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**WORLD MARITIME UNIVERSITY**

Shanghai, China

**RESEARCH ON THE COMPETITIVENESS OF  
CHINA HN CHEMICAL SHIPPING COMPANY**

By

**LUAN YUE**

**China**

A research paper submitted to the World Maritime University in partial  
Fulfillment of the requirements for the award of the degree of

**MASTER OF SCIENCE  
INTERNATIONAL TRANSPORT AND LOGISTICS**

2010

## DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): \_\_\_\_\_

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Supervised by

Professor Sha Mei

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## ABSTRACT

Title of Dissertation: **Research on the competitiveness of China HN chemical shipping company**

Degree: **Master of Science in International Transport and Logistics**

Sea transportation plays a quite important role in the modern world economy, for about 90% of the cargo of the international trade transported by sea. With the rapid development of the economy and external trade, the China's shipping industry has been confronted with great opportunity to development, the shipping companies have to enhance their competitive power in order to survive and develop in the open and unrestricted international shipping structure. Because of the rapid development of the chemical industry in China these years, the demand of the transportation of chemical products is increasing, and the requirements of the shipping transportation is also increasing, As the main participants of the chemical shipping market, chemical shipping companies play an important part. Whether the competitive power of the chemical shipping companies is strong or not has a direct influence on the rise and fall of chemical shipping industry of China. China's chemical shipping companies not only have the commonness of the general competitiveness of shipping companies, but also have its own industrial characteristic. These dissertations studied the factors effect and determine the competitiveness of the chemical shipping companies and build up a system to evaluate it.

**Key words:** competitiveness of companies; chemical shipping companies; fuzzy comprehensive evaluation; Competitiveness index system

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## **LIST OF ABBREVIATIONS**

AHP	analytic Hierarchy Process
SETC	state economic and trade commission
CDI	Chemical Distribution Institute
SCP	structure, conduct, performance
WTO	World Trade Organization
RMB	Renminbi
DWT	deadweight tonnage

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## **Chapter 1 Introduction**

### **1.1 Background**

Nowadays, international shipping has gained an unprecedented development under the impetus of world economy and international trade. Meanwhile it greatly enhanced the world economy and made a major contribution to the constant development and expansion of International trade. The shipping industry has become the basic industry to drive integration of world economy and globalization of international trade.

Whatever country it is, developed industrialized countries, newly industrialized countries or developing countries, all of them have recognized that shipping is the primary means and indispensable condition for achieving industrialization process as well as an important condition for accessing to international market. Therefore, a great many countries in the world have to invest in the shipping industry. In this way, they can promote international shipping market so as to enter the competitive market comprehensively.

Chemical shipping industry is an important part in Chinese shipping industry, in these years, the Chemical shipping market become more concerned as the international chemical trade continuous development. Because of the rapid development of the chemical industry in China, the demand of the transportation of chemical products is and the requirements of the chemical shipping transportation is increasing,

Because the late beginning of the development of chemical shipping companies in China, the tremendous gap with international counterparts, most of Chinese chemical shipping companies can only do domestic transportation for chemical products. This situation can not satisfy the continuous increasing requirement of chemical shipment need. How to promote the competitiveness of the Chinese chemical shipping companies become an important question to let the Chinese chemical shipping companies meet the domestic needs and participate in global competition, this

problem has become the subject studied by many specialists and scholars in shipping fields.

China's chemical shipping companies not only have the commonness of the general competitiveness of shipping companies, but also have its own industrial characteristic. These dissertations studied the factors effect and determine the competitiveness of the chemical shipping companies and build up a system to evaluate it.

## **1.2 Research Methodology**

This dissertation studies the competitiveness of chemical shipping companies in China by using criterion analysis and the demonstration analysis. The analysis based on the international chemical shipping market development and the chemical shipping market in China, in theory, put forward a complete set of chemicals shipping company of Chinese competitiveness evaluation index system; Secondly, use the fuzzy comprehensive evaluation model to analysis and research the comprehensive competitive of the competitiveness of HN chemical shipping company. In the end proposed some suggestions to improve the competitiveness of enterprises.

## **1.3 Literature Review**

The evaluation for the competitiveness of enterprises and the competitiveness of shipping companies. Xu Jianhua(1999) analyses the organization and management structure of the new shipping companies in his "international shipping economy", and analysis the competitive power of the companies from the view of the organization structure. Zheng Shiyuan(2003) used the structural equation model to evaluate the domestic trade container shipping companies in China's competitiveness

Jin Congli(2003)'s Empirical Analysis on the Competition of China's Shipping and Port Companies Listed on the Stock Market used the principal component analysis on

the competitiveness of listed companies of China's water transport industry, Based on fully comprehending the conception and features of company's competitiveness, in order to provide some guided suggestion in developing program for the shipping industry. Ye Jia(2005) analysis of China's shipping industry's international competitiveness from a qualitative point of view, and put forward corresponding countermeasures. Sun Junyan(2005) make a detailed overview of the competitive power of the shipping companies, he take tanker companies as the sample, use Assets, net profit margin indicator to comparative and analysis 4 specialized tanker company's profitability and ability to resist risks, Zhang Yan and Yu Siqin(2006) use fuzzy comprehensive evaluation method to analysis international shipping enterprise competitiveness. They Based on the 3C evaluation model and index system, a model of evaluating the competitiveness of international shipping enterprises is established by adopting Fuzzy-Evaluation method.15 international liner companies are selected for positive research on the basis of availability of information,and the results of which are accepted by relevant enterprises and specialists.

Duan Xueyan(2004) discussed about how the domestic container liner shipping companies to establish and strengthen their competitive advantage in 'containerized of Domestic container liner shipping enterprise's core competitiveness', and approach about how to accelerating cultivate the key competitive power of the domestic container liner shipping companies. Peter Lorange(2001) discusses the competitiveness of enterprises from the view of enterprise strategy in Strategic rethinking in shipping companies. Photis M.Panayides(2003) Study of competition in the shipping management strategy and organizational performance relationship, obtained with a positive correlation between these two conclusions. Tsung-Yu Chou and Gin-shuh Liang(2001). In their paper Application of a fuzzy multi-criteria decision-making model for shipping company performance evaluation, they use a negative-Mo method of decision-making model to make a quantitative analysis and comprehensive evaluation of the shipping company's operating results.

#### **1.4 Significance of the dissertation**

The shipping industry as a special industry, attract more and more people's concern as the growing of the international trade and the globalization. The competitiveness of shipping enterprise has the commonality as the competitiveness of the common enterprises, also has special industry personality. Scholars are also done a lot of research on the competitiveness of the shipping companies

At present, domestic and international shipping enterprise competitiveness studies have not obtained the system and in-depth results yet, more is similar general enterprise competitiveness, or only for shipping enterprise competitiveness make preliminary discussion, mainly in the shipping enterprise competitiveness implications, the factors affecting the competitiveness of the shipping companies, competition policy of the shipping companies, the competition risk that the shipping enterprises will face, and measures to strengthen the competitiveness of shipping companies, and so on. In addition, the study closely related shipping enterprise competitiveness content also includes the shipping enterprise development strategy, strategic alliances, the impact of shipping industry in China after the entrance into the WTO, the economic policy of international maritime, etc. Existing research results have not yet formed the overall framework of the shipping enterprises competitive system, also lack the necessary theoretical height about the nature of the shipping enterprise competitiveness, and evaluation of innovative mechanisms, shipping enterprises competitive and empirical analysis has not yet formed a system of systems.

The Focus of this paper is how to assess the competitiveness of chemicals shipping company in China. While also trying to be cognizant of this article our chemicals shipping market in which the state and study on the competitiveness of the HN Company.



