11
Accident risk	0.077	Maritime risk	0.693	0.054	6
		External risk	0.164	0.013	10
		Terminal operation risk	0.143	0.011	12

Table 4-9 Comprehensive weight values of western liners

As can be seen from the above, the participants of the Western liners believe that the most influential factors for the liners are the "tonnage of supply and demand risk", "human resources risk" and "interest rate risk".

Criterion		Eastern comprehensive weights	Ranking	Western comprehensive weights	Ranking
Operational risk	Ship tonnage Supply and demand risk	**0.168**	**1**	**0.338**	**1**
	Human resources risk	0.084	6	**0.160**	**2**
	Ship management risk	0.061	7	0.116	4
financial risk	Interest Rate Risk	**0.133**	**3**	**0.123**	**3**
	Exchange rate risk	**0.144**	**2**	0.039	7
	Voyage revenue risk	0.123	4	0.014	9
Strategic risk	Political and economic risks	0.041	9	0.089	5
	Regulatory risk	0.112	5	0.030	8
	Strategic Alliance Risk	0.037	10	0.012	11
Accident risk	Maritime risk	0.057	8	0.054	6
	External risk	0.021	11	0.013	10
	Terminal operation risk	0.018	12	0.011	12

Table 4-10 Comparison between East and West

Table 4-10 shows that all participants in the Eastern liners or Western liners are considered to be the most important of all risk factors for the ship's supply and demand risk.

V. CONCLUSIONS

1. The liner shipping industry is an international and capital-intensive industry with large investment, extended payback period, high barriers to entry and exit, and is susceptible to changes in exchange rates, interest rate changes, changes in world economic sentiment and political and economic events. In order to pursue economies of scale, the large-scale ship has become a trend.
2. 2.Through the literature review, the risk factors of regular liners are divided into four main criteria: “operational risk”, “financial risk”, “strategic risk” and “accident risk”, each of which contains 12 sub-criteria of the next level, as described below. :

(1) "Operational risk" includes "ship age and supply risk", "human resources risk" and "ship management risk"

(2) “Financial risk” includes “interest rate risk”, “exchange rate risk” and “voyage income risk”

(3) "Strategic risk" includes "political and economic risks", "regulatory risks" and "strategic alliance risks"

(4) "Accident risk" includes "maritime risk", "outside risk" and " Terminal operation risk ".

3. According to the questionnaire analysis of the whole collection, it can be seen that in the main criteria layer, the “operational risk” and “financial risk” are more important than the “strategic risk” and “accident risk”; in the sub-criteria layer. Among the twelve risk factors, the three most important risk factors considered by the liners are “tonnage supply and demand risk”, “interest rate risk” and “exchange rate risk”. The three least important risk factors are “strategic alliance risk”, “outside risk” and “Terminal operation risk”. The most important ones are the sub-criteria in “Operational Risk” and “Financial Risk”.
4. Comparing the perceptions of risk factors between the East and West liners in terms of the four risk main criteria, the participants of the Eastern liners believe that the importance is in order of “financial risk” (0.400), the second most important one. Operational risk" (0.313), the third important "strategic risk" (0.190), and the least important "accident risk" (0.097); the Western liner's participants considered the importance of the order as "operational risk" (0.615), "Financial Risk" (0.176), "Strategic Risk" (0.132), "Accident Risk" (0.077). Located right in the first place, "operational risk" with a significantly greater weight values than the other three main criteria, it can be seen in subjects considering shipping companies carrying out risk management, "operational risk" for the impact of shipping companies is more significant, which means If the operational risk management is appropriate, it can significantly reduce the operational risks of the liner. The rankings of the first and second places of the latter are different. The Eastern liners believes that “financial risk” is more important than “operational risk”. Western liners believe that “operational risk” is more important than “financial risk”.
5. For the risk factors of the twelve sub-criteria, the participants of the Eastern liners believe that the three most important risk factors are “ship supply and demand risk”, “exchange rate risk” and “interest rate risk”. The subjects considered that the three most important risk factors were “ship supply and demand risk”, “human resources risk” and “interest rate risk”. The latter all believe that "the risk of ship supply is the most important."
6. No matter what the probability of loss and risk management strategy, avoiding risk entirely is almost impossible. Every enterprise should base on the characteristics of different industries to assess business-related resources, integration and use, in order to raise the level of risk management systems, enabling businesses not to panic when they encounter problems, calmly deal with various affairs, enhance corporate Competition. Because preventive actions beforehand can be called risk management measures, actions taken afterwards can only be called punishments.

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