

**Corporate Social Responsibility and Green Finance for  
Sustainable Development: A Study of the Chinese  
Chemical Logistics Industry**

Thesis submitted to the University in partial fulfilment of the  
requirements for the degree of Doctor of Philosophy

**January 2025**

## **Dedication**

This dissertation is dedicated to my mother, my sisters, my daughter, and all my relatives, and my friends.

## **Declaration**

I hereby confirm that this thesis is the result of my original work. All references, citations, or quotes that are not my original work have been duly acknowledged. None of the materials in this thesis has previously been submitted for any other degrees in this or any other university of institute of learning.

The copyright of this thesis rests with the author. No quotation from it should be published in any format, including electronic and the internet, without the author's prior consent. All information derived from this thesis must be acknowledged appropriately.

## **Acknowledgement**

Many people have contributed directly or indirectly to the completion of my PhD degree. First at all, I would like to pay a special thanks to my mother, my sisters, and my lovely daughter.

Second, I would like to express my appreciation to my supervisor Professor Nirmala Lee and Dr. Lan Jiang. They have played the main role to the successful completion of my study. They have always pushed me to give the best thing related to my study. They kept on encouraging me and supporting me to finish my project. They also constructed appropriate critiques, and provided valuable comments and suggestions that enabled me to accomplish the timelines and objectives of the study. In effect, this stage was important and useful in my life to improve and develop my ability in the business research.

Third, I am thankful to all the interviewees who are all the senior management in the Chinese chemical logistics industry for they provided me all information related to this study. I would also like to thank all PhD candidates, who provided me some information about data collections and data analysis methods for my study.

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## Abstract

The aims of the research are to seek CSR management and green finance for business development to support business sustainability under the global call for carbon peak and carbon neutrality.

Through the analysis of the current situation of green finance and CSR in the selected case, the research endeavours to explore the prospects for sustainable development of green finance and CSR in Chinese Chemical logistics Industry. On this basis, the associated risk management is analysed to guide the direction of CSR and green finance in the long-term perspective of carbon peak and carbon neutrality. This thesis reports to examine and extend the literature, by obtaining a deeper understanding of the link between the implement of corporate social responsibility & green finance and the company sustainable development by using a mix methodology underpinned by stakeholder theory. This study combines the quantitative and qualitative research.

A quantitative examination of the relationship between corporate social responsibility and organizational performance for Chinese chemical logistics companies. It took the CSR data and financial data for the public listed Chinese chemical logistics companies which comprises 152 firm-year observations between 2010-2019 (There are 7 sample companies set up later than Year 2010). The study integrated the Hexun CSR data into CSMAR to test for linear relationships to identify the relationship between CSR and financial performance. First, the CSR data analysis helps to find out the CSR development level in the Chinese chemical logistics industry. Furthermore, it also utilized data from HEXUN CSR database and CSMAR database to examine the relationship between the company performance with each CSR dimensions of shareholders, employees, customers and suppliers, the environment. This study expected to find a positive relationship between corporate social responsibility and organizational performance. The evidence by secondary data analysis confirms the contribution of specific aspect of CSR to firm development. These findings suggest that firm's stakeholders' demands can be addressed by its CSR activities, which supports the instrumental aspect of stakeholder theory.

A qualitative interview-based inquiry about the relationship of CSR and Green Finance with company sustainable development. The interviews in this research included seven questions designed based on research questions. The 11 interviewees were invited to the research and includes the logistics managers, HSE managers, Finance V.P, Operation manager of the Chinese chemical logistics companies and invite the participators from the customers section of the Chemical logistics companies, which are those chemical manufacturers. During the interviews the interviewees all shared information and their experience according to the pre-provided questions list regarding the CSR & GF. The qualitative findings of this study also revealed that there is a positive relationship between levels of CSR and green finance development and organizational performance. The outcome of this analysis provides valuable insights into the practice of CSR & GF in the Chinese chemical logistics industry. The interviews with the chemical manufacturers employees also revealed the development gap in the different industry. It provided the understanding for the future potential development trends of the CSR and GF development of the Chemical logistics industry in China.

# **Chapter 1 Introduction**

## **1.0 Background of this study**

The concepts of Corporate Social Responsibility (CSR) and Green Finance (GF) have been developed from Western world. CSR has also been described as ‘a fundamentally subversive doctrine’ by Nobel Prize-winning economist, Milton Friedman. Green finance is one of several terms used to describe activities related to the interaction between the environment, finance and investment. It has become a widely recognized concept over the last decade. The global call for carbon peak and carbon neutrality supports the CSR, GF, and Sustainability exploration both academically and practically.

Academic research on CSR in China was mostly began in the 1990s, while research on GF emerged even later and has recently gained popularity, particularly in response to China’s “Dual Carbon” goals: peaking carbon dioxide emissions by 2030 and achieving carbon neutrality by 2060. Although there have been many research achievements by Chinese scholars on CSR, there is limited research specifically focusing on CSR and GF in the chemical logistics industry. However, although Chemical logistics industry is a niche market within the whole logistics industry, it attracts significant attention and demand for risk management due to its high potential risk to the public and society. Furthermore, drawing on extensive experience and knowledge in the Chinese chemical logistics industry, this study aims to explore CSR management and green finance for business development, with the goal of supporting sustainability in line with the global call for carbon peak and carbon neutrality.

## **1.1 Aims and objectives of this study**

By analysing of the current state of green finance and CSR in the selected case, the research seeks to explore the prospects for sustainable development of green finance and CSR in Chinese Chemical logistics Industry. On this basis, the associated risk management is analysed to guide the direction of CSR and green finance in the long-term perspective of carbon peak and carbon neutrality. The aim of the research is to explore how CSR management and green finance can contribute to business development and support business sustainability in response to the global call for carbon peak and carbon neutrality.

To achieve it, the following objectives are carefully considered:

- To explore the development of the Chinese chemical logistics industry and evaluate the problems and risks it faces.
- To study advanced CSR knowledge in risk management and understand its development within the Chinese chemical logistics industry.
- To critically review relevant green finance development in China, both at the national and international levels.
- To seek solutions for the implementation and practice of CSR and green finance to promote business development and sustainability, particularly in China.

## **1.2 Research questions**

To achieve the above aims and objectives, research questions were raised at the beginning of the study as below:

1. What theories are available for Corporate Social Responsibility?
2. What theories and practical examples are available for Green Finance in the global market?
3. How is the CSR & GF development in the China and international market?

4. What are the problems facing the chemical logistics industry in China related to CSR and green finance?
5. Can CSR and GF help the Chinese chemical logistics companies to make sustainable development? What can the chemical logistics companies do to achieve it?

To summarise and refine the general research question: How will CSR and Green Finance influence business financial performance and enhance sustainable practices?  
– A study on Chinese Chemical Logistics Industry.

### **1.3 Rationale motivation of this study**

The concepts of Corporate Social Responsibility (CSR), green finance, and sustainability have gained significant attention in recent years as global challenges such as climate change, resource depletion, and social inequality intensify. Generally, CSR refers to the ethical obligation of businesses to contribute positively to society beyond their profit-driven objectives. Green finance encompasses financial activities aimed at fostering environmental sustainability, including investments in renewable energy, energy efficiency, and other green projects. In a broader sense, sustainability seeks to balance economic growth, environmental stewardship, and social equity to ensure long-term prosperity for both current and future generations.

The pursuit of Corporate Social Responsibility (CSR) and Green Finance (GF) has evolved as essential frameworks, originating primarily from Western perspectives. Often perceived as a disruptive ideology, CSR has challenged conventional economic thinking, notably described by Nobel laureate Milton Friedman as 'fundamentally subversive.' Complementing this, Green Finance encapsulates the multifaceted relationship between financial practices and their environmental impacts, gaining substantial traction in recent years. The global imperative for carbon peak and neutrality further accentuates the significance of exploring CSR, GF, and broader sustainability initiatives, both in academia and practical implementation.

Despite commendable scholarly achievements by Chinese researchers in the realm of CSR, there remains a noticeable gap in the specific exploration of CSR and GF

within the chemical logistics sector. Notably, the chemical logistics industry, though niche within the larger logistics domain, commands significant attention and necessitates rigorous risk management protocols due to its substantial potential risks to public health and society. Moreover, within the Chinese chemical logistics sector, there exists a dearth of comprehensive research integrating CSR and GF methodologies. This scarcity of focused inquiry presents a unique opportunity to delve into the intricacies of CSR and GF application within this industry segment. Leveraging extensive working experience and in-depth knowledge within the Chinese chemical logistics sphere, this study endeavours to discern and implement CSR strategies and green financial models tailored for fostering sustainable business practices. By aligning these strategies with the global imperative for carbon peak and neutrality, the aim is to fortify business sustainability and resilience within the chemical logistics domain.

As stakeholders—including consumers, investors, and regulators—demand greater accountability and transparency from corporations, integrating CSR and green finance into business strategies is becoming increasingly important. This thesis aims to explore the intersection of CSR, green finance, and sustainability, investigating how these concepts can collectively contribute to sustainable development. The motivation underlying this research stems from the recognition of the critical nexus between CSR, GF, and the sustainable development of the chemical logistics industry. This study aims to bridge the gap in the existing literature by integrating CSR principles and Green Finance mechanisms tailored to the chemical logistics industry, while also aligning these efforts with the global push towards carbon mitigation and neutrality. By doing so, this research aspires to offer comprehensive insights and actionable frameworks that can augment responsible and environmentally conscious business practices within the chemical logistics sector, ultimately contributing to broader sustainability objectives.

## **1.4 Research methodology**

A research methodology provides a framework for conducting research in a specific area. Under this research methodology framework, both qualitative and quantitative methods are available for researchers to undertake their research activities and collect

data. To achieve the aim and objectives of this research, this study combines the quantitative and qualitative research.

To answer the research question of “How will CSR and Green Finance influence the business finance performance and enhance sustainable practices? – A study on Chinese Chemical Logistics Industry.”

Two sets of hypotheses are being developed:

- Risk management in the form of CSR increases profitability of corporations.

This means that the chemical logistics companies which make compliance management will lead to long term profit and sustainability. The practical compliance management is related on various stakeholders (shareholders, employees, customers, and suppliers, the environment and society)

H<sub>0</sub>: Risk management in the form of CSR has no relationship with firm performance. This is the null hypothesis of the research.

H<sub>1</sub>: Risk management in the form of CSR has a relationship with firm performance. This is the alternative hypothesis of this research.

- Green Finance boosts low carbon economy development and business sustainability. This means that developing Green Finance will strongly support the business development and thus contribute to business sustainability.

H<sub>0</sub>: Green Finance has no impact on chemical logistics business development and sustainability. This is the null hypothesis of the research.

H<sub>1</sub>: Green Finance has an impact on chemical logistics business development and sustainability. This is the alternative hypothesis of this research.

For the first hypotheses, secondary data for public list companies is more dependable and easier to access, so this research uses the quantitative method to analyse CSR data and evaluate the hypotheses. Therefore, the quantitative method was taken to explore the first hypotheses because it involves the analysis for enormous number of financial data. For do the secondary data analysis, it took the CSR data and financial

data for the public listed Chinese chemical logistics companies which comprises 152 firm-year observations between 2010-2019 (There are 7 sample companies set up later than Year 2010). The study integrated the Hexun CSR data into CSMAR to test for linear relationships to identify the relationship between CSR and financial performance. For this study, the Stata is the statistical software for doing the secondary data research. Stata is a complete, integrated software package that provides data science needs—data manipulation, visualization, statistics, and automated reporting. The structure of collected data suggests a panel-based regression model to control the unobserved heterogeneity in the proposed model.

For second hypotheses, as well as two additional sections of the research cluster: the private logistics companies, and the subsidiaries of chemical companies, qualitative research was conducted through interviews to collect and analyze primary data. The interviews in this research included seven questions designed based on research questions. The 11 interviewees were invited to the research and includes the logistics managers, HSE managers, Finance V.P, Operation manager of the Chinese chemical logistics companies and invite the participators from the customers section of the Chemical logistics companies, which are those chemical manufacturers. To develop a richer and more advanced interpretation of the findings, coding analysis and thematic analysis were applied to gain a more comprehensive understanding of the data and the research topic.

## **1.5 Organisation of this thesis**

This research is divided into eight chapters. The foundational chapters (Chapters 1, 2, 3,4) provide insights into the introduction and literature review, while Chapter 5 offers a detailed description of the research methodology. Chapters 6 & 7 serve as the operational chapters, presenting the empirical analysis. The closing chapter (Chapter 8) provides an interpretative discussion, offering conclusions and recommendations that conclude the thesis.

Chapter 1 introduces the research by outlining the background, motivation, and content of the study. Although a brief chapter, it is essential in guiding readers through the study's objectives.

Chapter 2 reviews the development and specific characteristics of the chemical logistics industry in China, highlighting the importance and urgency of risk management. It also argues that risk management in the form of CSR should be implemented by Chinese chemical logistics organizations to ensure sustainability in this high-risk niche market.

Chapter 3 and 4 focus on the main subjects of this study: CSR and Green Finance(GF) for sustainable development, from both international and Chinese perspectives. These chapters provide detailed literature review on CSR and GF development, proposing that both CSR and GF contribute to sustainable business development.

Chapter 5 explains the research methodology employed in this study, including data collection methods and data analysis techniques for both qualitative and quantitative research. These methods provide invaluable information for the study. Principally, interview survey (qualitative research) employs thematic analysis while secondary data analysis (quantitative research) widely uses statistical tools in STATA.

Chapter 6 presents the empirical analysis and describes the findings from the secondary data. It specifically discusses the reliability of the secondary data sources. The findings were analysed using statistical tools in STATA, including percentages and means. Inferential statistical tools were then used to determine the significance of differences and mean ranks among control variables. This chapter employs regression analysis to produce meaningful results.

Chapter 7 presents the findings from the semi-structured interviews, analysed through thematic analysis, with the aim of expanding the discussion. This chapter provides insights into the perceptions of the Chinese chemical logistics management team, including HSE managers, operations managers, and executives.

Chapter 8 provides an in-depth analysis by synthesizing the findings from both the quantitative and qualitative data analyses. It attempts to answer the research questions outlined in Chapter 1 through hypothesis testing, as detailed in Chapter 6, by cross-referencing the empirical findings. The chapter offers an interpretative discussion to further elucidate the study's results. It also provides a concise summary of the study and offers recommendations for future research. One of the study's findings is that CSR and GF are acknowledged and practiced in the Chinese chemical

logistics industry (referring to CSR and sustainable development activities); however, a systematic approach to support risk management is lacking. However, specific industry risks require joint efforts from the government, society, and enterprises. While CSR and GF can help enterprises reduce risks, social recognition and government support are also essential for the long-term sustainable development of high-risk industries.