Previous researchers often come from a certain point of view of the general competitiveness of a shipping enterprise factors. Or just stay in similar level of general enterprise competitiveness, there is less research specifically on the competitiveness of the shipping company in China chemical. This article base on reading a lot of literature, there was an attempt to make a comprehensive analysis of competitiveness to the chemicals shipping enterprises from various angles. Identify the various form factors of competitiveness of enterprises

In view of this, this article will use the canonical analysis and empirical analysis as the research methods. First, the international programme on chemical shipping market development and analysis of chemical shipping market in China, in theory make a complete set of Chinese chemical shipping enterprises competitive evaluation system; secondly, analysis the competitiveness of HN Company by using the fuzzy model to conduct a comprehensive, and give some suggestions to improve the competitiveness. These have a positive experience and guidance on chemicals shipping business strategy decisions, and this is helpful to improve the competitiveness of chemical shipping enterprises in China

### **1.5 The Content of this Dissertation**

This dissertation studies on the factors to influence competitiveness of chemical shipping companies in China. Firstly, this dissertation introduces the background of this topic, and introduces the review of previous academic studies, and the content of the dissertation. Then, the article discusses the basic theory of competitiveness of the companies and the factors that influence the competitiveness of the companies. In the third chapter. The dissertation analyses the domestic chemical shipping markets, using SCP analysis model to get the characteristic of structure, conduct and performance of china chemical shipping market. In the next chapter, this dissertation builds the evaluation index system for the chemical shipping companies according to the characteristic of chemical shipping from three key factors: marketing competence,

managing competence and confineable developing competence. Also take HN chemical shipping company as an example to analysis the competitiveness of this chemical shipping company, and put forwards some suggesting on improving the competitiveness for enterprises, and then give policy recommendations to enhance the competitiveness of chemicals shipping companies in China

## **Chapter 2 the basic theory of the competitiveness of companies**

### **2.1 Overview of the competitiveness of companies**

We can see that in different historical periods and under different economic forms, the meaning of the enterprises competitiveness has different emphases. The definition of the competitiveness of enterprises given by traditional economists represents that the advantage of traditional elements is the characteristics of competitiveness of enterprises under the natural resource-based industries form. As the economic formations changes from industrial economy to knowledge-based form, people realize that the significance of knowledge, innovation and environmental to the competitiveness of enterprises. The competitiveness of enterprises is no longer the advantage on the factor of production, information, knowledge, innovation and other potential factors also determine the extent of competitiveness of enterprises. The continued developments become an enterprise's core competitiveness of enterprises. The competitiveness of enterprises is an ability to promote sustainable development of an enterprise, means that in a competitive business environment do better than the other competition and meet the consumer demand to bring more benefits to the company at the product design, production, sales and other part of business activities based on the effective use or create of resources of the enterprise.

We all know that the external environment faced by the enterprise, market conditions, enterprise resources and the situations of the competitors are in a constant state of flux, the relative competitiveness between enterprises are also at the shift in flux, the mean factors constitute different industries and the competitiveness of enterprises are also different. Therefore, it is very difficult to define a very precise definition about the competitiveness of enterprises that fit every kind of companies. The more detailed the definition of the competitiveness of enterprises, the smaller scope of its application, so the key point of the definition of the competitiveness of enterprises is the definition can reflect the essence and to meet the research needs and get the point to enhance the

competitiveness of enterprises. After studying the previous understanding of the competitiveness, this dissertation argues that the concept of competitiveness of enterprises should include two aspects. The first aspect is a concept about 'relative position', means that the competitiveness of enterprises shows the relationship and the relative position between the company and the other competitors. The second aspect is the concept about 'trend', Means that the competitiveness of enterprises shows the change of the rate and trends about the affecting competitive factors between the company and other competitors. Every company not only care about the company's position in the industry, but also concerned about the ability of the sustainable development of the company. Based on the above analysis, this dissertation defines the competitiveness of enterprises as follows: the competitiveness of enterprises is the ability to provide products or services to market more efficient than other enterprises and maintain sustainable development of the enterprise in market competition environment.

## **2.2 The theory of the competitiveness of companies**

In the history of the development of human, western countries finished the industrial revolution and completed the market economy earlier than other countries in the world. Raised on enterprise competitiveness issues and the in-depth study of the enterprise competitiveness also started from West countries. In the 1980s, Michael Porter put forward a competitive strategy theory take the industry as the research target, this becomes mainstream strategy theory, but it is still lacking guidance enterprises on production activity in micro. In the early 90's, a group of business theory and enterprise strategy researchers advanced that must be reconsidered and analysis of enterprise. They study a special ability of companies: enterprise competitiveness and its core competence. They advanced that the competitiveness of enterprises is the key to succeed or failure of a company after analysis many large corporations. Enterprise competitiveness theory soon become very popular in the

1990s, has been engaged in the field of strategic management, soon spread around the world.

### 2.2.1 Porter's theory of business competition

Michael Porter from industrial structure analysis, advanced that where there are five basic strength in the industry environments: potential entrants, substitute threats, supply-side bargaining power and the buyer bargaining ability and industry competitors, enterprises in the industry must be accurate and sensitive in positioning to form a strategic advantage, And good use of the competitive relationship between these five strengths. Because of this Porter put forwards that there are three basic strategies to get competitiveness of Enterprise: leadership of the total cost, focusing on strategy, the target cluster strategy, in order to gain a competitive advantage. Potter also proposed the concept of value chain, through the value chain analysis to create notation, a competitive advantage. Enterprise gain competitive advantage, revealing how the enterprises enhance their competitiveness and gain competitive advantage. Porter's theory enlarges the thinking on the competitiveness of the enterprises, and provides a competitive analysis tool of the theory.

Porter's theory's deficiencies are: emphasis on corporate external analysis, without considering the various elements of competitiveness of enterprise. Porter tends to marketing and finance, but lacking in use economics, management science tools and porter's theory sometimes is also called Structuralisms.

### 2.2.2 Enterprise capability theory

In 1990, CK • G • Prahalad and Hamel in the "Harvard Business Review" published " The Core Competence of the Corporation ", since the article published, the Research and application of core competence are boom set off in Europe and the United States. According to their core competence theory, every company has a wide range of

capabilities (such as manufacturing capacity, distribution capacity, technical capability, etc.), will have their own special skills. However, the importance of different abilities and expertise to the enterprise is not the same. Those ability and expertise that can bring long-term competitive advantage and excess profits to the enterprise that are the company's core capabilities. To foster competitiveness of enterprises, we must identify and strengthen the core competencies of the enterprise, drive through the core ability to play the role of other resources within the enterprise, to obtain the enterprise of sustainability ability, accumulate, maintain, utilization core competence is business fundamental long-term strategy.

Chandler (Alfred D. Chandler, JR.) believe That Enterprise development power lies in the ability of the Organization, When an Enterprise Development to a certain size, there are four ways to continue development, i.e. horizontal integration, vertical integration, developing new markets and develops new products. Long-term investment of the company created economies scale and scope economies, while producing a large organization. Organizational capacity means productivity; marketing capabilities and management skills that take advantage of economies of scale and scope of economic in its historical development process. He considered the organizational capacity is characteristics to maintaining the advantages of enterprises in long-term development, Capacity on the ability to focus on the division of labor from the perspective of enterprise to examine the competitiveness of enterprises, search for enhancing competitiveness of methods and approaches from the enterprises internal. These have important implications in analyze the competitive advantage and its cultivation.

Enterprise capability theory emphasizes the main departure from enterprise's resources and not from market potential to explain the advantages of competition of the Enterprise. But a lack of Enterprise capability theory is the analysis of enterprises external is too simple, and the analysis of the overall competitiveness is not comprehensive. This theory focusing on internal research is very close to the

competitiveness of connotation. However, the impact on the business external environment factors, especially the market structure does not give enough attention, which makes this theory lack of dynamic and comprehensive.

### 2.2.3 Environment theory

Environment theory is known as market structure theory, it was rise after t1970s, and it is an important part of strategic management theory. This theory proposed analysis frame and method to the service level and the company strategy level. These theories and methods dominated management theory in the 1980s. The environment theory paid particular emphasis on the analysis from the enterprise exterior market mechanism, believe that the market mechanism play an important role to the establishment of enterprise' s competitive advantage. The profession attraction is the primary profit factor for the enterprise. Enters barrier decides whether the enterprise have the lasting competitive advantage. The enterprise must choose the product strategy under the existing market mechanism and own condition to enter the market, but is not to pay more attention to the enterprise' s internal resources and ability. This theory shift the analysis of the competitiveness from internal to external markets, stress the influence that the changes of market and market structure to enterprise' s competitive advantages or enterprise' s competitiveness, and overcome the defects of ability, so that expand the research perspective of competitiveness analysis.

## **2.3 Major evaluation systems of the competitiveness of companies in China**

### 2.3.1 Enterprise competitiveness index system of China Enterprise Confederation discussion group

China Enterprise Confederation began to study a specialized national business competitiveness index system in 1996, designed a set of indicators system to reflect the competitiveness of enterprises. Indicators system is divided into seven parts:

Economics, finance, management, and technological progress, the staff quality, opening to the extent and social benefits. Major economic benefits include sales revenue, profit, and labor productivity index; financial status mainly consists of net assets, assets and liabilities of stock indices; Management includes leading domestic market share and production and sales rate; the progress of science and technology consists primarily of new equipment, technical modification of profitability, etc; Staff include professional formation, educational level, staff education costs and time, etc; Opening to the extent mainly include the use of foreign capital and foreign exchange situation, etc; Social benefits include investment on environmental protection facilities , local employment situation, and tax indicators. These guidelines reflect the comprehensive quality and capability of the company like company's sustainable growth ability, profitability and market share, sales skills, product innovation, technology development capabilities.

### 2.3.2 SETC economic research competitiveness project group of enterprise competitiveness index system

SETC economic research competitiveness project group has designed a set of items with first level index 5, secondary level index 26, and three-level indicators for 79 of enterprise competitiveness index system. Specific indicators are as follows:

(1) Competitiveness scale (asset size of competitiveness, the competitiveness of business income, intangible assets, the competitiveness of large and small clients competitive)

(2) Market competitiveness (market competitiveness, quality of service, competitive, new business development competitiveness, competitiveness, market reflect sales network competitiveness, competitiveness, brand marketing team competition)



(3) Management competence (level of management competitiveness and management performance, financial management, competitiveness, capital operation competitiveness, profitability, competitiveness, talent management, competitiveness, information management, competitiveness, strategic management competence, corporate culture, competitive)

(4) Learning and innovation competitiveness (competitive learning, research and development competitiveness, and innovation competitiveness), policy and environmental competitiveness (trade policy of competitive environment, the competitiveness of the industry, to support the competitiveness of enterprises, the competitiveness of the local environment)

### 2.3.3 Business competitiveness index system of Chen Xiaohong

Chen Xiaohong considered in evaluating the competitiveness of enterprises, the main indicators should consider the following elements:

Market performance indicators: Including market share (goods and services, or sales revenue); corporate profit margins (net asset margin, the profit margin, etc.); and other indicators, such as capital market performance.

Capability index: Including technical capability (skills, research and development fees and the proportion); reputation and brand; customer relationships and marketing capabilities; knowledge capacity (patents, information, training); financial capability (net assets, cash flow and financial returns on index); equipment capacity (production and technical standards); public relations (particularly important in certain industries, such as telecommunications industry); human resources (qualified personnel, corporate culture, the cultural level of employees, human resources and pay system, etc.).

#### 2.3.4 Business competitiveness evaluation index system of Hu Dali

Hu Dali established the theory of index system in the assessment of the competitiveness of enterprises in his book 'the competitiveness of enterprises'. There are 12 evaluative features: Transport business ability, management security ability, profit ability, market controlling force, information technology level, technological innovation ability, organizational structure, human capital, enterprise culture, capital operation ability, knowledge management ability, external environment connection level

## **Chapter 3 Current situation about Competitiveness of chemical shipping companies in China**

### **3.1 Current situation of the chemical shipping market in China**

From 1948, the first generation of chemical tankers start, the chemical ship developed to fourth generation now. The birth of the fourth generation of chemical tankers was in the 1980s, since then the chemical tankers truly become chemical ship in bulk. The main characteristics of the fourth generation of chemical ship are: greater tonnage (normally 3 million deadweight tons), dense separation, a tube of a pump of liquid cargo piping, Can carry a strong corrosive acid, alkali goods, equipped with advanced control systems, heating system, detection systems, alarm systems, inert gas system, its structure and equipment meets the requirements of the safe transport of carrying chemicals and pollution prevention and has better fitness and operating performance

### **3.2 developmental trend of chemical shipping market in China**

In 2009, with new chemical tankers and liquefied gas tankers, and 1000 ton tanker truck on a mandatory basis-level policy implementation, and the old ship, single-hull oil tankers and other ships gradually withdraw behind in technology out of the markets, domestic chemical shipping capacity to further accelerate adjustment the structural, the proportion of old ships continued to decrease, the total amount of capacity that remains stable.

As of the end of 2009, there are about 1280 ships engaged in domestic coastal provinces of dangerous goods transport liquid cargo, it is about 100.3% of the number in 2008. and the total dead weight tonnage of these vessels is 8,417,000 DWT, this is about 103.4% of the data in 2008.in these vessels, there are about 213chemical vessels, decrease 6 vessels compared with the number in 2008, the dead weight tonnage of the vessels is 584,000 tons, increased 72,000 tons. The percentage of the vessels that

older than 12 years is decreased 7.1% compared with 2008, from 63.8% in 2002 to 27.9%, and this is the 7th year of consecutive declines.

Along with the implemented of policy measures of regulation of chemicals shipping and new chemical tanker forced entry-level examination. in 2009, the transportation capacity of chemical vessels that engaged in inter-provincial transportation of domestic coastal shipping market keep steady growth, and a net increase of the number of ships to continue to fall compared with 2008. The net increase of the chemical vessels dropped From 59 vessels in the capacity growth rush year to 6 vessels in 2009. This marks that the Regulatory policies have proved to be effective to the transportation capacity of coastal and inter-provincial chemical transportation from the second half of 2006.

As of the end of 2009, the number of coastal chemical ships falling 2.7%, but the total tonnage increase about 14.1%. Among them, the 2009 New build 9 chemical vessels with the dead weight tonnage 62 000 tons, no ship having reached the mandatory retirement age of the vessel out of the market, 15 old chemical vessels with 8725 tons dead weight tonnage do not meet the age and early retirement out of the market in 2009.

As of the end of 2009, the average age of chemical vessels are 7.4 years, compared with same period in 2008 the age of vessels decreased by 0.7 years, the ration of over 12 years of the chemical vessels is 22.1%. Age structure is reasonable.

In the steady growth in the total transport capacity, Chemical ship large trend further appearance, As of the end of 2009, the average tonnage of chemical vessels is 2741 tons over, Over the same period than 2008 increased by 17.3%, the average tonnage of new build chemical vessel in 2009 is 5275 DWT. the average tonnage transportation capacity yearly progressive increase (the number in 2007 is 3300 dwt,

the number in 2008 is 4777 dwt), the large-scale trend of the Chemical vessel is very obvious

### **3.3 The SCP analysis of the chemical shipping market in china**

Market structure, conduct, performance analysis models are also known as SCP analysis model; SCP is a "structure, conduct, performance" abbreviation. SCP mode analysis, that is, a research method to analysis a specific industry combination of the three elements "market structure, market behavior, market performance," it is a basic market analysis tools. Now, this dissertation will make the corresponding analysis to the chemicals shipping market in China from the market structure, market behavior, and market performance face three factors.

#### 3.3.1 Market structure

Market structure, refers to the profession of competition, competition, management style, price formation, and so have a major impact of the external market factors. There are four main indicators to Measure the market structure; they are Market concentration, Differentiation, the barriers that the enterprises enter or exit the market and the macro-policy environment.

##### 3.3.1.1 Market concentration

Market concentration includes industry market concentration and Regional market concentration. Industry market concentration is reflected in the degree of monopoly industries and the overall level of competition. Regional market concentration mainly reflected the distribution patterns on location of the individual enterprise in the industry in the space. At present, the description of the chemical shipping enterprises in China mainly focus on the economy and petrochemical industries are more developed like Yangtze River Delta, the Pearl River Delta, Bohai three economic

zone, as opposed to regional market focus. But considering that shipping has a strong liquidity, the influence of relatively concentrated of chemical shipping enterprises is not very obvious.

### 3.3.1.2 Differentiation

The Differentiation of different chemical shipping enterprises is considerable In terms of fleet size, management or service offerings. In the fleet, the large company has a fleet of more than 20 bulk chemical, more than 10 million deadweight tons, while small companies only have several 1000 tons of single truck shipping enterprises; at the management level, there are several large chemical shipping enterprises in China established a joint venture of marine transportation companies with the leading shipping companies in the world of chemicals in the maritime industry , these companies have imported foreign advanced management experience, and some small companies, especially small companies operations still remain in single-ship single kind of simple job way; in service offerings level, some companies can provide far, near Ocean international flights and domestic coastal routes of a variety of bulk chemical transport services, to develop procedures for marine operations, some small companies can only do a single kind of domestic transportation.

### 3.3.1.3 The barriers that the enterprises enter or exit the market

Our country's chemicals industry is relatively high barriers to entry. Chemical transportation because of the characteristics of chemical goods, the requirements on maritime safety, environmental protection, and product quality is high, this requires chemical shipping companies should have high-quality specialty chemicals ships, and there must also be a necessary advanced fleet management level. The traffic and the maritime department in China to have raised more requirements and engage higher standards to chemical transportation enterprise than the average transport enterprises.