## **Chapter 2 Explore Chinese Chemical Logistics Industry:**

### **CSR Driven Risk Management for a Sustainable Future**

#### **2.0 Introduction**

The Chinese chemical logistics sector, an integral constituent of the nation's economic framework, has faced significant scrutiny due to a series of severe incidents. This study examines the pivotal necessity of integrating risk management methodologies within the Chinese chemical logistics sector as a facet of Corporate Social Responsibility (CSR). Through an analysis of recent consequential occurrences, an exploration of CSR's role in risk mitigation, and the proposition of comprehensive strategies, the study endeavours to elucidate a trajectory towards a more secure and sustainable future for the industry.

This chapter commences by presenting pertinent definitions associated with chemical logistics and provides a concise overview of the sector's evolution within the global market. Subsequently, it delves into the intricacies of the Chinese chemical logistics industry to delineate its distinctive market attributes. Moreover, the research places emphasis on the analysis of the top one hundred entities operating within the Chinese chemical logistics domain, engaging in an in-depth examination based on the four principal business segments. Finally, to illuminate the heightened risk inherent in this industry, the study presents three significant incidents, elucidating their causative factors and delineating their repercussions on human life, the environment, and economic spheres. Conclusively, leveraging the insights from these case discussions, the study underscores the imperative and significance of a CSR-driven approach to risk management within the Chinese chemical logistics industry.

#### **2.1 Definitions of Chemical logistics industry**

Chemical logistics can be defined as the movement of chemicals within the supply chain, facilitated by transportation and storage services provided by chemical logistics companies. The chemical logistics industry is a niche sector within the broader logistics industry, and it's essential to understand some relevant definitions and

classifications. Since chemical transportation includes the transport of hazardous materials (HazMat), only those with strict scrutiny by relevant government authorities and the necessary facilities and equipment are eligible for transporting hazardous materials safely. According to the U.S. Department of Transportation (2017), hazardous chemicals are substances or materials that can cause harm to people, property, or the environment based on their physical and/or chemical properties or potential reactions. According to this definition, chemical transportation isn't limited to highly toxic, explosive, or polluting products; it also includes everyday products like fuel, natural gas, and fertilizers (both solid and liquid) that may pose risks to the population and the environment. In China, according to the "Regulations on the Safety Management of Hazardous Chemicals in China," hazardous chemicals refer to toxic chemicals and other chemicals with toxicity, corrosivity, explosiveness, flammability, combustibility, or the ability to aid combustion, which are harmful to human health, facilities, and the environment. According to the "Classification and Numbering of Dangerous Goods" (GB6944-2005), dangerous goods are categorized into nine classes, totalling 22 items. Each item contains specific dangerous goods, and there are 2763 types of products registered in the "Dangerous Goods Catalogue" (GB12268-2005). The physical and chemical properties of these 2763 dangerous goods and newly added ones differ significantly each year.

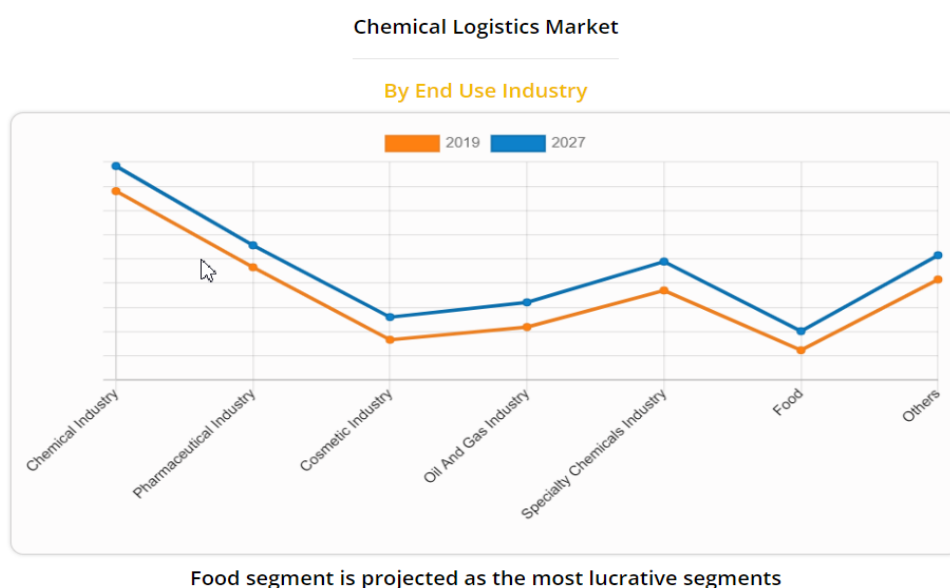
According to the "Industry Classification Guidelines for Listed Companies in China," the chemical logistics industry falls under the "Handling and Transportation Agents" category within the "Transportation, Warehousing, and Postal Services" sector, with the industry code G58. In 2013, the General Administration of Quality Supervision, Inspection, and Quarantine and the National Standards Committee jointly issued the "Classification and Evaluation Index of Logistics Enterprises" (GB/T 1968-2013), categorizing logistics enterprises into three types: transportation, warehousing, and comprehensive. The first two primarily involve the integration of single logistics services like transportation and warehousing, while comprehensive logistics enterprises engage in various logistics services, including transportation, warehousing, freight forwarding, distribution, logistics processing, and information services. They can provide customers with systematic logistics solutions, comprehensive logistics services, and value-added services, have a certain range of goods distribution,

distribution networks, specialized facilities, and personnel, and can offer timely and effective services to customers. They also provide information services such as status monitoring and tracking throughout the entire logistics process.

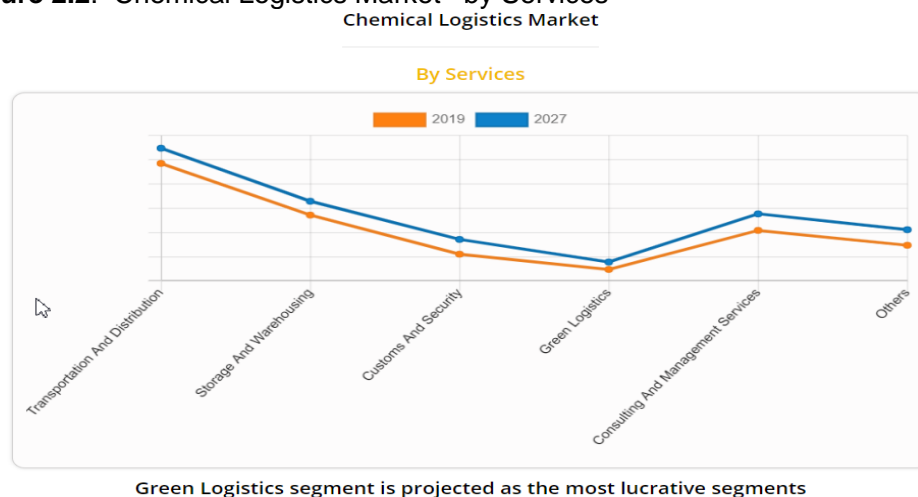
## **2.2 General review of the global chemical logistics markets**

The global chemical logistics market was valued at \$253.71 billion in 2019 and is projected to reach \$322.54 billion by 2027, reflecting a Compound Annual Growth Rate (CAGR) of 3.9% from 2020 to 2027 (Allied Market Research, 2020). The Asia-Pacific region claimed the largest market share in 2019, primarily driven by the swift recovery from the impacts of COVID-19. Chemical logistics can be defined as the management of chemical substances along the supply chain, with logistics companies offering critical services such as transportation and warehousing. The chemical sector plays a pivotal role in numerous industries, including plastics processing, pharmaceuticals, food production, and automobile manufacturing. Most industries rely on products originating from the chemical sector. Whether in liquid or solid form, chemicals serve as the fundamental building blocks for various everyday products, including pharmaceuticals and food items. The transport of these chemicals demands special attention to ensure safety and prevent issues like contamination and spoilage during handling and storage. The global chemical logistics market can be categorized by the mode of transportation, services, end-use industries, and geographical regions. In terms of transportation modes, it encompasses roadways, railways, airways, waterways, and pipelines. In terms of services, the market can be divided into transportation and distribution, storage and warehousing, customer support and security, green logistics, consulting, and management services, among others. The end-use industries include the chemical industry, pharmaceutical industry, cosmetics industry, oil and gas industry, specialty chemicals industry, food industry, and more. Prominent players in the chemical logistics market include A&R Logistics, Agility, BASF, BDP International, BDtrans, C.H. Robinson Worldwide Inc., Deutsche Bahn (DB) Schenker, Deutsche Post AG (DHL), Rhenus Logistics, Ryder System Inc., and others.

**Figure 2.1:** Chemical Logistics Market by End Use Industry



**Figure 2.2:** Chemical Logistics Market by Services



Source: *Prospect Research Institution* <http://www.bg.qianzhan.com>

Regarding to the developing trends of chemical logistics globally, it can see the rapid Increase in demand for chemical logistics, owing to rise in chemical production and safety concerns for transportation, storage, and distribution of dangerous chemicals drives growth of the chemical logistics market. However, complexities in chemical logistics, safety concerns, and poor infrastructure hinders growth of the market. Further, rise of tech-driven logistics services, coupled with growth in adoption of IoT enabled connected devices provide remarkable growth opportunities for players operating in the market.

Rise in demand for automation and modernized green warehouses in the chemical industry for sustainable business operations propels the market growth. With rise in

concerns regarding energy conservation and environment protection, chemical manufacturers are increasingly investing in cost-effective warehousing solutions that combine green practices and smart technology, such as the Internet of Things (IoT), smart sensors, and robotics. In addition, vendors also provide digital tools to automate chemical logistics and process data with enhanced productivity, efficiency, and convenience. Moreover, growth in use of Artificial Intelligence (AI), machine learning, radio-frequency identification (RFID), and Bluetooth, coupled with other newly introduced technologies such as drone delivery and driverless vehicles is witnessed in logistics services. Therefore, growth in technological advancements in the logistics industry offer lucrative growth opportunities for the chemicals logistics market.

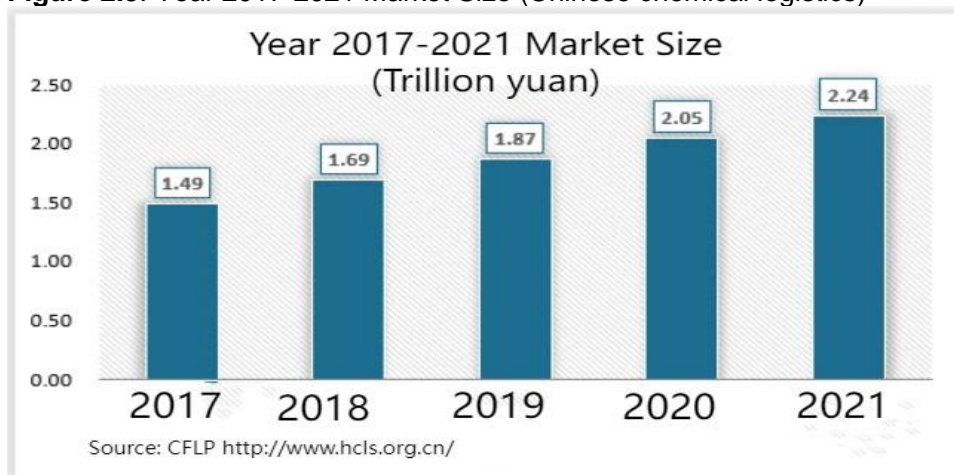
### **2.3 Chemical logistics in China**

In the context of chemical logistics, there has been significant and sustained growth both domestically and internationally in recent years, especially in the thriving field of chemical logistics in China. This surge is closely tied to the rapid expansion of the global chemical industry. It is worth noting that, due to China's vast consumer market and its role as a manufacturing hub, the chemical logistics industry has garnered considerable attention in recent years. Major global chemical enterprises have gradually established local facilities in China to serve regional markets and even expanded their product supply scope to other parts of the world. This intricate transport network, encompassing various chemical raw materials, finished products, and seamless flows between factories, has greatly propelled the development of the chemical logistics industry in China. The uniqueness of the products transported in the Chinese chemical logistics industry requires stringent government regulation and continuously improving policies. As China's supply-side structural reform deepens, the market size of the chemical logistics industry continues to expand. Simultaneously, the supply chain structure of the chemical industry has seen significant enhancements, spanning chemical production, packaging, transportation, and warehousing. In the fiercely competitive chemical logistics market, leading companies are gradually solidifying their positions, leading to an increasing concentration of the market. The third-party chemical logistics distribution industry has also witnessed significant growth, indicating a shift in the industry structure from fragmentation towards a greater degree of integration.

### 2.3.1 Chinese Chemical Logistics Market scale rapid growth

Chemical logistics is a specialized and indispensable component of commodity logistics. It differs from traditional logistics in that it requires a higher level of expertise and demands comprehensive, precise, and reliable information management and control. With the rapid development of the petrochemical industry, China's chemical transportation sector is in a phase of rapid growth. According to data from the Chemical Subsidiary of the China Federation of Logistics and Purchasing, China transports over 300 million tons of chemicals annually by road (CFLP, 2022). The growing demand for chemical logistics is intricately linked to the rapid development of the chemical industry in China. Concurrently, China has been increasing its policy support for the chemical logistics industry, providing a solid foundation for its sustained development. Currently, there are more than one million enterprises engaged in chemical transportation in the chemical industry, with over 360,000 railway transport vehicles. This thriving industry is driven by dual forces: on one hand, the significant import and export of chemicals necessitate specialized cross-border chemical logistics services, and on the other hand, regional disparities in chemical production and consumption in China result in a high demand for domestic chemical transportation. Therefore, the chemical transportation sector is a key growth area within the logistics field.