#### 3.3.1.4 macro-policy environment

In recent years, as the rapid development of petrochemical industry in China, the transportation of chemicals produced a corresponding demand for more and higher requirements. Since 2001 the Ministry of Communications in China has increased the transportation of chemicals and management of development efforts, has introduced several industry-related regulations, In terms of the foreign investment authorized access into the chemical shipping market in China. In May 2004, authorized by the Ministry of Communications, Shanghai Shipping Exchange, Chartered set up five joint venture shipping company in the domestic chemical transport between the ports by open tender. Overall, the country's macroeconomic policy environment is conducive to China's development of chemical shipping industry.

#### 3.3.2 Market conduct

Market conduct, refers to individual chemical shipping enterprises take a series of behavior in order to obtain greater resistance to risk appetite, increased profitability and competitiveness or other goal in the market. The market conduct in the chemicals shipping market in China mainly means optimization services, joint management and price competition.

##### 3.3.2.1 Optimization services

The important competition policy for strong powerful chemicals shipping enterprises are mainly like follows: Improving technology and service level, the expansion of the fleet, competing for large shippers, gaining market share.

##### 3.3.2.2. Joint management

Joint management mainly takes the way like the foreign capital + local famous

enterprises. In 2004, 5 national and International enterprises approved to access the chemical shipping transportation between the harbors in China by the Ministry: these companies are quite powerful in the domestic and international levels. These companies which have achieved a engaged in domestic port-to-ship transport of qualification.

#### 3.3.2.3. Price competition

In the past few years, the situation of the chemical shipping market in China is more chemical ships and less chemical cargo, the market competition of fighting for chemical cargo sources is heating up, the focused point of the competition is price. Some enterprises cannot seize to more customers because of insufficient funds and seize the wrong time; so operators are just select tariff as their key point, competition on the price has become the norm, this competition cause the chemical shipping price declines a lot, the average rate decreases in more than 40%. But in the meantime, the fuel prices keep rising, making the entire chemical shipping losses a lot of money, the development of the chemical shipping industry suffered serious constraints.

In the recent years, the Association of industry self-regulation and industry coordination achieved some success, freight satisfied recovery but slow. Because of the particularity of the chemical transport, cargo owners, especially those with the strength of bulk cargos more emphasis on the safe, reliable and high quality transport services, price competition become smaller attractive to the cargo owners, also the chemicals shipping market there are commonly published various routes chemicals shipping cost index, on the whole price competition on the market will become smaller and smaller.

#### 3.3.3 Market performance

Market performance, refers to the industry overall level of development and



profitability of the enterprise determined by the established market structure under its market behavior. This dissertation mainly analysis the market performance of chemical shipping companies in China from the technical progress.

Along with chemical transportation market further open up to the world, several joint venture transportation companies are also expected to enter the domestic chemical transportation market, the increased competition, advanced management methods and ideas access into the domestic chemical shipping market, these promote the chemical technological level and the ship enterprise management level. Realized the management and operation of the two companies complement each other, the establishment of a high standard of safety and quality management system. This combination brings the advantages of technological progress can make the chemical shipping company get more advantage in the chemical shipping market in China.

### **3.4 The factors that influence the competitiveness of chemical shipping companies in China**

The Factors that affecting the competitiveness of enterprises are different in different historical periods also have different emphases under different economic forms. Traditional economists believe that the factors affecting the competitiveness of enterprises shape gradually changes to a knowledge-form as the industrial economy based on natural resource-based industrial economy form -- which the comparative advantages of the traditional factors of production. People awarded the importance of knowledge, innovation, environment and other factors on the significance of the competitiveness of enterprises. Factors affecting the competitiveness of enterprises are no longer just on the comparative advantages of production factors, management, knowledge, innovation and other potential factors that determine the competitive ability of enterprises, Sustainability development ability of enterprises become the core part of the competitiveness of enterprises.

In view of this, this dissertation establishes a hierarchical model of enterprise competitiveness, as a theoretical basis for design evaluation index. Based on the inside and outside the influence of multiple factors of the competitiveness of enterprises, the first level is performance level; performance level is measured by the indicators related to the market control. The second level is the impact level; it means the key factor of the internal management that influences the competitiveness of the chemical shipping enterprises. The third level is decision level; that means the soul of the competitiveness of enterprises and the highest level of the ultimate goal of a company-sustainable development capacity. That is, factors affect the competitiveness of enterprises mainly by following three components: market control, management capacity and sustainability. This dissertation analysis these three levels of competitiveness from the chemicals of competitive evaluation perspective on.

#### 3.4.1 Market control ability

The factor of market control ability Includes the firm size, market share, and the market performance through the marketing. Market control is the most basic the most appearances of a competitive chemical shipping companies. With the growing international and domestic competition, maintain a certain scale of a company is to protect and support to enhance their competitiveness. In order to do effective marketing should under certain develop capacity scale, the company can achieve to match the rivals market coverage and market share. It is difficult to talk about and other chemicals of competition issues without enough market control ability

#### 3.4.2 Management ability

Management ability is an ability that makes the enterprise has better management performance than other competitors. An enterprise's security management level, corporate culture, capital management ability, and enterprise business performance are important aspects to reflect this enterprise's competitiveness.

### 3.4.3 Sustainability development ability

Another important aspect of competitive evaluation is the Sustainability development ability of the enterprise. Sustainability development ability refers to the ability that the chemical shipping company should have in chemicals industry in the development to overreach its competitors and can maintain the enterprise's long-term development potential. Human resources, the ships updates speed, management level, innovation, industry, services developed indices are reflected in the corporate sustainability index of Chemicals shipping companies.

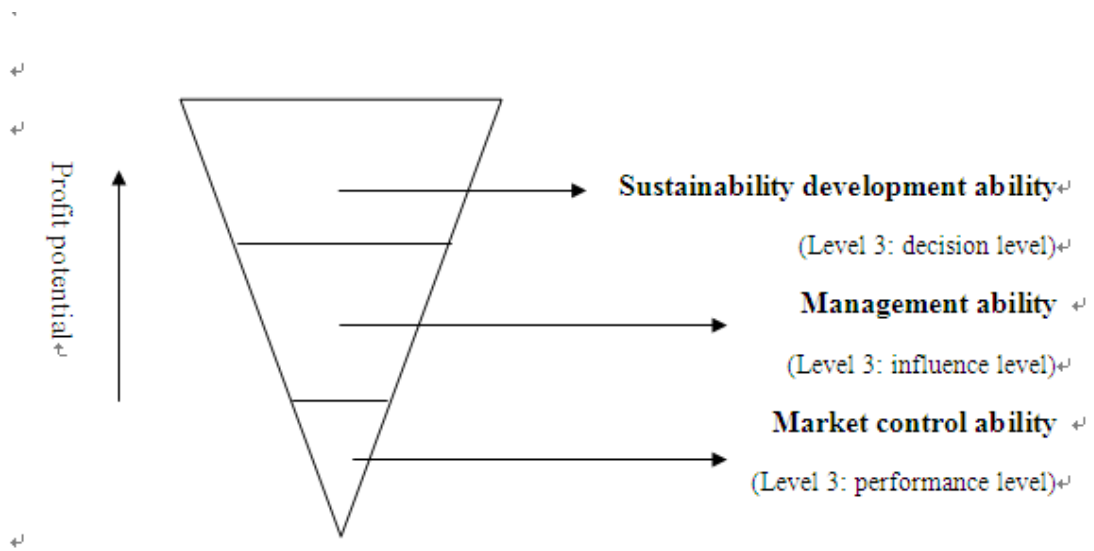
Although Market control ability, management ability and Sustainability development ability are three most important parts in the competitiveness of enterprises, but they taken different share in the overall competitiveness.

The competition with competitors in the market control is the lowest level of competition; a company has a certain level of competitiveness of enterprises at this level did not mean this company has a high profit potential.

Competitors has the competence in the market control and management, at this stage may be regarded as a competitive strength, and the company will get a certain amount of profit potential, but enterprise cannot get enough development stamina, at that time, the company's market share will declining.

The enterprise only has the competitive in all aspects of the market control, management and sustainable development, this company can continue to ensure that a certain amount of market share and profit potential, at least the company can compete with rivals, and don't lose market share, and make profits maintain a certain profession. Consideration into these three levels of competition; that is a high level of competition, and have the sustainability development ability advantage is the key to

the competition. As shown in following figure.