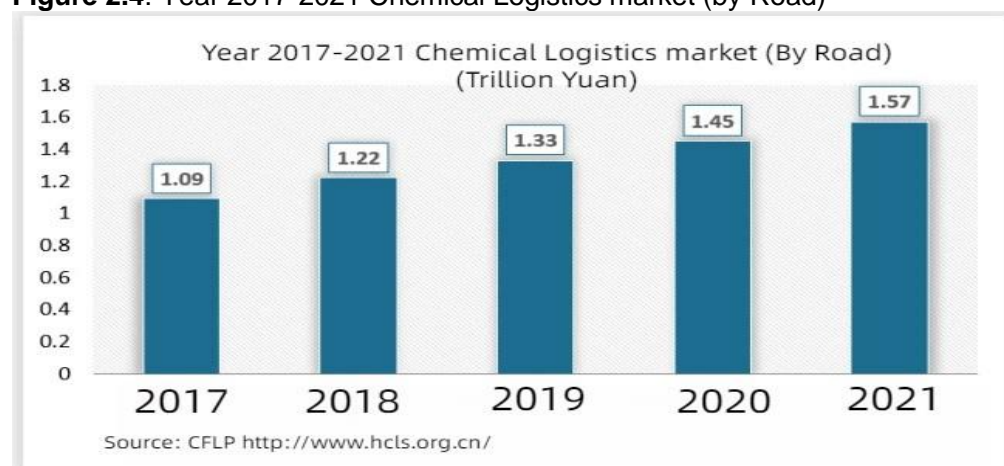
**Figure 2.3:** Year 2017-2021 Market Size (Chinese chemical logistics)



In China, chemical production is primarily concentrated in coastal regions, while the application and consumption ends are relatively dispersed. The complexity of various chemical categories and highly specialized transportation processes has given rise to a vast chemical logistics market. In recent years, the Chinese chemical logistics

industry has experienced rapid development, with significant increases in the size of enterprises and the number of professionals in the field. In 2021, the market size of the chemical logistics industry reached approximately 2.24 trillion yuan, with road transportation being the dominant mode, accounting for around 1.57 trillion yuan (CFLP, 2022). This dominance of road transportation can be attributed to several factors. On one hand, road transportation has well-developed capabilities, and the final mile in urban areas often relies on road transportation. On the other hand, the continuous improvement of the highway network has provided increasing convenience for the road transportation of Chinese chemical products.

**Figure 2.4:** Year 2017-2021 Chemical Logistics market (by Road)



The overall scale of the Chinese chemical logistics market continues to grow, with a continuous increase in the penetration rate of third-party chemical logistics services. The China Federation of Logistics & Purchasing (CFLP, 2022) forecasts that: it is expected that by 2025, the chemical logistics industry will reach a scale of approximately 2.85 trillion yuan, with a growth rate of 5.7% or more from 2022 to 2025. As the industry's demand for specialized logistics services increases and the requirements for operational and transportation standardization become stricter, Chinese chemical enterprises, driven by cost control, have gradually divested themselves of their in-house chemical logistics operations during their initial stages. They have opted to entrust their logistics operations to market-oriented third-party specialized chemical logistics companies. The CFLP (2022) also note that the market size of third-party logistics services increased from 422.5 billion yuan in 2018 to 896 billion yuan in 2021, with the penetration rate rising from 25% in 2018 to 40% in 2021. It is projected that by 2025, the penetration rate of China's third-party chemical logistics

market will reach 50%, with a market size of 1.4 trillion yuan, and the industry is expected to achieve a growth rate of 11.6% from 2022 to 2025”.

### 2.3.2 Geographical Dispersion Fuels Growth in Chinese Chemical Logistics

In the Chinese chemical logistics industry, enterprises strategically locate their operations close to their service targets to minimize empty running costs. As a result, chemical logistics companies are predominantly situated in regions corresponding to the development of major chemical bases in China. They collaborate with chemical enterprises to establish logistics hubs in various locations. Therefore, the registered headquarters of these chemical logistics companies and their operational centres may not necessarily be in the same place, but their regional operational centres must be located near chemical bases. The rapid development of the chemical logistics industry in these regions is primarily attributed to factors such as their strategic geographical locations, important levels of economic development, and concentration of the chemical industry. In the central and western regions of China, where transportation costs are high, the chemical logistics market for pipeline transportation and finished product consumption is still in need of further development.

**Figure 2.5:** Map of 7 Main Petrochemical Based in China



Source: Prospective Industry Research Institute <http://www.bg.qianzhan.com>

Simultaneously, China's chemical industry is transitioning from large-scale production to more specialized, fine-tuned manufacturing. This transformation in chemical enterprises is bound to result in the production of more specialized and higher-refinement products. The emergence of such products will have a certain impact on

market information transparency and stimulate a new round of industrial upgrades and agglomeration.

- **Greater Bay Area: China's largest consumer and producer of electronic chemicals**  
Guangdong province stands as China's largest chemical consumption market base, primarily due to its massive GDP, ranking first among all provinces in the country. This has driven the flourishing development of the chemical industry's consumption end. Currently, majority of the chemical logistics in China follows a north-to-south logistics pattern, with one of the key terminal target markets being Guangdong province. Guangdong province has strategically planned the development of five major petrochemical bases, all equipped with large-scale integrated refining and chemical equipment. This development has completed the chemical industry chain in Guangdong province, thereby improving product refinement and supply scale. Additionally, market supply gaps still need to be supplemented by northern cities like Jiangsu and Zhejiang, especially for high-end new material products that require resource imports.

Simultaneously, driven by consumer demand, Guangdong province is also China's largest electronic industry production base. It is China's largest producer and consumer of electronic chemicals. Guangdong province manufactures over a hundred types of electronic chemicals, with the most comprehensive range of products and the highest degree of product refinement. It not only offers a wide range of electronic chemicals but also includes electronic-grade new materials, film materials, and electronic-grade coating materials.

In recent years, due to the geographical advantages of maritime transportation in Fujian coast, many chemical enterprises have also built factories here, representing enterprises such as Wanhua Chemical, Chimei Chemical, etc., echoing Guangdong Province to the south and undertaking Zhejiang's resources to the north, with rapid development.

- **Greater Bohai Area: China's Largest Refining Hub**  
Shandong province is China's largest regional hub for oil refining, with Dongying in Shandong being the area with the highest concentration of local refining companies

globally. Searching from the database of Prospective Industry Research Institute . (2022), Shandong currently houses over 60 local refining companies, and at its peak, the province had nearly a hundred such companies. As of mid-2023, Shandong has a primary crude oil processing capacity of 220 million tons per year, with ethylene production capacity exceeding 3 million tons per year and propylene production capacity exceeding 8 million tons per year. Additionally, Shandong has the highest number of chemical industrial parks of any province in China, with more than 100 provincial and national-level chemical industrial parks in the province. Shandong's chemical industrial parks are key aggregation areas for chemical enterprises, in line with China's requirements for locating chemical industrial parks.

- The Yangtze River Delta: China's Largest Hub for Pharmaceutical Finished Products; Jiangsu, China's Leading Area for Polyester Fiber Production

“The data published by China's State Administration for Market Regulation : there are a total of 5,065 companies producing active pharmaceutical ingredients and pharmaceutical formulations in China. Among them, Jiangsu province has the highest number of pharmaceutical companies, with a total of 4,067 businesses involved in the pharmaceutical intermediate industry, making it the largest production area for pharmaceutical finished products in the country. Zhejiang province is China's largest production base for polyester fibres, with over 30 companies engaged in the production of polyester staple fibres, totalling a production capacity of over 4.3 million tons per year. The production scale for polyester filament yarn exceeds 30 million tons per year, while the production scale for polyester staple fibres is over 1.7 million tons per year. In addition to numerous downstream textile and weaving enterprises, the influence of Zhejiang in industries such as polyester, chemical fibres, and textiles is highly significant at the national level” (Prospective Industry Research Institute,2022). Such huge amount of materials transport and final products delivery create great demand for chemical logistics business development.

In summary, the Chinese chemical logistics market is on a growth trajectory, thanks to its strategic alignment with upstream industries across various regions. Chemical logistics companies position themselves near major chemical bases to minimize costs and establish logistics hubs. This approach, driven by regional economic development

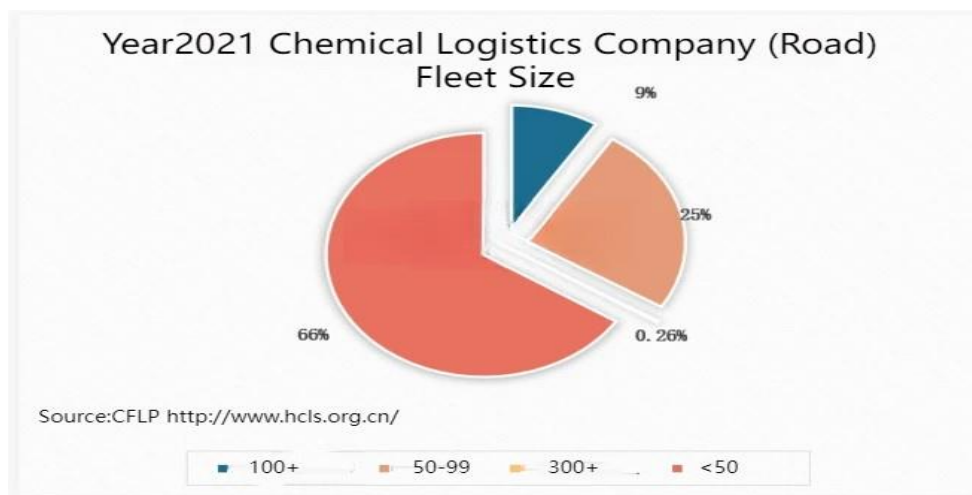
and industry concentration, fuels the industry's rapid growth. The continuous expansion of the Chinese chemical logistics market hinges on its symbiotic relationship with the development of upstream industries, capitalizing on the nation's diverse economic landscape and strategic logistics positioning. To some extent, it provides the more potentials growth space comparing to that of other global area.

### **2.3.3 Low Industry Concentration and High Market Competition**

Chemical transportation is divided according to the mode of transportation, which can be divided into road transportation, water transportation and railway transportation. Among them, road transport and water transport are the most important modes of transportation, due to certain differences in transportation modes and industry entry barriers. These two modes are the focus sections to study the Chinese chemical logistics industry.

From the perspective of road transport, due to its short development history, it is much difference from other global market and there is still a certain gap between the development level of China's chemical road transport industry and developed countries. China's chemical transportation industry presents a high concentration of low-level logistics service providers, more homogeneity of products and services, and a lack of integrated logistics service providers. Most of the basic logistics service providers can only provide relatively low-end logistics services such as warehousing and transportation, and the market entry threshold of basic logistics service providers is low and the market competition is fierce; there are fewer modern logistics service providers that can provide integrated logistics services and supply chain services, and only a small number of leading logistics enterprises can participate in enterprise procurement, production and sales decisions, share resources, share risks, and carry out value management of upstream and downstream industrial chains from the logistics link. Generally, the fleet size over 100+ could be service wide region other than just local cities, However, refer to the following chart, the majority (66%) of the Chinese chemical logistics companies, their road fleet is under 50 units, and the leading ones(300+ fleet) is at the very limited number(0.26%). The whole pictures just indicate the low concentration of this industry.

**Figure 2.6:** Year 2021 Chemical Logistics Company (Road) Fleet size

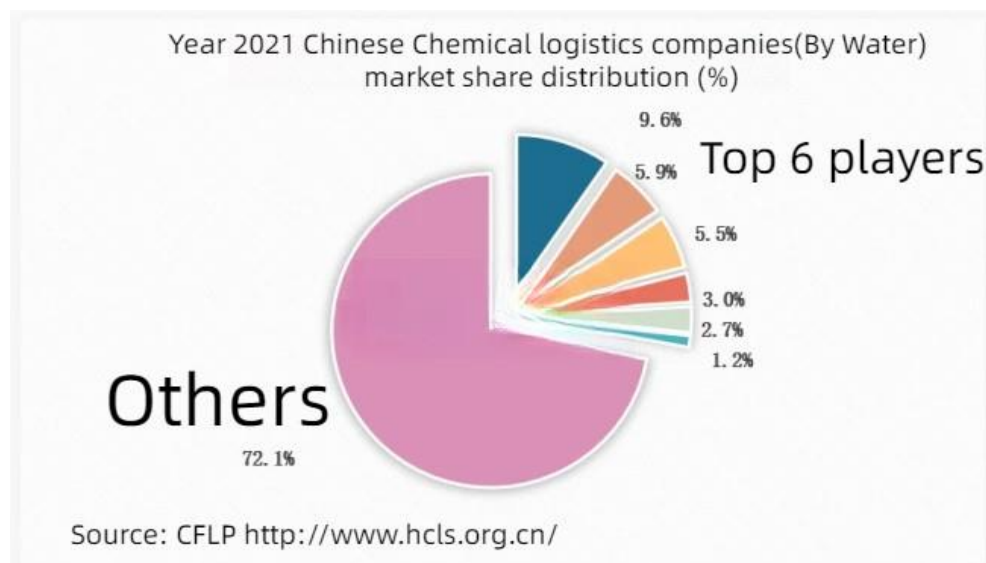


From the perspective of chemical water transportation, in comparison to road transportation, the overall marketization level of China's chemical water transportation industry is notably higher. Furthermore, in terms of scale, the sector features a mix of large and medium-sized shipping companies, as well as a significant number of small and medium-sized shipping enterprises, contributing to heightened market competition.

Large and medium-sized shipping companies exhibit substantial transport capacities, a diverse range of cargo types, including high-end varieties. They maintain a wide-reaching network of routes, predominantly serving both domestic and international large-scale petrochemical enterprises. Conversely, numerous small and medium-sized shipping enterprises operate with relatively smaller transport capacities. However, they often possess specific competitive advantages in niche areas. Regarding ownership, state-owned enterprises such as China Merchants South Oil and China COSCO Shipping Energy primarily focus on petroleum transportation, with chemical transportation as a secondary activity. Their routes extend globally, and international trade accounts for a significant proportion of their operations. In contrast, private companies like Dingheng Shipping, Junzheng Shipping, Haichanghua, Tongzhou Shipping, actively engage in the hazardous chemical shipping sector, each specializing in distinct business areas. Despite this differentiation, the market concentration in China's chemical logistics water transportation sector remains relatively low, with the top six players collectively holding around 28% of the market

share, as depicted in the chart below. This distribution implies a level of market dispersion, and such low concentration leads to the high competition in the market.

**Figure 2.7:** Year 2021 Chinese Chemical logistics companies (By water) market share distribution



The low concentration in China's chemical logistics market fuels intense competition. The presence of numerous small sized players, various-sized companies exist, both state-owned and private, necessitates constant innovation and differentiation, driving a competitive and customer-focused environment, promoting industry growth.

### High Market Competition

China's chemical logistics industry is highly competitive, with enterprises primarily competing in terms of brand, scale, service quality, and cost. As the market continues to expand, new companies emerge, further intensifying competition. According to statistics from the China Federation of Logistics and Purchasing (CFLP, 2023), by the end of 2022, the number of chemical logistics enterprises in China had exceeded 100,000. However, the industry is characterized by a "mixed fish" market, due to the lack of standardization in early entry thresholds, which has resulted in a proliferation of scattered small and micro-enterprises.

With the increasing occurrence of chemical road traffic accidents, China's government and relevant authorities have been implementing stricter regulations for chemical logistics companies. Despite this, the top 100 enterprises in chemical logistics account for less than 20% of the market (CFLP, 2022). The industry's overall scale remains relatively small, and the market structure is highly fragmented. Furthermore, dangerous goods logistics enterprises are geographically dispersed due to the

regional approval process for hazardous materials warehouses and transportation vehicles. The large number of chemical categories and varying professional requirements across different categories further contribute to low industry concentration and high market competition.

## **2.4 TOP100 chemical logistics enterprises in China**

### **2.4.1 General Review and six indicators**

From the above analysis, I can see that the number of small and medium-sized enterprises in China's chemical logistics industry is complex, there are many non-standard enterprises, fierce competition, market concentration is relatively low, because this research focuses on corporate social responsibility and green finance, enterprises that do not have standardized business philosophy and ability cannot be used as an effective research direction, so this part focuses on the head enterprises in China's chemical logistics industry that are deeply involved in this to analyse. According to the industry statistics of 750 key units of road transportation, water transportation, warehousing and comprehensive services of chemical logistics carried out by the China Logistics Federation (China Forward Industry Research Institute. 2023). The study analyses the leading enterprises in the chemical logistics industry from four sectors: comprehensive service enterprises, road transport service enterprises, warehousing service enterprises and water transport service enterprises. The analysis focuses on six indicators, the first is the accident situation, for enterprises with major accidents within three years, it is not included in the scope of research statistics; the second is assets and benefits, which are divided according to the total assets of the enterprise and the annual turnover of the enterprise; the third is the main business situation, including its own transportation equipment, its own transportation capacity, the warehouse storage capacity of chemicals, and the logistics operation capacity; the fourth is the market situation, including the scale of personnel, and whether it has the business ability to serve the world's top 500 chemical companies. The fifth is HSE management. Including but not limited to the standardization level of safety production, quality management system, enterprise information application, etc.; the last point is corporate social responsibility, including whether there is a manifestation of social responsibility: honours and awards in the field of social

responsibility. These six indicators comprehensively consider factors such as the scale, operation, channel, growth and social contribution of the enterprise.

- First, let's take a look at a set of overall data calculated by the China Logistics Association in 2022 (unit: RMB YUAN) (CFLP, 2023): The total revenue of China's leading chemical logistics enterprises exceeded 66.7 billion yuan in 2022, a year-on-year increase of 20%, accounting for about 28% of the overall market; The total assets of TOP100 chemical logistics enterprises reached 107.7 billion, a year-on-year increase of 46%. Among them, the total area of the reservoir area of TOP100 enterprises reached 2.32 million square meters, an increase of 31% year-on-year, and the total amount of road transport goods of TOP100 enterprises reached 125 million tons, accounting for 15% of the total road transportation of chemical logistics: The water transport volume of TOP100 enterprises accounts for 16% of the total transportation volume of the chemical logistics water transport market. From here, it can see that these head enterprises, the head enterprises of China's chemical logistics, the business scale is rapidly expanding, and the service capacity is constantly growing.
- From the analysis of enterprise types by China Federation of Logistics & Purchasing in 2023, the performance of private enterprises is particularly prominent, accounting for 74 of the top 100, (including 14 comprehensive enterprises, 42 road transport enterprises, 9 warehousing business, and 9 water transport enterprises). Among these top 100, except the private enterprises, there are 17 state-owned enterprises, 5 joint ventures and 4 foreign-funded enterprises. Therefore, private enterprises are still the main components and important components of key enterprises in chemical logistics.
- From the perspective of regional distribution(CFLP, 2023), it is still concentrated in East China, and the top 100 enterprises in East China account for 71. From the perspective of market vitality, the market development is active. From 2021 to 2022, among the leading enterprises in China's chemical logistics, there are 78 enterprises that originally remained within the 100, and 22 new enterprises, which shows that the overall chemical logistics market has greater competitive pressure.
- The annual per capita output value and profit margin of the top 100 enterprises (CFLP, 2023):

- ✧ Per capita output value: comprehensive service enterprises (1.5 million / person) > warehousing enterprises> water transport enterprises> road transport enterprises (450,000 / person)
- ✧ Profit margin: water transport enterprises (15-35%), > warehousing enterprises (20-30%)> comprehensive service enterprises (5-15%), > road transport enterprises (5-10%)
- In terms of corporate social responsibility, the social responsibility ability of TOP100 enterprises is continuously enhanced, all the head enterprises have emergency rescue capabilities, professional rescue teams and leaders who have participated in emergency rescue in emergency rescue, but almost half of the enterprises reflect that the shortage of employees, especially drivers, is still serious, and the lack of professional management personnel in the industry is also quite prominent. In terms of corporate social responsibility, he began to actively participate in the development of policies and standards.

#### 2.4.2 Four business sectors of Chinese chemical logistics industry

- Comprehensive services enterprises: It has comprehensive advantages such as large transportation capacity, extensive warehousing layout, many types of goods to be transported, and strong integrated service capabilities. From the perspective of the area of enterprise registration, it is mainly concentrated in East China, with a total of 14 companies, accounting for 78% of revenue. Among the top 20 enterprises in this part, private enterprises account for 70%, and the average assets have reached 2.417 billion yuan (Zhu,2024). The efficiency of enterprises has shown steady growth, and the space for development is relatively large. In addition, the cooperation with the world's top 500 chemical companies is good, most of which are long-term orders. It has maintained a relatively stable development. Therefore, although the unstable factors of comprehensive service enterprises have increased due to the epidemic, they still rely on this wide layout, large business, and more customers. The service capability of the supply chain is strong, and most of them are due to long-term orders, so the overall development of the business is growing rapidly.
- Road transport enterprises: the main participants are mainly logistics subsidiaries of chemical enterprises (their main business is to undertake the transportation

business of the parent company) and third-party logistics companies (mainly serving large customers in the chemical industry), and the transportation volume in the TOP50 of this part accounts for 23% of the overall chemical road transport industry(Zhu,2024). To a certain extent, this also supports the current situation of low market concentration in China's chemical logistics industry mentioned above. This section is also dominated by private enterprises, but they are mainly logistics subsidiaries of chemical enterprises. The vast majority of road transport companies' revenue should still be between 100 million and 300 million, accounting for more than half. Overall, the road transport industry in chemical logistics has formed a market competition pattern in which logistics subsidiaries of large and medium-sized chemical enterprises and small and medium-sized private enterprises with good business development coexist. The logistics subsidiaries under chemical enterprises account for more market share, but the number of third-party logistics private enterprises is large, mainly small and medium-sized enterprises, but in this part, the market concentration of the head enterprises is low.

- ✧ From a regional point of view, it is mainly concentrated in East China, the largest are Shandong, Jiangsu and Shanghai, and East China accounts for 29% of revenue.
- ✧ From the perspective of the history of enterprises, there are 7 established before year2000, most of which are logistics companies under state-owned petrochemical enterprises, and most of founded after 2000 are private enterprises established, which reflects the development trend of third-party logistics in the chemical logistics industry, and on the other hand, it is mainly driven by the development of petrochemical industry in the East China coastal region.
- ✧ From the perspective of fleet size, most of the enterprises with more than 500 vehicles are logistics subsidiaries of chemical companies, the private third-party players normally owns the fleet of 100-300 vehicles.
- Warehousing enterprises: From 2021 to 2022, third-party warehousing has maintained rapid development, and regional differentiation is obvious. The average assets of the TOP20 warehousing enterprises are 1.1 billion, an increase of 7% year-on-year, and the average turnover is 323 million. It increased by 30%

year-on-year, with 6 state-owned enterprises accounting for 16% of turnover, 9 private enterprises accounting for 36% of turnover and joint venture turnover accounting for 44% (CFLP, 2022). China's third-party warehousing has maintained rapid development, economic cycle fluctuations and COVID 19 have not affected the expansion of tank companies, especially the demand for third-party warehousing is still growing steadily. From the perspective of regional distribution, Sinopec warehousing is still concentrated in East China, South China and other coastal and riverside areas, head enterprises have formed a storage strategic network covering the three major economic circles of Bohai Rim, Yangtze River Delta and Pearl River Delta, the characteristics of geographical concentration distribution are very obvious, most of the warehousing enterprises have formed a scale in multi-functional value-added services, more suitable for providing supply chain integration services. It currently has three major features:

- ✧ First, demand and stability continue to grow. At present, China's chemical warehousing supply capacity is slightly lacking, but the warehousing operation service capacity of the head enterprise is relatively stable, the reservoir area has maintained a small increase, and the demand for chemical logistics warehousing will remain stable and may show a certain degree of growth.
  - ✧ Second, the business is doing well, comprehensively. The leading enterprises of warehousing services have maintained a good level of development, and the net profit margin accounts for 20%-30%.
  - ✧ Third, the planning layout and industrial structure will tend to be reasonable. With the industrial transfer of the petrochemical industry, the eastern region of China will focus on the development of high-end chemical projects, while the traditional chemical industry will gradually tilt towards the central and western regions, and the western and central regions will focus on development.
- Water transport enterprises (here excluding long haul ocean business): The water transport market size of chemical logistics in China is about 380 million tons, with the top10 enterprises accounting for 23%, consisting of seven maritime transport enterprises and three river shipping enterprises, mainly distributed in the middle and lower reaches of the Yangtze River. The average assets are 289 million, of which three have revenue of more than 1 billion, with an average revenue of 625

million (CFLP, 2022). Affected by the development of the petrochemical industry, the overall efficiency of the water transport industry has improved greatly. In addition to economic factors accelerating the development of water transport, macro policies (China's policies to promote dual carbon targets and energy conservation and emission reduction) also affect the development of the water transport market. In the top 10 markets of water transport, private enterprises are the mainstay, accounting for 90%, of which there are two listed companies, and the growth of water transport capacity is more focused on the expansion of fleet scale due to stable profit margins. The development of the water operation industry has three characteristics:

- ✧ The competition threshold is high, and the profit of the enterprise is good. Overall, in the past two years, China's coastal liquid chemical water transport volume has shown an increasing trend, and the head enterprises of water transport have developed well, with high profit margins, reaching 15%-35%. At present, the comprehensive capacity of the entire chemical water transport market has been greatly improved, and the competition threshold of the industry is relatively high. are relying on management level and scale effect to meet their safe, diversified and timely transportation requirements and needs.
- ✧ Second, the service capacity provided by enterprises is improved. The development of the chemical industry is in the growth stage, and the competitive landscape is still relatively scattered. Leading companies deeply engaged in the industry have obtained scale improvement through extension mergers and acquisitions and new capacity approvals, continuously broadened market layout and capacity scheduling capabilities, improved logistics service levels, and continuously increased the market share of leading enterprises.
- ✧ Third, the transportation structure is gradually tilted towards water transportation, and the domestic refining and chemical base is still intensively put into operation. With the continuous advancement of multimodal transport and the in-depth implementation of green logistics, the demand for water transport is expected to continue to increase, while the capacity structure is further optimized, and the freight rate remains stable. Structurally, the transportation mode that used to be

mainly by road will also be tilted towards environmentally friendly and large-scale water transportation.

## 2.5 Risk Management in Chinese Chemical logistics industry

Risks of operating in the Chinese chemical industry are identified clearly as well as some related terms.

### 2.5.1 Terms and Definitions

- ✧ **Risk:** A measure of potential economic loss, human injury, or environmental damage in terms of both the incident likelihood and the magnitude of the loss, injury or damage. According to Roberts and Lewis (1995), risk is commonly defined as the combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.
- ✧ **Consequence:** A measure of the expected effects of an incident outcome case on human, economic and environment stakes.
- ✧ **Intensity:** represents the strength of the incident.
- ✧ **Severity:** defined as the effect of an undesirable event on the targets point, or on the elements exposed.
- ✧ According to Article 3 of the Regulations of the State Council of the People's Republic of China on the "Reporting, Investigation and Handling of Production Safety Accidents "(effective as of June 1, 2007), accidents are generally divided into the following levels according to the intensity and severity: particularly major accidents, major accidents, large accidents, and general accidents.
- **Particularly serious accidents** refer to accidents that cause the death of 30 or more people, or the serious injury of more than 100 people (including acute industrial poisoning, the same below), or direct economic losses of more than 100 million RMB Yuan.

In addition, pollution accidents that seriously affect the production and life of the people due to the leakage of hazardous chemicals (including highly toxic drugs) during the production and storage and transportation are **particularly major environmental incidents (level 1)**.

- **Major accidents** refer to accidents that cause the death of between 10 and 30 people, or the serious injury of between 50 and 100 people, or the direct economic losses of between 50 million and 100 million Yuan.

But for road traffic accidents, A major accident refers to an accident that causes the death of 3 or more people, or the serious injury of 11 or more people, or the death of 1 person and the serious injury of 8 or more people at the same time, or the death of 2 people and the serious injury of 5 or more people at the same time.

- **Relatively Large accidents** refer to accidents that cause the death of 3 to 10 people, or the serious injury of 10 to 50 people, or the direct economic loss of between 10 million and 50 million RMB yuan.
- **General accidents** refer to accidents that cause the death of less than 3 people, or the serious injury of less than 10 people, or the direct economic loss of less than 10 million yuan.

### 2.5.2 Influential Accident cases in China's chemical logistics in recent years

From the above review for the Chemical logistics industry especially the Chinese one, it is obvious that it is a growing market in China with good potential as well. However, Due to the particularity of the industry, a safety accident may lead to several tons or even dozens of tons of dangerous goods into the natural environment, seriously damage and pollute the ecological environment, and cause serious harm to the society; at the same time, the management foundation of China's chemical logistics industry is relatively weak, the safety awareness of the employees of the transportation of dangerous goods is weak and the quality of the safety management personnel of the transportation enterprises cannot meet the needs of the modern chemical transportation situation, so that the accident rate continues to increase, and the harm caused by the chemical logistics accident is becoming more and more serious. What is particularly serious is that once a major accident (or above) occurs in an enterprise, resulting in mass deaths and injuries, it will have devastating consequences for both the society and the family and the enterprise itself.