**Figure 3. 1 Competitiveness components factors and profit potential**

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## **Chapter 4 Research of HN chemical shipping company**

### **4.1 Competitiveness index system**

#### 4.1.1 The basic principles of the Establishment of the competitiveness of chemical shipping business index system

Chemical shipping enterprises, on the one hand, have the commonality with General Enterprise; on the other hand, as a special industry have personality of chemicals shipping industry, so, the design of chemical shipping enterprise competitiveness evaluation system must follow a series of basic principles to reflect chemicals shipping enterprise competitiveness dynamically.

##### 4.1.1.1 Scientific principles

Evaluation system is the result of theory and practice; it must be abstract description of chemical shipping market and the chemical shipping enterprises in the market. There are a lot of factors that involved the competitiveness of Chemical shipping enterprise, how to grasp the characteristics of the competitiveness of chemical shipping enterprises, take the most important and most representative thing from a large number of enterprise competitiveness factors is the key indicator of the system design. Therefore, the design must comply with scientific principles, can accurately reflect corporate competitiveness indexes concept correctly, clear meaning, and between the objectives should not be a strong correlation.

##### 4.1.1.2 Systemic principles

The competitiveness of enterprises is influenced by their own human capital, technology innovation, management, information and other factors and the impact of combination effects, therefore, the evaluation of the competitiveness cannot only

consider a single factor, must be taken to system design, system evaluation principle, To comprehensively and objectively to make the shipping of chemicals and reasonable assessment of the competitiveness of enterprises.

#### 4.1.1.3 Comparability principles

In the study of competitiveness of the chemical shipping enterprises must take the international programmed on chemical shipping market objective situation as prerequisite, considering the characteristics of the development of the market, competition and competitive environment, and other individual factors, needs to have some certain degree of comparability. Index should, as far as possible, unified the existing statistical indicators, accounting indicators, business accounting indicators, the required evaluating data should be ease of acquisition.

#### 4.1.1.4 Dynamic principle

The competitiveness of enterprises is a dynamic process of development, the design of the index system must be shown not only consider the external competitiveness, but also consider the potential competitive Only in this way, their evaluation system to reflect the company's long-term competitive advantage.

#### 4.1.2 The complete index system

In order to evaluate of the competitiveness of enterprises objectively and scientific, observation the location of enterprises in the market in the fierce competition, explore ways to improve market competitiveness of enterprises, the need to design an enterprise competitiveness index system of science, complete, from every angle. In this dissertation, establish a chemical shipping business competitiveness index system after read a lot of information, and consultation with the opinions of experts in relevant units in Shanghai Maritime University, according to scientific, systematic,

comparable, dynamic principles to design indicators index system.

The index system is based on the three subsystems of a three-tier evaluation index system, by nature is divided into two indicators: quantitative and qualitative indicators index. Chemical shipping enterprise competitiveness indicators forms in China are shown in the following table.

**Table 4. 1 Chemical shipping enterprise competitiveness indicators forms**

Factors (level 1)	Level 2	Level 3	Meaning and method of calculation
<b>Market control ability</b>	Shipping capacity	Fleet (tones)	The total load tons of ships
		The number of operating the ship (vessel)	Including their own, leasing and factoring of ships
		The average tonnage ships (ton)	Total load tons/total number of vessels
	Market share	Total capacity	the total carrier volume of all vessels in Certain period of time
		Operating route network coverage	Including the near ocean, ocean of all routes
		market occupancy	Enterprise share of total shipments in the country
	Market Operating ability	Customer service satisfaction	Prospective class rate of transport, transport safety and quality, service attitude
		The proportion of private ship	Own shipping capacity / total capacity control
		Customer stability	COA freight / total shipments
		Corporate brand	Intangible value
		Tariff levels	evaluation by the cargo owners,
	<b>Management ability</b>	Security management	Improvement and perfection of the security management system
Emergency support			For emergency situations the ability to support the ship
Personnel security management			Security management with relevant personnel the

		capabilities	knowledge and skills
	The operation and management of ships	Trading rates	Operation time / ship registration time
		Capacity utilization	Volume of freight / shipping tons of sea
		Ship average tonnage productivity	The total transport volume / total tonnage of ships
	working capital management	Net return on capital	Net income / total assets
		Return on sales	Profit / Revenue
		Mobile Asset Turnover	Sales revenue / average balance of current assets
		Total assets turnover	The average gross sales revenue/total assets
		Asset-liability ratio	Total debt/total assets
	Corporate culture	Corporate culture adaptability	Evaluation by the senior staff assessment in the enterprise
		Business integrity	Evaluation by shippers
		Enterprise leader quality	Evaluation by Some experts, shipping companies, ship
Factors (level 1)	Level 2	Level 3	Meaning and method of calculation
<b>Sustainability development ability</b>	Human Resources	The total number of employees	Including the crew, shore staff
		Staff education	the proportion of The number of people with college education in the total number of staff
		Proportion of Staff education and training expenses in the total cost	
		Human resource performance	Net profit / total number of employees
	Technology Innovation	gravity of Age is less than 10 years	Vessel age of less than 10 years of shipping capacity / total capacity of ships
		Update speed of	the new ship capacity/ total transport capacity of ships



		ships	
		Ship input	Annual actual new shipbuilding input
		The proportion of marine technology transformation input	Marine technology transformation input/total investment
	Management Innovation	Business process reengineering frequency	the number of times of the change In the structure and management, adjustment range greater than 50%
		Enterprise mimic ability	the ability to timely initiative to introduce other enterprise valuable innovation
		The number of international partners	The number of the foreign large chemical shipping enterprises that cooperation with the company
		Enterprise investment proportion of total revenue	Research investment / total investment
	Ability to support extend industry	Integrated logistics capability	Providing customers with shipping, handling, storage, transfer, distribution, and other integrated logistics services
		number of participation in the operation of the port	Including participation, holdings, leased port
		Self Terminal Throughput	The chemical shipping company's own Terminal throughput

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### 4.1.3 Recommendation indicator system

Although a complete index system can depict a more comprehensive chemical shipping company's competitiveness, but in actual there are always difficult to use the data for these indicators. In order to facilitate the data collection, we need for a more simple shipping enterprise competitiveness indicator system. Recommended indicator system should meet the following conditions:

- (1) More accessible in the data collection
- (2) Has certain coverage in three-tier structure of complete index system;
- (3) Has a vital role in the complete index system.

**Table 4. 2 Recommendation indicator system**

Factors (level 1)	Level 2	Meaning and method of calculation
<b>Market control ability</b>	Total capacity	the total carrier volume of all vessels in Certain period of time
	The average tonnage ships (ton)	Total load tons/total number of vessels
	Fleet (tones)	The total load tons of ships
	market occupancy	Enterprise share of total shipments in the country
	Corporate brand	Intangible value
	The proportion of private ship	Own shipping capacity / total capacity control
	Customer stability	COA freight / total shipments
<b>Management ability</b>	Improvement and perfection of the security management system	A complete set of safety, quality management certificate, ship management meet the international standard
	Enterprise leader quality	Evaluation by Some experts, shipping companies, ship
	Ship average tonnage productivity	The total transport volume / total tonnage of ships
	Net return on capital	Net income / total assets
	Return on sales	Profit / Revenue
	Asset-liability ratio	Total debt/total assets
<b>Sustainability development ability</b>	Human resource performance	Net profit / total number of employees

	gravity of Age is less than 10 years	Vessel age of less than 10 years of shipping capacity / total capacity of ships
	Update speed of ships	the new ship capacity/ total transport capacity of ships
	The number of international partners	The number of the foreign large chemical shipping enterprises that cooperation with the company
	Integrated logistics capability	Providing customers with shipping, handling, storage, transfer, distribution, and other integrated logistics services
	number of participation in the operation of the port	Including participation, holdings, leased port

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## 4.2 fuzzy comprehensive evaluation of competitiveness of Chemical shipping company in China

### 4.2.1 Determination of weights

The indicators in the assessment system for the evaluation of the objective function is not the same degree, to importance to distinguish the difference between various factors is very helpful to highlight the main role of the factors that help to ensure the accuracy of the assessment results. Determine the weight by the most common method is through investigation by experts in relevant units in Shanghai Maritime University, That, base on the determining of the evaluation by various experts, they analysis and pair wise comparison of all the importance of the indicators based on their years of work and experience. Then you can then use the AHP analytical principle to do the related calculation.