The Ministry of Emergency Management of the People's Republic of China(MEM,2022) is the official authority for publishing the accidents data in China. Here I list three

influential **Particularly Serious Accidents** related to Chinese chemical logistics in the recent years:

Case 1) Tianjin Binhai Port Chemical Warehouse Explosion Particularly Serious Accident -----Warehousing business section(Investigation Report released in Jan. 2017 at the official website of MEM (<https://www.mem.gov.cn/>))

- Description: At around 23:30 on August 12, 2015, an explosion occurred at a container terminal of the hazardous chemicals warehouse of Tianjin Port Ruihai Company at the intersection of Fifth Avenue and Yuejin Road, Binhai New Area, Tianjin. At 23:34:6 on the 12th, the first explosion occurred, equivalent to 3 tons of TNT equivalent, and 30 seconds later, a second explosion occurred, equivalent to 21 tons of TNT equivalent.
- Loss and Impact:
  - As a result of the accident, **165 people** were killed (109 firefighters, 11 policemen, 55 employees of the accident company, surrounding enterprises and surrounding residents), 8 people were missing, 798 people were injured and hospitalized, and 304 buildings, 12,428 commercial vehicles, and 7,533 containers were damaged.
  - As of December 10, 2015, the accident investigation team had assessed direct economic losses of RMB 6.866 billion in accordance with the "Statistical Standards for Economic Losses of Enterprise Employee Casualty Accidents" (GB6721-1986) .
  - Analysis of the chemical composition of 111 dangerous goods stored by Ruihai at the time of the incident determined that at least 129 chemical substances had exploded, burned or leaked and spread. At the same time, the explosion also ignited surrounding buildings and many cars, coke and other general goods. More than 100 kinds of chemicals and secondary pollutants were left in this accident, which caused varying degrees of pollution to the atmospheric, water and soil environments in local areas, and it is necessary to carry out medium and long-term environmental risk assessments.
  - In order to rescue the accident, experts from various regions of China and a professional team of 16,000 people were dispatched, and more than 2,000 vehicles and equipment were mobilized.
  - Investigation of the direct cause of the accident:

The nitrocellulose in the container on the south side of the arrival area of the dangerous goods warehouse of Ruihai company is partially dry due to the loss of wetting agent, and the heat is accelerated under the action of high temperature (weather) and other factors, and the accumulated heat spontaneously combusts, causing the nitrocellulose and other hazardous chemicals in the adjacent container to burn in a large area for a long time, resulting in the explosion of ammonium nitrate and other hazardous chemicals stacked in the arrival area.

According to the accident investigation report, it was found that the company (after the accident, the business license was cancelled, and 13 managers put into prison), as the second largest chemical storage company in Tianjin Port District, had a number of violations of laws and regulations in the operation and storage of dangerous goods (the company had a port operation license, but no hazardous chemicals business license). The safety management is extremely chaotic, the main responsibility of safety production is not fulfilled, the safety production education and training is seriously lacking, and the emergency plan is not formulated and drills are not organized according to the regulations, resulting in a large number of potential safety hazards for a long time. As a result, nearly 200 government managers at all levels in Tianjin, including Tianjin Port, Tianjin Transportation Administration, Tianjin Customs, Tianjin Safety Supervision Bureau, Maritime Safety Administration, Environmental Protection Bureau, and Public Security Bureau, were subjected to varying degrees of criminal and administrative punishment.

Case 2) Shanghai-Kunming Expressway "7.19" Particularly Serious Accident ----Road transport business section (Investigation Report released on 3 Nov.2014)

At 2:57 on July 19, 2014, at Shanghai-Kunming Expressway in Shaoyang City, Hunan Province, China, a light truck with a license plate number of Xiang A3ZT46 carrying ethanol from east to west collided with a large ordinary passenger car with a license plate number of Fujian BY2508 waiting in front of the park. Five vehicles, including light trucks, were burned, killing **58 people**, injuring 2 people, and causing direct economic losses of more than 5,300 RMB yuan. The direct cause of the accident was: the non-compliance operation of light truck operator.

- ✓ serious overload and did not drive safely in accordance with the operation specifications.
- ✓ did not use hazardous chemicals compliant vehicles.
- ✓ drivers operated in violation of regulations (should stop from 2:00 am),

Case 3) Baomao Expressway "8.26" Particularly Serious Accident -- Road transport business section (Investigation Report released on 11 Apr. 2013)

At about 2:31 on August 26, 2012, a particularly serious road traffic accident occurred in Yan'an City, Shaanxi Province, Baomao Expressway, a semi-trailer loaded with methanol collided with a bus, and the right longitudinal beam of the passenger car hit the rear discharge pipe of the tank, resulting in the vertical ball valve shell of the semi-trailer discharge pipe being broken, resulting in a large amount of methanol leakage. The collision also caused a short circuit due to the insulation of the bus's electrical wiring, and the resulting sparks caused the explosive mixture of methanol vapor and air to deflagrate and ignite, and the fire quickly ignited the rear of the heavy semi-trailer truck and the sleeper bus and spread along the direction of the methanol leak to the road surface and culvert of the nearby highway. It caused **36 deaths**, 3 injuries, and a direct economic loss of 31.606 million RMB yuan.

The direct cause of the accident was also the non-compliance of the truck operator.

- ✓ Overloading: a heavy semi-trailer truck loaded with 35.22 tons of methanol.
- ✓ Illegal operation: illegally entering the highway from the ramp and driving at a low speed (under the regulation request) on the highway.

All these three cases collectively emphasize the critical importance of robust risk management in the Chinese chemical logistics industry. The incidents in the chemical logistics area underscore the need for thorough risk assessments, proper storage products, and emergency response plans to mitigate the impact of potential disasters. The "7-19" and "8-26" accidents on expressways further illustrate the vulnerabilities in the transportation aspect of chemical logistics. Overloaded vehicles carrying hazardous chemicals collided, resulting in significant loss of life and economic damage. These incidents highlight the imperative for comprehensive risk management measures throughout the supply chain, from storage facilities to transportation routes.

Effective risk management in the Chinese chemical logistics industry should encompass various facets. Firstly, regulatory compliance is paramount. Companies must adhere strictly to safety standards, obtain the necessary permits, and regularly audit their facilities and operations to ensure adherence to regulations. Secondly, investment in technology plays a crucial role. Advanced monitoring systems for both storage and transportation can provide real-time data, allowing for prompt identification and response to potential risks.

Moreover, training and awareness programs are essential components of risk management. Personnel involved in the handling, storage, and transportation of hazardous materials must be well-versed in safety protocols and emergency procedures. Regular drills and simulations can better prepare them for unforeseen events, reducing the likelihood of accidents and enhancing overall industry resilience.

In conclusion, the string of incidents in the Chinese chemical logistics industry underscores the urgent need for a comprehensive and proactive approach to risk management. A robust risk management framework, encompassing regulatory compliance, technological integration, and employee training, is essential to safeguard lives, protect the environment, and ensure the sustainable growth of the industry. As China continues to witness economic growth and industrial development, prioritizing risk management becomes not just a necessity but a fundamental responsibility for the stakeholders in the chemical logistics sector. How to assess and effectively manage risks in the rapid development of the industry and its corresponding high risks is an inevitable problem faced by China's chemical logistics industry.

### **2.5.3 CSR Driven Risk Management in Chinese Chemical logistics industry**

A holistic approach CSR involves integrating social and environmental concerns into a company's business model, emphasizing ethical practices, and fostering a positive impact on society. CSR driven risk management involves integrating social, environmental, and ethical considerations into a company's risk management strategy. By incorporating CSR principles into risk management practices, companies aim to mitigate potential risks associated with social and environmental impacts while also leveraging opportunities for positive societal impact. In the chemical logistics sector, CSR extends beyond philanthropy, encompassing proactive measures to identify,

mitigate, and respond to potential risks associated with the transportation and storage of hazardous materials.

How CSR can be integrated into risk management?

There are 8 areas that the CSR can be integrated into risk management:

- **Identifying Social and Environmental Risks:** Assessing and recognizing risks associated with social and environmental factors, such as climate change, supply chain ethics, labor practices, community impact, etc., is crucial. Understanding these risks helps in creating strategies to address and manage them effectively.
- **Stakeholder Engagement: Engaging with stakeholders** - including employees, communities, customers, and NGOs - helps in understanding their concerns and expectations. This engagement can uncover potential risks that might not be immediately obvious and aid in building strategies to mitigate these risks.
- **Compliance and Regulations:** Staying compliant with regulations and standards related to CSR not only helps in avoiding legal risks but also ensures that the company operates in a manner aligned with societal expectations and ethical norms.
- **Risk Mitigation Strategies:** Developing strategies to mitigate identified risks is essential. For instance, ensuring a responsible supply chain, adopting sustainable practices, reducing carbon footprint, and creating contingency plans for social or environmental crises are proactive measures that can minimize risks.
- **Monitoring and Reporting:** Continuous monitoring of CSR-related risks and performance metrics is crucial. Regular reporting on CSR initiatives and their impacts not only enhances transparency but also helps in identifying any emerging risks or areas that need improvement.
- **Integration into Business Operations:** Integrating CSR principles into core business operations ensures that risk management strategies align with the company's overall objectives. It fosters a culture where social and environmental considerations are part of decision-making processes.
- **Adaptation and Improvement:** As societal expectations and environmental factors evolve, it's vital to adapt risk management strategies accordingly.

Continuous improvement and adaptation are necessary to stay ahead of emerging risks and changing stakeholder demands.

By aligning CSR with risk management, companies not only mitigate potential negative impacts but also capitalize on opportunities to create value, build brand reputation, attract investors, and foster long-term sustainability.

- The Significance of Risk Management as CSR in the Chinese Chemical Logistics Industry
  - Human Safety and Well-being: The paramount consideration in CSR is ensuring the safety and well-being of individuals. By prioritizing risk management, companies directly contribute to safeguarding the lives of their employees, first responders, and the communities where they operate.
  - Environmental Stewardship: The ecological impact of accidents, as witnessed in the Tianjin explosion, highlights the need for environmental stewardship. Integrating risk management as CSR involves implementing measures to prevent and mitigate environmental damage, aligning with sustainable business practices.
  - Public Trust and Reputation: CSR initiatives build public trust and enhance a company's reputation. In the Chinese chemical logistics industry, where accidents can have severe consequences, a commitment to risk management demonstrates accountability, fostering trust among stakeholders.
- What CSR Driven Risk management can do for the three cases above:

The Chinese chemical logistics industry plays a vital role in facilitating the movement and storage of hazardous materials crucial to industrial processes. The various road traffic accidents have underscored the urgent need for a paradigm shift in safety practices within the industry. Per to the cases reviewed above, CSR-driven management could be a blueprint for change to other players in the Chinese chemical logistics industry.

- Tianjin Binhai Port Chemical Warehouse Explosion: This incident serves as a stark reminder of the severe consequences of inadequate risk management. The

company, Ruihai, displayed non-compliance with safety regulations, negligent storage practices, and a lack of proactive risk identification and mitigation. A CSR-driven approach would involve comprehensive safety audits, adherence to regulations, and proactive measures to address identified hazards. Post-incident efforts could include extensive environmental remediation, compensation for affected parties, and community engagement initiatives.

- Shanghai-Kunming Expressway "7.19" Accident: The collision between a light truck carrying ethanol and a large passenger car highlights the need for CSR-driven risk management. Overloaded vehicles, unsafe driving practices, and the absence of compliant vehicles underscore the industry's vulnerabilities. CSR initiatives could have compelled the transportation company to invest in compliant vehicles, enforce safe driving practices, and provide ongoing training for drivers. This proactive approach aligns with CSR's emphasis on preventing harm to human life and the environment.
- Baomao Expressway "8.26" Accident: This accident involving a collision between a semi-trailer carrying methanol and a bus emphasizes the importance of proactive risk management. Non-compliance with safety regulations, including overloading and illegal operations, contributed to the tragic outcome. A CSR-driven response would involve measures to prevent overloading, illegal operations, and adherence to safety regulations. Post-incident efforts could focus on compensating victims, supporting affected communities, and implementing preventive measures for future incidents.

- Demand for CSR Driven Risk Management:

- From chemical logistics companies' sustainable development:

The harm caused by these accidents has a huge impact on society and the environment, and the consequences of the accident are largely contrary to the principles of the global sustainable development strategy, and it has seriously affected social stability. On the other hand, based on China's current punishment model for major accidents, once a major accident occurs, it also means the close of the chemical logistics enterprise, so the enterprise must put the safety management of chemical logistics in the first place when making a profit, and take sustainable development as the primary goal of enterprise development, and strengthen the risk management of

the enterprise is the basic requirement and fundamental guarantee for the sustainable development of chemical logistics enterprises. Actively improve the importance and investment in risk management, constantly modify and improve the risk management process, clarify the supervision responsibilities of various departments, make the enterprise process and standardized operation, make the risk management of chemical logistics more scientific and standardized, and realize the economic interests of the enterprise under the condition of safe production, which is the basic social responsibility of the enterprise, only under safe conditions can the company reduce the harm of chemical logistics accidents to the surrounding environment and public health, and at the same time the enterprise can achieve sustainable development.

➤ From the customers' request, especially the important service buyers:

Both the Chemical logistics providers and their service buyers (the Chemical enterprises or other upstream players) have the great concern and attention for the risk management and risk assessment. Especially for those reputable global chemical giants, first, they need to find their reliable logistics providers (it is not easy because there are too much "mixed fish" in the market pool), and make sure their long-term relationship and sustainable development. Therefore, they choose the target of TOP 100 group in the Chinese chemical logistics industry and invite the risk assessment (either by their own employee team or buying the independent third-party service or both) process. BASF China presents a good example of integration of Risk Management as Corporate Social Responsibility in the Chinese Logistics Industry:

From the first Sustainability Symposium in Beijing in 2002, to the launch of the 1+3 Corporate Social Responsibility (CSR) program in 2006, to the launch of the Supplier Sustainability Training Program in September 2014, BASF has been committed to promoting sustainability in the value chain and maintaining and deepening collaborative relationships with suppliers through evolving and evolving activities and initiatives. In 2011, BASF co-founded the TFS (together for sustainability) initiative with five other multinational chemical companies. As a leading company in the chemical industry, BASF strongly believes that it has a responsibility to support and encourage its supply chain partners, including China Chemical Logistics Corporation, to comply with established rules and regulations and meet the needs and expectations of

customers and society within its sphere of influence. They developed audit standards, established audit databases, and developed a comprehensive supplier assessment and audit program. The TfS initiative was originally initiated by six multinational chemical companies: BASF, Bayer, Evonik Industries, Henkel, LANXESS and Solvay. Later, AkzoNobel and Clariant joined the initiative. Prospective members of the TfS, including Merck, DSM and Uxinbang, can share supplier sustainability assessment and audit data, thereby simplifying the supplier review process. BASF China is now working hard to promote this initiative in China, believing that increasingly transparent sustainability standards provide a solid basis for long term supply chain relationship.