Calculated on all the weights through the analytic hierarchy process, average the indicators of relative weights should be the following data

**Table 4. 3 The weights of Recommendation indicator**

Factors (level 1)	weight relative to the upper level index	Level 2	weight relative to the upper level index	weight relative to the total index
<b>u<sub>1</sub></b> <b>Market control ability</b>	0.321	<b>u<sub>11</sub></b> Total capacity	0.206	0.066
		<b>u<sub>12</sub></b> The average tonnage ships (ton)	0.122	0.039
		<b>u<sub>13</sub></b> Fleet (tones)	0.136	0.044
		<b>u<sub>14</sub></b> market occupancy	0.198	0.063
		<b>u<sub>15</sub></b> Corporate brand	0.168	0.054
		<b>u<sub>16</sub></b> The proportion of private ship	0.086	0.028
		<b>u<sub>17</sub></b> Customer stability	0.084	0.027
<b>u<sub>2</sub></b> <b>Management ability</b>	0.324	<b>u<sub>21</sub></b> Improvement and perfection of the security management system	0.190	0.062
		<b>u<sub>22</sub></b> Enterprise leader quality	0.151	0.049
		<b>u<sub>23</sub></b> Ship average tonnage productivity	0.142	0.046
		<b>u<sub>24</sub></b> Net return on capital	0.144	0.047
		<b>u<sub>25</sub></b> Return on sales	0.261	0.084
		<b>u<sub>26</sub></b> Asset-liability ratio	0.112	0.036
<b>u<sub>3</sub></b> <b>Sustainability development ability</b>	0.335	<b>u<sub>31</sub></b> Human resource performance	0.182	0.065
		<b>u<sub>32</sub></b> gravity of Age is less than 10 years	0.139	0.049
		<b>u<sub>33</sub></b> Update speed of ships	0.136	0.049
		<b>u<sub>34</sub></b> The number of international partners	0.175	0.062
		<b>u<sub>35</sub></b> Integrated logistics capability	0.196	0.061
		<b>u<sub>36</sub></b> number of participation in the operation of the port	0.172	0.069

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## 4.2.2 Fuzzy Synthetic Evaluation Model

### 4.2.2.1 Establishing factors set and its weight

According to earlier identified indicators and weights, and can find factors set and its weight

$U = \{\text{Market control ability } u_1, \text{Management ability } u_2, \text{Sustainability development ability } u_3\}$

Weight  $\tilde{A}_1 = (0.321, 0.324, 0.355)$

Among them, three child factors set are respectively.

(1) Market control ability  $u_1$

$u_1 = \{\text{Total capacity } u_{11}, \text{The average tonnage ships } u_{12}, \text{Fleet } u_{13}, \text{market occupancy } u_{14}, \text{Corporate brand } u_{15}, \text{The proportion of private ship } u_{16}, \text{Customer stability } u_{17}\}$

Weight  $\tilde{A}_1 = (0.206, 0.122, 0.136, 0.198, 0.168, 0.086, 0.084)$

(2) Management ability  $u_2$

$u_2 = \{\text{Improvement and perfection of the security management system } u_{21}, \text{Enterprise leader quality } u_{22}, \text{Ship average tonnage productivity } u_{23}, \text{Net return on capital } u_{24}, \text{Return on sales } u_{25}, \text{Asset-liability ratio } u_{26}\}$

Weight  $\tilde{A}_2 = (0.190, 0.151, 0.142, 0.144, 0.261, 0.122)$

(3) Sustainability development ability  $u_3$

$u_3 = \{\text{Human resource performance } u_{31}, \text{gravity of Age is less than 10 years } u_{32}, \text{Update speed of ships } u_{33}, \text{The number of international partners } u_{34}, \text{Integrated logistics capability } u_{35}, \text{number of participation in the operation of the port } u_{36}\}$

Weight  $\tilde{A}_3 = (0.182, 0.139, 0.136, 0.175, 0.196, 0.172)$

#### 4.2.2.2 Set up an evaluation set

The more detailed the Evaluation set classification is, more accurate evaluation is, but the process will be more cumbersome, the more difficult to grasp. Therefore, to select the appropriate rating level is very important. Too much Classification make the survey object very difficult, the result is not necessarily the best one. In this article, in determining the evaluation level, according to the characteristics of the thesis, the evaluation rating set  $V$  is defined as one of the four levels,

$$V = \{v_1, v_2, v_3, v_4\} = \{\text{Excellent, good, fair, poor}\}$$

We use this to show evaluation level of competitiveness of chemicals shipping enterprises in China.

#### 4.2.2.3 Determination of the membership of the evaluation of the index

After the Determining of the factors set (and weight), evaluation set, we will do single-factor judging to determine the index of the membership. In this article have two main kinds of indexes: one is represented by the number of quantitative indicators, most of the indicators in this dissertation are this kind of index. The second is the vagueness of qualitative indicators, which is difficult to use quantity to define, such as corporate brand, safety management systems, corporate leaders, quality, logistics, etc.

The first class of index, this dissertation reference commonly used by fuzzy control method for determining the membership function, According to the experience prior to determine fuzzy membership subset table. Allowing the established evaluation model can have strong objectivity and operability. According to the evaluation determined in this dissertation and related information, classification the index range and do the investigation in the experts in Shanghai Maritime University by a ‘membership questionnaire’. According to the results of the surveys, the share of the scale of each level, we can set up a membership subset table. Take the membership subset table of total capacity of the chemical shipping enterprises in China and the stability of the customers as an example:

**Table 4. 4 Total capacity of the chemical shipping enterprises in China**

total capacity (tons)	Excellent	Good	Fair	Poor
50000~100000	0.75	0.15	0.10	0
10000~50000	0.10	0.60	0.30	0
5000~10000	0	0.35	0.65	0
2000~5000	0	0	0.55	0.45
0~2000	0	0	0	1

Source: Drawn by author: ©Copyright Luan Yue, WMU-ITL Shanghai, (2010) by Research on the competitiveness of China HN chemical shipping company.

**Table 4. 5 The stability of the customers**

Customer stability (%)	Excellent	Good	Fair	Poor
Above 85	0.10	0.40	0.40	0.10
70~85	0.10	0.70	0.20	0
50~75	0.80	0.10	0.10	0
25~50	0.20	0.50	0.20	0.10
0~25	0	0	0	1

Source: Drawn by author: ©Copyright Luan Yue, WMU-ITL Shanghai, (2010) by Research on the competitiveness of China HN chemical shipping company.

To the second kind of index, we first invest the chemical shipping enterprise, and then get the membership of the indicators  $\tilde{R}_1$  which calculated from the proportion of evaluation levels of each indicator according the evaluation results from the evaluators.

$$\tilde{R}_1 = (r_{i1}, r_{i2}, \dots, r_{im})$$

Then form the comprehensive evaluation fuzzy matrix R according to the membership from the single factor evaluation.

$$\tilde{R}_1 = \begin{pmatrix} R_1 \\ R_2 \\ \vdots \\ R_n \end{pmatrix} = \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1m} \\ r_{21} & r_{22} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & \dots & r_{nm} \end{pmatrix}$$

In the fuzzy matrix,  $r_{ij} = \mu_k(u_i, v_j), 0 \leq r_{ij} \leq 1$ . Means the level of the evaluation result when the evaluators  $u_i$  considering about  $v_j$ . In this paper, index system of factors classified by the composition of multi-level factors, we can use the results

above as to the next level evaluation of membership, and do the next level of evaluation base on this.

#### 4.2.2.4 Fuzzy Operator

According to the single factor assessment evaluation results, calculates the proportion of all indicators of their levels, get fuzzy matrix  $\tilde{R}$

$$\tilde{R} = \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{pmatrix}$$

And,  $\sum_{j=1}^m r_{ij} = 1 (i = 1, 2, 3, \dots, n)$

After the determining the membership and the weight of Evaluation index, we can determine the fuzzy operator based on the characteristics of the target system.

The key to Fuzzy evaluation is the determination of the fuzzy operator. There are mainly three types of fuzzy operators, they are: the main factors prominent type, the main factors determine type and weighted average based type. In this dissertation, Combines the features and characteristics of this evaluation model and various types of fuzzy operator, we choose weighted average based type M as the fuzzy operator.

M means  $b_j = \sum_{i=1}^n a_i r_{ij}, j = 1, 2, \dots, m$

The fuzzy operator calculates follow the algorithm of matrix operation, according to the size of weight, take all factors affecting into account, and Keep all the information of the single-factor evaluation.