- Challenges and Opportunities in CSR-Driven Risk Management
  - Regulatory Compliance: While regulatory compliance is fundamental, companies must move beyond the minimum standards to identify and address emerging risks. This poses both a challenge and an opportunity for the industry to lead in adopting best practices.
  - Technology Integration: Embracing technological advancements, such as real-time monitoring systems and predictive analytics, presents an opportunity to enhance risk management capabilities. The challenge lies in the initial investment and industry-wide adoption of such technologies.
  - Training and Education: Developing a culture of safety through continuous training and education poses a challenge, particularly in large and diverse industries. However, it is also an opportunity to empower employees with the knowledge and skills needed to navigate potential risks.
  - Transparent Communication: Open and transparent communication is integral to CSR-driven risk management. The challenge lies in effectively communicating risk management strategies, incident response plans, and environmental impact assessments to build trust with stakeholders.
  - Community Engagement and Support: Engaging with local communities and providing support in the aftermath of incidents is both a challenge and an opportunity. While it requires resources, it also presents a chance for companies to demonstrate their commitment to CSR.

## 2.6 Conclusion

### 1) The difference for Chinese Chemical Logistics Industry:

The Chinese chemical logistics industry presents several distinct characteristics that make it unique when compared to other sectors, particularly due to the high-risk nature of its operations, competitive market landscape, relatively weak risk management structures, and emerging corporate social responsibility (CSR) initiatives. This essay explored these unique aspects, utilizing insights from both global practices and specific nuances of the Chinese context.

#### **High-Risk Nature of Operations**

The transportation, storage, and handling of hazardous chemicals require stringent safety protocols. Chemical logistics companies must navigate a complex network of regulatory compliance while ensuring the safety of personnel, communities, and the environment. In China, recent catastrophic accidents, such as the Tianjin Port explosion in 2015, have highlighted the catastrophic consequences of operational failures in this industry. The high risk is compounded by the vast variety of chemicals transported, each with its hazards and handling requirements. Therefore, risk management in Chinese chemical logistics is not merely an operational consideration but a critical imperative that has significant societal implications.

#### **Market Competition**

The Chinese chemical logistics market is characterized by intense competition. The industry is fragmented, with numerous small and medium-sized enterprises (SMEs) operating alongside a few large players. The competitive landscape is driven by the ongoing expansion of the chemical industry in China, leading to increased demand for logistics services. However, this rapid growth has outpaced the development of a standardized framework for operations, resulting in a highly competitive environment where companies vie for market share, often at the expense of investment in safety and risk management systems.

#### **Weak Risk Management Structures**

Despite the high-risk operations, risk management structures within the Chinese chemical logistics industry are often found lacking. Regulatory enforcement is uneven, and companies frequently operate with inadequate risk assessment and emergency response plans. The historical focus on growth and expansion has, at times, overshadowed the importance of developing robust risk management practices. Moreover, the lack of transparency and the inadequate implementation of regulations

can lead to situations where risks are not effectively identified, communicated, or managed.

### **CSR driven risk management for sustainable development**

In recent years, there has been a shift towards incorporating CSR into the chemical logistics industry in China. Companies are beginning to recognize that beyond compliance, there is value in integrating social and environmental considerations into their business models. CSR initiatives in this context go beyond philanthropy and include investing in safer technologies, enhancing training programs for employees, and engaging with communities to build trust and resilience. However, these initiatives are still in nascent stages, and there is a considerable gap between current practices and the industry's potential to fully embrace CSR as a driver of sustainable growth.

In summary, the Chinese chemical logistics industry stands out due to the inherent risks of its operations, the competitive nature of its market, the current weaknesses in risk management, and the early stages of its CSR initiatives. These factors collectively shape an industry landscape that is both challenging and ripe with opportunities for transformation. As China continues to grow its chemical industry, the logistics sector must evolve in tandem, addressing these unique characteristics through improved safety protocols, regulatory compliance, competitive strategies that do not compromise on risk management, and a robust embrace of CSR for long-term sustainability. The industry's ability to navigate these aspects will be crucial in ensuring not only its economic success but also the protection of people and the planet.

### **2) Conclusion for this chapter:**

Drawing conclusions from the extensive examination of the Chinese chemical logistics industry reveals a market fraught with inherent complexities and significant challenges. This sector, crucial to the functioning of numerous global supply chains, has demonstrated both robust growth and formidable risks, necessitating a shift towards a more sustainable and safety-conscious operational paradigm.

The need for an enhanced approach to risk management within this industry is underscored by past incidents that have not only led to tragic loss of life and environmental degradation but have also had severe economic repercussions. The

industry must transcend traditional risk management practices, embedding a culture of safety and sustainability into every facet of its operations.

This study has illuminated the high-stakes environment in which the Chinese chemical logistics industry operates—a landscape characterized by rapid growth, intense competition, and significant safety concerns. The sector's sprawling scale and regional disparities in management capabilities, coupled with the logistical challenges of long-distance transportation, contribute to its distinct nature.

Key takeaways from the sector's current state include the paramount importance of stringent regulatory adherence, the strategic value of technological advancements in monitoring and logistics, and the critical role of skilled human resources. Companies that prioritize these areas, integrating them with a strong corporate social responsibility (CSR) ethos, are likely to lead the industry toward a more secure and resilient future.

The current landscape of China's chemical logistics industry reveals a scenario characterized by intense competition, decentralized scale, low overall industry concentration, and a persisting separation between production and marketing, along with enduring challenges in long-distance transportation. Regional concentration and disparate management capabilities among companies in different areas persist, yet promising signs of advancement in specialization, scale, and technological sophistication within the industry have emerged. The scrutiny faced by this industry following notable incidents emphasizes the urgent necessity for proactive risk management strategies embedded within the framework of Corporate Social Responsibility (CSR). The comprehensive examination of recent accidents, the exploration of CSR's pivotal role in mitigating risks, and the proposal of holistic strategies collectively illuminate the trajectory toward a safer and more sustainable future for this pivotal sector.

This study, through an exploration of definitions pertinent to chemical logistics, a comprehensive overview of the industry's global evolution, and an in-depth analysis of the unique attributes characterizing the Chinese market, has offered valuable insights into the complexities that underlie its functioning. The examination of major industry players has provided a nuanced comprehension of its diverse business segments. Furthermore, despite the absence of a pronounced scale effect, the chemical logistics sector in China has drawn attention from the capital market due to its unique

characteristics within the logistics field and the influential role played by leading enterprises. The increased pace of enterprise investment, financing activities, and penetration into the capital market underscores a significant shift. Enterprises with comprehensive service capabilities are expanding their business volumes, while those with more specialized yet stable operations are strategically diversifying through acquisitions, equity investments, and other means to evolve into comprehensive supply chain service providers offering diversified and integrated services.

The subsequent chapter delves into an exploration of literature reviews concerning CSR and green finance development, thus laying the foundation for this study's exploration of risk management strategies within this high-risk industry.

## **Chapter 3 Corporate Social Responsibility and Long-term Sustainability in the Chinese Logistics Industry**

### **3.0 Introduction**

In recent decades, the pressing need for sustainable development has led to the convergence of various concepts and strategies aimed at fostering long-term economic, social, and environmental well-being. Among these, Corporate Social Responsibility (CSR), green finance, and sustainability have emerged as pivotal frameworks. Each of these concepts addresses different facets of sustainable development, yet their intersection offers a comprehensive approach to achieving global sustainability goals.

This chapter serves as the first part of the literature review for this study. The concept of CSR has gained widespread popularity worldwide, with business publications such as Fortune and Forbes incorporating "social responsibility" as a criterion in their ranking and evaluation of enterprises. This underscores the significant emphasis placed on CSR in Western societies. In recent years, some Chinese public companies have started to include CSR reports alongside their annual reports. Increasingly, Chinese researchers are exploring CSR and sustainability issues, driven by China's rapid development over the past few decades, which has brought attention to corporate social responsibility and long-term sustainability. Incidents such as fraudulent charity donations, food safety scandals, water pollution, and other forms of "moral deficit" are frequently emerging. These are all negative consequences of companies prioritising short-term economic gains. Since enterprises are the fundamental units of economic society, their harmonious development is essential for the well-being of the entire society.

To address this 'ethical deficiency,' CSR and sustainability have become dynamic tools for promoting social justice. These two major concepts form a complementary paradigm, emphasising the importance of social concerns in business practices. This chapter aims to explore CSR from both academic research perspectives and industry implementation.

## **3.1 CSR Definitions and Development History**

### **3.1.1 Historical Definitions of CSR**

The concept of CSR can be traced back to the American scholar Oliver Sheldon, who first introduced the term "corporate social responsibility" in his book *The Philosophy of Management* (1924). Sheldon linked corporate social responsibility with a corporation's duty to meet various internal and external needs, arguing that CSR encompassed moral considerations. In the early writings on CSR, it was often referred to as "Social Responsibility" (SR) rather than CSR. However, there remains no unified definition of CSR, with different scholars proposing various definitions from different perspectives. Matten and Moon (2008) outline three reasons for the difficulty in defining CSR: (1) differing valuations of intrinsic values, (2) overlap with other concepts such as business ethics, and (3) the dynamic nature of CSR.

The evolution of CSR definitions provides insight into the scope and content of this concept, laying a solid foundation for further research. Howard R. Bowen, often referred to as the 'Father of Corporate Social Responsibility,' was instrumental in shaping the modern understanding of CSR. His publication *Social Responsibilities of the Businessman* (1953) marked the beginning of the modern CSR literature. Bowen (1953, p. 6) defines CSR as "the obligations of businessmen to pursue policies, make decisions, and follow lines of action that are desirable in terms of the objectives and values of our society." His work, alongside that of others such as Selekman (1959), Heald (1957), and Eells (1956), significantly shaped CSR in the 1950s. However, Bowen was the first to set forth a formal definition of the social responsibilities of businessmen.

In the 1960s, CSR literature expanded, leading to significant growth in the understanding of CSR. Keith Davis, known for his "Iron Law of Responsibility," argued that social responsibility should be seen in a managerial context and that socially responsible business decisions could bring long-term economic gains (Davis, 1960). Carroll (1999) noted that Davis could be considered the "runner-up to Bowen for the Father of CSR designation." During this period, the focus was more on social

responsibility, with Frederick (1960) stating that businessmen should oversee an economic system that meets public expectations. McGuire (1963) expanded the definition, asserting that corporations have economic, legal, and social obligations, noting the potential costs associated with fulfilling these responsibilities. Garriga and Melé (2004) highlighted Davis's influence on the interaction between business and politics, with politics playing a role in regulating the business environment to serve social interests.

The 1970s saw further proliferation of CSR definitions, particularly in the context of globalisation. Johnson (1971) identified a "multiplicity of interests" for firms, including those of stockholders, employees, suppliers, dealers, local communities, and the nation. In 1971, the Committee for Economic Development (CED) published *Social Responsibility of Business Corporations*, which contributed to clarifying CSR's scope. Abbott and Monsen (1979) developed a Social Involvement Disclosure (SID) scale to measure CSR activities, focusing more on evaluation than definition. Carroll (1979, p. 497) provided a comprehensive definition of CSR, stating that it encompasses the "economic, legal, ethical, and discretionary (philanthropic) expectations that society has of organisations at a given point in time."

As CSR research progressed into the 1980s, the focus shifted towards themes such as corporate social responsiveness, public policy, and stakeholder theory, with fewer new definitions. Jones (1980, p. 59-60) defined CSR as the "notion that corporations have an obligation to constituent groups in society other than stockholders and beyond that prescribed by law and union contract." Carroll (1983) further refined his earlier definition, while Frederick (1986) emphasized CSR's fundamental goal of contributing to social betterment.

The 1990s saw further theoretical development and measurement initiatives to support future research (Carroll, 1999). With the increasing globalisation and industrialisation in the West, CSR gained prominence among academics, governments, and international organisations. The World Bank, the European Union, and the World Business Council for Sustainable Development (WBCSD) all contributed to defining CSR during this time. The World Bank (2004) defined CSR as a set of policies and practices regarding an enterprise's relationships with key stakeholders, as well as its commitment to sustainable development. The European Union (2001) described CSR

as companies integrating social and environmental concerns into their operations and stakeholder interactions. The WBCSD (2002) defined CSR as a commitment to ethical behaviour, economic development, and the improvement of quality of life for employees, their families, and the local community.

Cama (2004) stated that CSR does not have a single, definitive meaning but is open to interpretation based on context. Despite the variations in CSR definitions, they all acknowledge that CSR involves attention to non-shareholder stakeholders and that corporations have obligations beyond profit maximisation. These responsibilities include protecting the environment, supporting communities, and promoting social justice alongside traditional business goals. It believes that the study of modern corporate social responsibility arose in the attention to various social problems of modern society, the traditional enterprise theory will seek to maximize shareholder value and profit maximization as its goal. Therefore, it believes that corporate social responsibility should be defined as the obligations that enterprises should fulfil to non-shareholder stakeholders while pursuing the maximization of shareholders' interests, including the responsibility of enterprises to employees, consumers, investors, and the responsibility of protecting the environment and resources, and the contribution to the community in which they live. Therefore, corporate social responsibility refers to a series of responsibilities that an enterprise, as a member of the society, should undertake to protect its brand and reputation, enhance its competitiveness, promote the harmonious development of the society and safeguard the overall interests of the society, in addition to being responsible to shareholders and creating profit.

For better looking into these various definitions in the different stage and from various focus, the below table sort out the representing CSR definitions globally.

Table 3.1: CSR definition and development in the international level

| Author              | Definition   |
|---------------------|--|
| <b>Bowen (1953)</b> | [CSR] refers to the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society. |

|                                       |  |
|---------------------------------------|--|
| <b>Frederick (1960)</b>               | Social responsibility in the final analysis implies a public posture toward society's economic and human resources and a willingness to see that those resources are used for broad social ends and not simply for the narrowly circumscribed interests of private persons and firms |
| <b>Friedman (1962)</b>                | There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud      |
| <b>Davis and Blomstrom (1966)</b>     | Social responsibility, therefore, refers to a person's obligation to consider the effects of his decisions and actions on the whole social system.   |
| <b>Sethi (1975)</b>                   | Social responsibility implies bringing corporate behaviour up to a level where it is congruent with the prevailing social norms, values, and expectations of performance   |
| <b>Carroll (1979)</b>                 | The social responsibility of business encompasses the economic, legal, ethical and discretionary expectations that society has of organizations at a given point in time.  |
| <b>Jones (1980)</b>                   | CSR is the notion that corporations have an obligation to constituent groups in society other than stockholders and beyond that prescribed by law and union contract.  |
| <b>Wood (1991)</b>                    | The basic idea of corporate social responsibility is that business and society are interwoven rather than distinct entities.   |
| <b>McWilliams &amp; Siegal (2001)</b> | CSR are actions that appear to further some social good, beyond the interest of the firm and that which is required by law.  |
| <b>Baker (2003)</b>                   | CSR is about how companies manage the business processes to produce an overall positive impact on society.   |
| <b>Windsor (2006)</b>                 | CSR is any concept concerning how managers should handle public policy and social issues   |
| <b>Eells &amp; Walton (2006)</b>      | CSR refers to the problems that arise when corporate enterprise casts its shadow on the social scene, and the ethical principles that ought to govern the relationship between the corporation and society.  |

*Source: International Journal of Business and Management Review, Mar.2020*

After reviewing the CSR definitions throughout its history during the past decades, although there are various definitions either by the scholars or by the world business commissions, they were all developed from the basis of social, economic, political, and environmental perspectives. Not a single definition can be used for all purposes and for all business environments. However, various definitions of CSR could explain some of the detail contents of CSR and cover various dimensions of CSR.

### 3.1.2 CSR Development Stages

The development of Corporate Social Responsibility (CSR) has traversed distinct stages over the years, as outlined in Table 3.2 by William C. Frederick (2006). This literature review delves into each stage, examining the time frames, main focuses, drivers, and policy instruments associated with CSR evolution.

Table 3.2: CSR stages of development

| Stage       | Time Frame  | Main Focus                      | CSR Drivers  | CSR Policy Instruments                               |
|-------------|-------------|---------------------------------|--|--|
| <b>CSR1</b> | 1950s-1960s | Corporate Social Stewardship    | Executive conscience and company reputation          | Philanthropy and public relations                    |
| <b>CSR2</b> | 1960s-1970s | Corporate Social Responsiveness | Stakeholder pressures and government regulations     | Stakeholder negotiations and regulatory compliance   |
| <b>CSR3</b> | 1980s-1990s | Corporate / Business Ethics     | Human rights and religio-ethnic values               | Mission statements, ethics codes, social contracts   |
| <b>CSR4</b> | 1990s-2000s | Corporate Global citizenship    | Globalization disruptions of economy and environment | International code compliance, sustainability policy |

*William C. Frederick (2006)*

## 3.2 CSR Content and Dimensions

### 3.2.1 Corporate Social Responsibility (CSR) Content

Upon reviewing the extensive literature on CSR definitions, numerous details have emerged regarding its content. Scholars such as Jules Backman have highlighted specific examples of CSR, including the employment of minority groups, pollution reduction, active community engagement, improved healthcare, and enhanced industrial health and safety standards (Backman, 1975). These various social responsibility initiatives collectively aim to improve overall quality of life. Understanding

the content and dimensions of CSR is essential to grasping its diverse interpretations and applications across industries.

To further explore the nuances of CSR content, I draw on examples from multiple industries. Backman, an esteemed professor of economics, identified CSR examples such as the employment of minority groups, pollution reduction, community improvement projects, better medical care, and upgraded industrial health and safety measures (Backman, 1975). Building on the definitions discussed in the previous section, I outline fundamental CSR content as follows:

- **Corporate Responsibility to Employees:** Recognizing employees as the creators of enterprise wealth, their rights and interests constitute a primary focus of corporate social responsibility. This involves ensuring fair labour remuneration, maintaining a safe and healthy work environment, and providing equal employment, promotion, and education opportunities.
- **Responsibility of Enterprises to Consumers:** Consumer satisfaction is integral to the survival and growth of enterprises. CSR involves addressing customer concerns promptly, as failure to do so may impact future business. In the era of brand competition, social responsibility serves as a competitive advantage.
- **Responsibility of Enterprises to the Community and Environment:** Acknowledging the interdependence between enterprises and their environment, CSR mandates active participation in philanthropic activities, environmental protection, and community development initiatives.
- **Corporate Responsibility to the Government:** Enterprises must comply with laws, pay taxes, and support government public welfare activities, charities, and undertakings to contribute meaningfully to society.
- **Corporate Responsibility to Shareholders:** In a market economy, the relationship between enterprises and shareholders is pivotal. CSR involves fostering transparency and accountability to maintain trust and uphold the interests of investors.
- **Responsibilities to Suppliers:** Businesses should uphold their reputation, strictly adhere to contracts, and develop mechanisms for evaluating and encouraging suppliers to meet their CSR obligations, contributing to a shared social responsibility strategy.

- **Corporate Responsibility to Competitors:** In market competition, enterprises are urged to adopt fair and legal means, fostering a corruption-free environment for healthy competition.

In the 21st century, CSR has emerged as a distinct industry. Major companies have established dedicated CSR departments and appointed managers or consultants. CSR reporting has become an integral part of companies' annual reports. The outlined CSR content not only enhances our understanding of CSR but also provides a framework for measuring and evaluating companies' CSR performance within these specified parameters.

### **3.2.2 The dimensions of CSR**

- **Carroll's pyramid of CSR.**

One of the most widely recognised frameworks for CSR is Carroll's Pyramid of CSR. Over the past few decades, several dimensions of CSR have emerged, evolving in focus. For example, CSR in the 1950s primarily dealt with societal obligations, while in the 1960s, the focus shifted to the relationship between corporations and society. By the 1970s, many dimensions had emerged, including stakeholder involvement, economic responsibility, legal responsibility, and improving the quality of life. In 1983, Carroll proposed that CSR consists of four key components: economic, legal, ethical, and philanthropic responsibilities. In 1991, Carroll further illustrated these four dimensions using his pyramid model, which has since become one of the most well-known frameworks for CSR. As CSR expert Dr. Wayne Visser noted, "Carroll's CSR Pyramid is probably the most well-known model of CSR" (Visser, 2006).

#### **Figure 3.1 Carroll's pyramid of CSR**



Carroll's pyramid of CSR.

Source: Carroll (1991)

Carroll's four-dimension definition of CSR was originally stated as follows: "Corporate social responsibility encompassed the economic, legal, ethical, and discretionary (philanthropic) expectations that society has of organizations at a given point in time". (Carroll 1979 p497, 1991 p38). This creates a foundation to explore in some detail and to frame the nature of corporate's responsibilities to the society. According to Carroll's CSR pyramid, the economic responsibilities and legal responsibilities are the foundation for firms to fulfil their business objectives, and other than that, ethical responsibilities and philanthropic responsibilities are required by society so as to achieve business sustainability. I explore it as follows:

#### 1) Economic Responsibilities are required.

As a fundamental condition, businesses have the economic responsibility results in producing goods and/or services to the society to get the business created and sustained. Garriga and Mele stated that the main purpose of business is to create wealth, to maximise shareholders' profit. (Garriga and Mele, 2004) Profits are necessary not only to reward shareholders but also for reinvesting back into the business. Therefore, the economic responsibilities are

the baseline requirement that must be met in the current competitive business world.

2) Legal Responsibilities are also what the operation required.

Society has established the minimal ground rules for business to operate and function. Legal responsibilities require corporations to follow these rules which include laws and regulations to run their business. The corporations need to comply with various international and government laws and regulations to be the law-abiding corporate citizens, fulfil all the legal obligations to societal stakeholders. For example, for the logistics companies, except the common business laws for normal business, there are lots of dedicated regulations just for this specific industry. All these are the basic operation requirement for the companies in this industry to start their business.

3) Ethical Responsibilities are expected by the society.

Ethical responsibility is introduced because the legal responsibilities do not cover every aspect of moral behaviour (Masaka, 2008). In other words, the legal responsibilities are essential but not sufficient. In addition to what is required by regulations and laws, society expects businesses to operate and conduct their works in an ethical way. Therefore, ethical responsibilities as part of proactivity in social responsibilities imply how ethical values are perceived as a duty or task which is obligatory for the organisation in relation to the society (Garriga and Mele, 2004). The ethical responsibilities embrace those activities, standards, policies, and practices that are expected by society even though they are not codified into law. Taking the example for our researched Chinese logistics industry, for the vehicle equipment procurement, some players use the standard vehicle as long as it has good economy cost and satisfy the regulations requirement, but some players may use more expensive vehicles with cleaner emissions for considering the environmental issues.

4) Philanthropic Responsibilities are also the expectation of the public.

Corporate philanthropy refers to social activities which are beyond the legal requirement and performed on a completely voluntary basis to improve the quality of life and the welfare of the society (Kitson and Campbell, 1996). It includes all forms of business giving and embraces voluntary or discretionary

activities. Philanthropic responsibilities may not be a compulsive responsibility but is a part of the everyday expectations of the public.

Carroll's pyramid of CSR is an integrated structure that focuses on the whole rather than the individual parts. Companies are expected to fulfil all responsibilities simultaneously, encompassing strategy, business operations, and procurement policies. A CSR-driven firm should strive to make a profit, obey the law, engage in ethical practices, and be a good corporate citizen. The pyramid should be seen as a unified whole (Carroll and Buchholtz, 2015). Garriga and Mele's CSR Four Dimensions

Garriga and Mele(2004) clarified the main CSR theories into four dimensions:

- (1) Instrumental theories: The corporation is viewed as an instrument for wealth generation, with its social activities serving this purpose.
- (2) Political theories: corporations must responsibly use their power in society
- (3) Integrative theories: Besides economical functions, corporation should focus on social demands.
- (4) Ethical theories, Corporations have ethical responsibilities to society, contributing to a better society.

By the research of above theories, Garriga and Mele(2004) suggested that new CSR theory should integrate the four dimensions: profit, political performance, social demands and ethical values.

- Dahlsrud's Five dimensions of CSR

Dahlsrud(2008) analysed 37 definitions used by researchers on CSR and categorised CSR into 5 dimensions: environmental; social, economic, stakeholder (entrepreneurs, consumers, politicians, and the media) and charity dimension.



Since there are no unified opinion about a universal comprehensive definition for CSR, the CSR dimensions may vary as well. Some scholars even listed over ten dimensions for CSR. The reason is because many CSR definitions and its associated dimensions are developed by the scholars based on the social, economic, political and environmental context of those periods. Since the society is always in the process of changing and developing, the CSR concept is in the dynamic process of expanding and enrichment.

### **3.3. CSR implementation and adaptation in the business practices**

Nowadays, large companies have independent CSR departments and CSR managers and CSR consultants. The purpose of understanding CSR definition, CSR content and its category, and its dimensions, will help us to explore the advantages for CSR implementation. It can be said that business ethics are integrated into companies through CSR.

#### **3.3.1 The CSR Theories**

Corporate Social Responsibility (CSR) has evolved into a vital aspect of modern business practices, shaping the relationship between corporations and society. There are several theories explain the significance and benefits of CSR: Instrumental stakeholder theory (Jones, 1995) clarifies how CSR contributes to the bottom line via its favorable influence on the firm's relationships with important stakeholders. The

importance of stakeholders can be determined by their relative power, legitimacy, and urgency (Mitchell, Agle, & Wood, 1997); The social contract theory, Moir stated that a responsible business does not operate only because of its commercial interests but also because of how the society expects business to operate (Moir, 2001); Garriga and Mele's Instrumental theories: the corporation is just like an instrument to work on the wealth gaining its social activities are also work for it. It made CSR a strategic tool leading to competitive advantages and building a good image and reputation (Garriga & Mele, 2004); The Social Identity Theory (Gao & Yang, 2016; Schaefer et.al. 2019) states that individuals are more likely to identify with entities with similar values to their own and entities that have a good image and reputation. It explains that individuals may be more likely to identify with companies that carry out CSR practices. There are quite many theories supporting CSR to be positive to the company performance. For instance, according to Harold Johnson (1971)'s view: "Social responsibility states that business carry out social programs to add profits to their organization". Although the social costs associated with each activity, product, and service should ultimately be passed on to the consumer. Social responsibility is perceived as long-run profit maximization.

The landscape of CSR theories has evolved over time in response to changing societal, environmental, and economic contexts. Early CSR theories, such as the Social Responsibility of Business (Bowen, 1953), focused on philanthropy and charitable giving. As societal expectations evolved, scholars began to recognize the need for a more comprehensive framework that considered the broader impacts of corporate activities. In the 1980s and 1990s, Stakeholder Theory gained prominence, emphasizing the importance of identifying and managing the interests of various stakeholders. The shift towards a stakeholder-centric approach marked a departure from shareholder-centric views and acknowledged the interconnectedness of businesses with their external environment. In the 21st century, the discourse on CSR expanded to include sustainability concerns, prompting the development of concepts like Corporate Sustainability (Eccles and Serafeim, 2013) and Corporate Social Innovation (Battilana et al., 2017). These theories highlight the need for businesses to proactively address environmental and social challenges, viewing sustainability as a strategic imperative rather than a discretionary activity.

The seminal work of Garriga and Mele (2004) classifies CSR theories into four distinct groups, each with a unique focus on Economics, Politics, Social Integration, or Ethics. This literature review aims to provide a comprehensive analysis of the four mainstream CSR theories: Corporate Social Performance (CSP), Shareholder Value Theory (SVT), Stakeholder Theory, and Corporate Citizenship. By delving into the historical context, key tenets, criticisms, and applications of each theory, this review seeks to offer a nuanced understanding of the multifaceted landscape of CSR.

- Corporate Social Performance (CSP):

The inception of Corporate Social Performance as a theoretical framework can be traced back to Carroll's (1979) groundbreaking work. Carroll conceptualized CSR as a four-tiered pyramid, encompassing economic, legal, ethical, and philanthropic responsibilities. CSP contends that corporations, beyond profit maximization, should actively contribute to societal well-being. The economic dimension involves the efficient utilization of resources, legal responsibility adheres to regulatory compliance, ethical responsibility requires moral conduct, and philanthropic responsibility entails voluntary contributions to the community.

CSP gained prominence for emphasizing the positive impact businesses can have on society, portraying CSR as a source of competitive advantage and long-term sustainability (Wood, 1991). However, criticisms have surfaced, particularly regarding CSP's narrow focus on external stakeholders and economic performance. Some argue that CSP overlooks the internal dynamics of organizations and the multifaceted nature of social responsibility (Carroll & Shabana, 2010). Nevertheless, CSP remains influential, guiding organizations towards a holistic approach to CSR.

- Shareholder Value Theory (SVT):

Shareholder Value Theory presents a contrasting perspective, positing that the primary obligation of a corporation is to maximize shareholder wealth (Jensen, 2001). Advocates contend that by focusing on profitability and shareholder returns, corporations indirectly contribute to societal welfare through job creation and economic growth. SVT assumes that market forces and competition will naturally guide

corporations to act in socially responsible ways, as any deviation from ethical conduct would adversely impact financial performance (Friedman, 1970).

Despite its prominence, SVT has faced substantial criticism. Detractors argue that the theory's narrow focus on short-term financial gains may lead to ethical compromises and neglect of other stakeholder interests (Donaldson & Preston, 1995). The tension between short-term financial objectives and long-term sustainability remains a critical concern, challenging the theory's ability to address the broader social and environmental challenges faced by modern corporations.