After the determining of the weight set  $\tilde{A}$  and evaluation matrix  $\tilde{R}$ , do matrix multiplication In accordance with the fuzzy operator, we can get Comprehensive evaluation set  $\tilde{B}$ ,

$$\tilde{B} = \tilde{A} \times \tilde{R} = (a_1, a_2, \dots, a_n) \times \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{pmatrix} = (b_1, b_2, \dots, b_m)$$



Then, take the judge results as the membership of the evaluation object in the next level, and then we can get the resultant next-level evaluation results, so until you arrive at the final evaluation results. This article first calculate two single-factor evaluation index of level 2 index, then calculate level 1 index, at last to get a final evaluation vector  $\tilde{B}$ .

#### 4.2.2.5 Reverse fuzzing

The result of the Fuzzy comprehensive evaluation is fuzzy vector, which the membership vector that the judge objects belonging to different levels evaluation. After the determination of the level of the evaluation object, the author needs to do reverse fuzzing to the fuzzy vector, also known as clarifications. There are two methods to do reverse fuzzing: Maximum membership method and Gravity method. Maximum membership method is a more common way to do reverse fuzzing, use the Maximum membership method to the final evaluation vector  $\tilde{B}$

$$b_0 = \max(b_1, b_2, \dots, b_m)$$

We can get a result  $b_0$ , this method is simple, but not clear enough to get more detail results, summarize the exact volume is not enough. This method did not take the other smaller evaluation membership factors into the calculation. If there are more than one Maximum membership factors, cannot calculate a result by the Maximum membership method.

We can use Gravity method to avoid the above disadvantages,

$$M = \frac{\sum_{i=1}^n b(u_i) \times u_i}{\sum_{i=1}^n b(u_i)}$$

corresponding scores of Various factors and evaluation set  $u_i$ , In order to obtained an accurate results of the evaluation, we determine the range of the value of the variable level is: {Excellent, Good, Fair, Poor} = {100~90, 89~75, 74~60, 59~0}, if calculate the class mid-value, the result is {95, 82, 67, 30}

You can derive the following table:

**Table 4. 6 Evaluation results and reviews-level**

level of the Evaluation	Comprehensive value	class mid-value
Excellent	$100 \geq u_j \geq 90$	95
Good	$90 > u_j \geq 75$	82
Fair	$75 > u_j \geq 60$	67
Poor	$60 > u_j \geq 0$	30

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gravity method can reflect the whole information in the fuzzy vector during the reverse fuzzing, this dissertation use this method to do the reverse fuzzing, get a comprehensive quantitative value  $M$ , then according to the value  $M$ , to find the appropriate level evaluation in the table, this level evaluation is the final evaluation of a chemical shipping enterprise.

### **4.3 The study of the competitiveness of HN chemical shipping Company**

In this part, this dissertation will analysis the competitiveness of the enterprise of HN Company base on the recommended standard index system, from three factors that affecting the competitiveness of enterprises, research the detail situation of the competitiveness of HN Company, and based on the evaluation of results corresponding to enhance their competitive proposals and measures. Then up to the industry level to put forward some proposals to help the chemical enterprises to strengthen the competitiveness of enterprises.

HN Company was founded in 1994, with the registered capital of 2.44 billion RMB, The company is mainly engaged in near the ocean, Ocean and coast along the

Yangtze River in China the liquid chemical transportation, awarded by the ship, provision of security management system and forensic consulting, Contract goods, including liquid chemicals, vegetable oil, fuel oil, diesel, petrol and oil, etc. Sailing routes involving mainland ocean coastal, and near international routes, North Indian Ocean route, American Airlines, the Middle East Mediterranean routes and European routes, Have a stable supply of liquid bulk chemical and oil transport In coastal and Southeast Asia and the Middle East, far East market.

In this dissertation, the author gets the detail data from the various index of competitiveness of the HN Company through the investigation and survey to the HN Company and the annual report of HN Company. And the author also do normalization job of the compiled data, and summarizes the survey data, from the data, get the Get a quantitative index of membership subset table and qualitative indicators of membership vector; corresponding the detail data of HN Company to the appropriate subset of the membership, then can get the membership vector of quantitative indicators. Final we can get the membership vector  $\tilde{R}$  of the evaluation of the various indexes. By the following table:

**Table 4. 7 Membership vector  $\tilde{R}$  of the evaluation of the various indexes**

Level 2	HN Company Data	Membership vector $\tilde{R}$
<b>u<sub>11</sub></b> Total capacity	1000000	(0.75, 0.15, 0.10, 0)
<b>u<sub>12</sub></b> The average tonnage ships (ton)	6858	(0.80, 0.20, 0, 0)
<b>u<sub>13</sub></b> Fleet (tones)	200	(0.75, 0.25, 0, 0)
<b>u<sub>14</sub></b> market occupancy	26.9	(0.50, 0.40, 0.10, 0)
<b>u<sub>15</sub></b> Corporate brand	-----	(0.55, 0.45, 0, 0)
<b>u<sub>16</sub></b> The proportion of private ship	74	(0.75, 0.25, 0, 0)
<b>u<sub>17</sub></b> Customer stability	60	(0.80, 0.10, 0.10, 0)
Weight $\tilde{A}_1 = (0.206, 0.122, 0.136, 0.198, 0.168, 0.084)$		
<b>u<sub>21</sub></b> Improvement and perfection of the security management system	---	(0.70, 0.20, 0.10, 0)

<b>u<sub>22</sub></b> Enterprise leader quality	---	(0.75, 0.15, 0.10, 0)
<b>u<sub>23</sub></b> Ship average tonnage productivity	20	(0.25, 0.65, 0.10, 0)
<b>u<sub>24</sub></b> Net return on capital	10.3	(0, 0.35, 0.65, 0)
<b>u<sub>25</sub></b> Return on sales	2.95	(0, 0.30, 0.70, 0)
<b>u<sub>26</sub></b> Asset-liability ratio	7.7	(0.80, 0.20, 0, 0)
Weight $\tilde{A}_2 = (0.190, 0.151, 0.142, 0.144, 0.261, 0.112)$		
<b>u<sub>31</sub></b> Human resource performance	54.3	(0.80, 0.20, 0, 0)
<b>u<sub>32</sub></b> gravity of Age is less than 10 years	16	(0.75, 0.15, 0.10, 0)
<b>u<sub>33</sub></b> Update speed of ships	17.3	(0.20, 0.70, 0.10, 0)
<b>u<sub>34</sub></b> The number of international partners	2	(0.60, 0.40, 0, 0)
<b>u<sub>35</sub></b> Integrated logistics capability	---	(0, 0, 0.55, 0.45)
<b>u<sub>36</sub></b> number of participation in the operation of the port	0	(0, 0, 0.40, 0.60)
Weight $\tilde{A}_3 = (0.182, 0.139, 0.136, 0.175, 0.196, 0.172)$		

Source: Drawn by author: ©Copyright Luan Yue, WMU-ITL Shanghai, (2010) by Research on the competitiveness of China HN chemical shipping company.

Setting up an evaluation matrix According to the above data, calculate the data by using the following formula

$$\tilde{B} = \tilde{A} \times \tilde{R} = (a_1, a_2, \dots, a_n) \times \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1m} \\ r_{21} & r_{22} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & \dots & r_{nm} \end{pmatrix} = (b_1, b_2, \dots, b_m)$$

Then get the evaluation result of level 1:

**Market control ability**

$\tilde{R}_1 = (0.6772, 0.2740, 0.0488, 0)$ ;  $M_1 = 90.1$ ; the level is ‘Excellent’

**Management ability**

$\tilde{R}_2 = (0.3713, 0.3041, 0.3246, 0)$ ;  $M_2 = 82.3$ ; the level is ‘Good’

### **Sustainability development ability**

$\tilde{R}_3 = (0.2778, 0.2016, 0.3026, 0)$ ;  $M_3 = 66.6$ ; the level is 'Fair'

We can get the Weight  $\tilde{A}$ :

Weight  $\tilde{A} = (0.321, 0.324, 0.355)$

After the above calculation, we do the evaluation of the level 2, and get the final evaluation vector  $\tilde{B}$ :

$$\tilde{B} = (0.4363, 0.2581, 0.1982, 0.1074)$$

Use the following formula to do reverse fuzzing:

$$M = \frac{\sum_{i=1}^n b(u_i) \times u_i}{\sum_{i=1}^n b(u_i)}$$

We can get the result that  $M=79.1$ . And the final evaluation result of the HN Company is 'Good'.

#### **4.4 The recommendations to enhance the competitiveness of HN Company**

In the above section on domestic and international chemicals shipping market analysis and comparison of the competitiveness of enterprises, based on the actual situation of HN Company, this dissertation put forward three suggestions.

1. Identify the market position, expand the fleet scale and improve the control of the market

Specialized chemicals shipping has developed for more than 60 years, the chemicals market is already quite mature and standardized and there is a cut-throat competition in the chemicals shipping market. The chemicals shipping companies in China have many disadvantages, like the companies started very late, the scale of the companies are small and the strength is weak. So it is very critical for the Chinese chemicals shipping companies to find their own market position in the detailed classification

chemicals shipping market if the Chinese chemicals shipping companies want have a successful operation. With China's rapid economic growth and increased demand for chemical products, the chemicals transport demand in China will increase in the future. However, China's shipping companies cannot meet the requirements of the transportation of chemicals because the lack of chemicals fleet. In this case, HN Company shall expansion the domestic market based on the company's domestic advantage in China, expand the fleet scale through new build, purchase, lease, etc. keep sustained development on the fleet, locked the high-end customers as the company's target. The company can occupy more internal high-end market share through provide high value-added service by combination of domestic transport and international transport; meet the customers' requirements about safe transportation, environmental conservation, on time transportation and quality management. The high-end customers in internal market are mostly large-scale chemicals manufacturers; their chemical transport demand often throughout the world, the company can establish a good reputation to attract more international chemical shipping market through the domestic chemical transport.

## 2. Improve the management by strengthen safety management and optimized the business process

The level of the safety management is very closely related to service quality, particularly to the chemical shipping companies. HN Company has established a high standard of safety and quality management system, in the operation of the safety and quality management system, HN Company make the transportation safe and in a pre-control situation mainly through the establishment of relevant rules and regulations, strengthen the sense of safety in navigation safety, equipment safety, cargo security, personal safety, environment protection efforts and several other areas. From the internal control to the management structure of the company, HN Company optimized the decision-making system and business processes to keep the high level of management, in the same time do the business risk control and the quality assurance of the company on account of the frequent changes in market condition. HN

Company also should continue to strengthen the training of human resources, strengthen the customer-focused marketing ideas and service awareness, and guide the employees of HN Company by the target of ‘pursuit of excellence’.

3. Develop the integrated logistics, create new profit growth point and establish the capacity for sustainable development

After 70s, the international shipping companies pay more attention to the logistics service, some large-scale chemical shipping companies also set up their logistics companies. Stolt-Nielsen Transportation Group constituted by the three main business units: Stolt liquefaction shipping companies think more and featured canning company and Stolt Tank Terminals, is the global leading company bulk liquids chemical, cooking oil, acids and other special fluid, this company can provides the global integrated transportation service for the customer by the company’s coastal waters and inland river bulk liquids chemical fleet, collection packing, the bulk fluid goods storage tank wharf and the railroad fluid goods tank truck.

#### **4.5 Policy recommendations to enhance the competitiveness of chemicals shipping companies in China**

The chemical shipping industry's competitiveness is an organization problem of the chemical shipping industry, to establish an effective competitive market structure and industrial structure is important to increase the competitiveness of the shipping industry chemicals, this a fundamental approach and decisive condition for the chemical shipping market in China. The Government should strive to create an appropriate external environment for the improvement of the competitiveness of chemical enterprises in China. The government should strengthen the Government’s positive role of research and policy recommendations. The mean responsibility of the Government is to take positive measures to ensure fair market competition to speed up the legal system. Governments should work to formulate relevant policies to gradually establish a consistent international rule for shipping companies in China

chemical shipping companies with foreign chemicals to create fair competition in the external environment and conditions.

#### 4.5.1 Establish National chemical ship technology management inspection standards

The CDI survey mechanism, set up by The European Chemical Industry Council is widely recognized chemical ship technology management inspection standards by most big multinational chemical groups. In recent years, several large chemical enterprises in China have established a joint-venture projects and international projects with some big multinational chemical groups, these projects not only introduced the international advanced production technology, while also encouraging mainland bulk chemicals and transportation management and international standards process acceleration. In these years our traffic Department accumulated some experience during in charge of water transport ship technology management inspection also of supervisory practice. Therefore, it is recommended that the Transport Department in charge of the China shipping ships of liquid chemicals to enact and introduce our liquid chemicals in water transport ship technology management inspection standards combined with our goals that develop liquid chemicals in the maritime industry, considering the ships situation and the skill levels, corporate management and the quality of the actual situation, in the light of existing international practice and common criteria, At the same time, after the established of the standard, the Transport Department or its authorized units can be used as a technical advisory unit, give the chemicals enterprises comprehensive, objective risk assessment services of chemicals shipping.

#### 4.5.2 Establish national chemicals crew training and the examination and certification system

For the large lurking risk in current chemical ship's safety work, the chemicals crew need rigorous training and examination. It is recommended that the Transport



Department should set up chemicals crew training and the examination and certification system, this system give crews training and exams from chemical tankers, cargo operations and management expertise, dangerous chemicals, environmental pollutants and controlling the safety and pollution prevention measures, and so on. In order to improve the quality and technical capabilities of the chemical shipping service and to ensure that chemicals maritime services of high quality and minimize the possibility of contamination incidents because of human factors.

#### 4.5.3 Encouraging and supporting the development of powerful chemicals shipping enterprises and port in China

To maintain an appropriate degree of industrial concentration and firm size is the protection and supporting to enhance the competitiveness of shipping companies. The number of a national's large shipping companies has become an important indicator to measure the industrial competitiveness level between countries. Thus, according to the requirements of economies of scale, the state should be preferred, focusing to develop some chemicals shipping companies which has advantages in capital and technology-intensive, concentrate their efforts on improving the most competitive chemicals shipping enterprises and make these companies become the dominant force in optimal organizational structure and promote industrial upgrading, at the same time, the chemicals shipping company should be given greater autonomy such as investment management and decision-making with, and fully mobilize the enthusiasm of chemicals business of shipping.

Along with the gradual opening-up of the chemicals shipping market in China, overall domestic chemical shipping transport will continue to raise the technology level. At present, because the domestic chemical transportation enterprises' level is not high to catch the world level, some international large-scale transport enterprises can't find the domestic transport carriers, so sent the large ships that carrier China's imports chemicals to hang Korean ports, and then distribution to the port in China. As China's

domestic liquid chemical transportation becomes more quality and security during the development, would facilitate the port liquid chemicals shipping transport transit business development in China. Our Transport Department should encourage and support some ports with certain foundation and the strength, speed up the construction and development, improve the management and technical levels, build the coastal and river-liquid chemicals transit ports as soon as possible.

## Chapter 5 Conclusion

The chemical shipping in China is still in its infancy, compared with foreign countries there is a clear gap. Grasp the opportunity to develop chemicals shipping market, increase competitiveness of the chemical shipping enterprise, is undoubtedly an important task of the shipping industry.

This dissertation analysis the situation of present environment of chemicals shipping market by a general sense of enterprise competitiveness connotation, then commenced on the study of competitiveness of the shipping company. This article comes up with ideas in the following areas after reading large amounts of documentation.

1. Through the comprehensive analysis about the domestic chemicals shipping market, the authors believe that China's chemicals shipping market is still in the backward development, and there will provide a large market space to domestic chemical shipping enterprises because of the domestic chemical shipping transportation market opening to the world chemical shipping market.
2. Establish a complete index system to measure the competitiveness of the shipping companies combined with the characteristics of chemicals shipping companies from three main factors: market control, management capacity and sustainability. In order to facilitate data collection and the practical operability of evaluation of the competitiveness, the article provides a more simple assessment index system of the chemicals shipping enterprise competitiveness, and determines the target weight basis on this index system, set up in China chemical shipping company competitive fuzzy comprehensive evaluation model.
3. Analysis the competitiveness of HN Company and give recommendations to improve their competitiveness; and from a single enterprise to rise to the industrial

level, proposed recommendations. Improve the competitiveness of the shipping companies of chemicals industry policy.

Because of the limitations of time, conditions, data sources and knowledge, there are still many want to do but did not work, for example the ranking of all the chemicals shipping company's competitiveness ranking in China, more comprehensive comparison for the competitiveness of chemical shipping enterprises of domestic and foreign companies, and so on. Although the article inevitably flawed and inadequate, but I still hope that this study of the competitiveness of chemicals shipping companies can provide a good idea to the chemical shipping companies, can provide a reference to the development of the competitiveness of chemical shipping companies in China,

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