- Stakeholder Theory:

Stakeholder Theory (Freeman, 1984) represents a shift by emphasizing the importance of considering the interests of all relevant stakeholders. Recognizing that corporations operate within a network of relationships, Stakeholder Theory posits that organizational success depends on satisfying various stakeholders, including employees, customers, suppliers, and the broader community. The theory emphasizes the interdependence between corporations and stakeholders, urging businesses to balance competing interests and prioritize long-term relationships over short-term profits.

From the perspective of the stakeholder theory, the company must consider not only the interests of the shareholders but those of all those who may have a legitimate interest in the entity. The cornerstone of the business case for CSR, highlights the importance of a firm's relationships with a broad set of individuals and organizations, beyond just shareholders. (Freeman 1984, Wood 1991). Stakeholder Theory has gained widespread acceptance for its inclusive approach to CSR, acknowledging the interconnectedness of business and society (Freeman et al., 2010). However, the practical implementation of Stakeholder Theory poses challenges, particularly in balancing conflicting stakeholder interests and navigating complex decision-making processes. Critics argue that the expansive scope of stakeholder management may lead to organizational challenges and decision-making complexities, potentially hindering business agility and competitiveness. Moreover, measuring and managing stakeholder relationships effectively require robust frameworks and methodologies, which may vary across industries and organizational contexts.

Despite these challenges, Stakeholder Theory remains a potent framework for guiding corporate governance and CSR practices. By recognizing the interdependence between businesses and society, Stakeholder Theory encourages companies to embrace responsibility beyond financial performance and consider the broader societal impacts of their actions. In doing so, organizations can cultivate sustainable relationships, mitigate risks, and contribute to the well-being of both shareholders and stakeholders alike.

- Corporate Citizenship:

Corporate Citizenship represents a more proactive and comprehensive approach to CSR, positioning corporations as responsible and ethical members of society. Matting and Crane (2005) define Corporate Citizenship as going beyond legal and economic obligations, urging businesses to contribute positively to the well-being of society and the environment. The concept encompasses economic, legal, ethical, and discretionary responsibilities, aligning with the broader goals of sustainable development.

Corporate Citizenship encourages businesses to move beyond mere compliance and actively engage in socially responsible practices (Maignan & Ralston, 2002). However, challenges persist in operationalizing the concept and integrating it effectively into organizational strategies. Critics argue that, without clear guidelines and metrics, Corporate Citizenship may remain an idealistic aspiration rather than a practical framework for CSR implementation.

By the research of above theories, CSR concept provides diverse advantages to organisations by fulfilling not only the objectives of the business but also the social responsibility in the way that business is operated and in the outcomes that will affect its stakeholders in a positive manner (Dusuki, 2008).

While the four mainstream CSR theories provide valuable insights, scholars have explored integrative approaches that seek to combine elements from multiple theories, acknowledging the limitations and strengths of each. One such approach is the Triple Bottom Line (Elkington, 1997), which expands the traditional focus on financial performance by incorporating environmental and social dimensions. The Triple Bottom

Line (TBL) theory, as proposed by Elkington (1997), presents a compelling argument for a paradigm shift in corporate performance evaluation, advocating for a comprehensive assessment that goes beyond mere financial metrics. The essence of TBL lies in its recognition that businesses operate within a broader societal and environmental context, and thus should be accountable not only for economic outcomes but also for their impacts on people and the planet.

Elkington's seminal work, "Cannibals with Forks," lays the foundation for understanding the interconnectedness of economic, social, and environmental dimensions in corporate decision-making. By introducing the concept of the "three Ps" – profit, people, and planet – Elkington highlights the need for businesses to consider the full spectrum of their impacts when measuring performance. This argument is further supported by empirical evidence from studies examining the relationship between corporate social responsibility (CSR) and financial performance (Margolis & Walsh, 2003; Orlitzky et al., 2003). These studies suggest that companies embracing TBL principles may experience improved financial outcomes over the long term, as they mitigate risks, enhance reputation, and attract socially conscious investors.

Moreover, the TBL framework offers practical guidance for organizations seeking to integrate sustainability into their business strategies. By adopting a triple-bottom-line perspective, companies can identify opportunities to create shared value for stakeholders while minimizing negative externalities (Porter & Kramer, 2011). For example, initiatives focused on environmental sustainability, such as resource efficiency and renewable energy adoption, can yield cost savings and operational efficiencies while reducing ecological footprint.

However, the implementation of TBL is not without its challenges. One key concern relates to the measurement and reporting of non-financial outcomes, such as social impact and environmental performance. Scholars have emphasized the importance of developing robust metrics and methodologies for assessing these dimensions, as well as enhancing transparency and accountability in reporting practices (Eccles et al., 2014; Krüger & Rehbein, 2015). Moreover, the trade-offs inherent in pursuing multiple objectives simultaneously pose a dilemma for organizations striving to balance economic, social, and environmental priorities (Bansal & DesJardine, 2014).

Addressing these challenges requires a nuanced understanding of the complexities involved and a commitment to stakeholder engagement and collaboration.

Despite these challenges, the TBL framework remains a valuable tool for advancing the agenda of responsible business practices and sustainable development. By encouraging businesses to embrace a broader conception of corporate success, TBL fosters innovation, resilience, and long-term value creation. As organizations navigate an increasingly complex and interconnected global landscape, the principles of TBL offer a roadmap for achieving economic prosperity, social equity, and environmental stewardship in harmony.

While CSR theories have significantly contributed to understanding the role of businesses in society, challenges persist in their practical application. One challenge involves the measurement and assessment of CSR activities. Determining the impact of CSR initiatives on stakeholders and society at large remains a complex task, requiring robust metrics and evaluation frameworks (Karnani, 2010). Standardized reporting mechanisms, such as the Global Reporting Initiative (GRI), aim to address this challenge by providing guidelines for transparent and consistent CSR reporting.

Another challenge revolves around the integration of CSR into organizational strategies. Embedding CSR practices into the core business operations requires a cultural shift and strategic alignment. Barriers may include resistance from internal stakeholders, resource constraints, and the perceived trade-off between financial performance and social responsibility (Porter and Kramer, 2006). Overcoming these challenges necessitates visionary leadership and a commitment to long-term sustainability.

As looking towards the future, CSR theories are likely to evolve in response to emerging issues, such as the digital transformation of business, artificial intelligence, and the growing urgency of addressing climate change. New theories may emerge to guide businesses in navigating these complexities while ensuring ethical, responsible, and sustainable practices.

### **3.3.2 Advantages and Benefits for CSR adaption**

While CSR may not solve all the world's problems and CSR isn't the panacea to the world's problems. But it certainly does start to move the needle toward an economy that is much closer to one where people would like to conduct business. That said, CSR is a way for companies to benefit themselves while also benefiting society. Companies have to a variety of reasons for being attentive to CSR. Companies have a variety of reasons for being attentive to CSR. Some of the potential bottom-line benefits are reducing cost and risk, gaining competitive advantage, developing and maintaining legitimacy and reputational capital, and achieving win-win outcomes through synergistic value creation (Tonello, 2011) .

According to Simon Zadek, CEO of the UK-based institute Account Ability, "Who cares about the business case for CSR?"(Zadek, 2000) First of all, corporate boards, CEOs, CFO, the high executives care, because they are the guardians of companies' financial performance. Besides these, other groups, such as Shareholders looking at management performance, social activities desiring long-term best interests, Governmental bodies looking at social and environmental benefits, and Consumers looking forward to passing a better world to children, they all also care CSR because of these mentioned advantages for them.

CSR can differentiate a firm's products (Porter, 1991), reduce its operating costs (King and Lenox, 2000), and serve as a platform for future opportunities, as well as a buffer from disruptive events (Fombrun, Gardberg, and Barnett, 2000).The following CSR initiatives offer practical example of the business value generated by the allocation of resources in socially responsible pursuits (Archie Carroll, Kareem Shabana, 2010). They are from the rational (Kurucz et al., 2008) for the business case for CSR. Actually, it could sort out the benefits of CSR implementation from these initiatives:

(1) Reducing costs and risks:

- Equal employment opportunity policies and practices
- Energy-saving and other environmentally sound production practices
- Community relations management

CSR makes employees happier and more fulfilled, and it is essential to employee loyalty and dedication. When personally fulfilled, people are less vulnerable to fatigue and stress. They're also more likely to stay with the company. There are also a range

of benefits for employees when the company embraces CSR. The workplace will be a more positive and productive place to work, and by promoting things like volunteering, it encourages personal and professional growth. It's proven that employees enjoy working more for a company that has a good public image than one that doesn't. Furthermore, by showing that the company committed to things like human rights, it's much more likely to attract and retain the top candidates.

According to Zadek, it is a cost-benefit approach that CSR implementation is the principal attraction for organization. Zadek also give a good example on cost saving from CSR, General Mills is on a path to reduce its energy savings by 20% by 2015. According to its 2011 CSR report, after installing energy monitoring meters on several pieces of equipment at its Covington, Ga. plant, the company saved \$600,000 (Zadek, 2007).

- EEO policies
- Customer relations program

CSR provides the advantage of brand differentiation for the companies. Using CSR can help the company to engage with their customers in new ways and it also can increase brand awareness and recognition. If the company committed to ethical practices, this news would spread. More people will therefore hear about the brand, which creates an increased brand awareness. By embracing CSR, the company may stand out from competitors in their industry and establish themselves as a company committed to going one step further by considering social and environmental factors.

#### (2) Developing reputation and legitimacy

- Corporate philanthropy
- Corporate disclosure and transparency practices

Improved public image is crucial, as consumers assess the company public image when deciding whether to buy from them. Something very simple, for example, like staff members volunteering an hour a week at a charity, shows that the company is a brand committed to helping others. As a result, the company will appear much more favorable to consumers.

#### (3) Seeking win-win outcomes through synergistic value creation

- Charitable giving to education
- Stakeholder engagement

Investors care about a business's sustainability, customer loyalty, and competitiveness. There are also many eager to support companies that work to make the world better. Corporations that commit to social change and are willing to adapt are very attractive to investors. Incorporating CSR is an effective way to attract socially minded stakeholders as well as those thinking about long-term financial success.

Further than the above reasons, CSR implementation also helps on innovation, long-term sustainability, and makes a better world. Some scholars (Exter, Cunha, and Turner, 2011) list these benefits as the companies' frequency citation: Brand differentiation, Employees attraction, Operational effectiveness, Risk management, Direct Financial impact, Organizational growth, Business opportunity, Responsible leadership, Macro-level sustainable development. Zadek also describes it is the innovation and learning approach leading to companies' competitive advantage (Zadek, 2007).

### **3.3.3 Major debates against CSR implementations**

This research also examines debates regarding CSR implementation. Different scholars hold varying views on the value of CSR for organization profit. Milton Friedman argued that the main objective of a business is to maximize profit. (Friedman, 1970). Zinkin(2004) stated that CSR is like a 'license-to-operate' consists of 'efficiency' and 'effectiveness' which means such two values are imperative to ensure the corporate not only profit growing but also the big environment friendly.

The debates against CSR primarily focus on the relationship between CSR and financial performance. Critics contend that spending limited resources on social issues can weaken a firm's competitive position by unnecessarily increasing costs (Barnett, 2007). The core argument against CSR is that such expenditures may not contribute directly to profitability.

Milton Friedman is perhaps the most prominent critic in this area, arguing that while CSR is widely practiced, it represents an agency loss. He suggested that managers pursue CSR for personal gain, not for shareholder benefit (Friedman, 1970). According

to Friedman, the main goal of business is profit maximization, and if social intervention is required, it should be the responsibility of the government and legislation (Carroll & Buchholtz, 2006). McWilliams and Siegel (2001) also defined CSR as actions that further social good beyond the firm's interests and what is required by law, emphasizing a neutral relationship between CSR and financial performance.

Some scholars have questioned whether the financial benefits to a corporation can exceed the costs of its contributions to social welfare (Margolis & Walsh, 2003; Orlitzky, Schmidt & Rynes, 2003). After years of research, it remains unclear whether investing in social initiatives yields financial returns equivalent to or greater than the initial investment (Barnett, 2007). Friedman (1970) further argued that corporations are inefficient agents of social change and that voluntary contributions to social causes are a misappropriation of shareholders' funds. He claimed that funds should be focused solely on financial returns, and CSR does not guarantee this.

Sternberg (2000) added that businesses that prioritize goals such as public good involvement, philanthropy, and charitable activities deviate from their primary purpose of maximizing owners' value by selling goods and services. Sternberg explained that owners' value could be anything valuable to the owner, indirectly benefiting the business, not just from a financial standpoint. Although numerous studies have attempted to understand the relationship between CSR and profitability (Sternberg, 2000), Mahon and Griffin (1997) argued that after 25 years of research, no definitive solution has been reached, with insights being scattered like "isolated islands" in an incomplete larger picture.

CSR cannot consistently produce favorable returns for all firms all the time, meaning that positive findings will not be replicable across all datasets. Returns to CSR are contingent, not universal (Ullmann, 1985). McWilliams and Siegel (2001) suggested that managers should approach CSR decisions as they would any other investment decisions. From a contingent perspective, Barnett (2007) argued that while not all CSR activities are profit-maximizing, some may be, and with careful application, CSR can fulfill management's fiduciary responsibilities. In summary, CSR may not financially always benefit all corporations, but it can benefit some corporations under certain circumstances.

### **3.3.4 CSR Disclosure—CSR Report**

The debates against CSR primarily focus on the relationship between CSR and financial performance. Critics contend that spending limited resources on social issues can weaken a firm's competitive position by unnecessarily increasing costs (Barnett, 2007). The core argument against CSR is that such expenditures may not contribute directly to profitability.

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Not like the company financial report, CSR reports significantly vary in form and content, and not being structured under formal mandatory rules. Unlike managerial accounting, CSR reports primarily address external stakeholders such as customers, investors, and the public. The main intention of a CSR report is to improve the transparency of organizations' activities. CSR reports aim to enable companies to measure the impact of their activities on the environment, on society and on the economy. In this way, companies can get accurate and insightful data which will help them improve their processes and have a more positive impact in society and in the world. On the other hand, a CSR or sustainability report also allows companies to externally communicate with their stakeholders what are their goals regarding sustainable development and CSR. This allows stakeholders such as employees, investors, media, NGOs, among other interested parties, to get to know better what the short, medium and long-term goals of companies are and make more informed decisions. Although CSR report is not mandatory for all companies, but Directive 2014/95 from the European Union demands large companies to reveal certain non-financial information about how they operate and run their social and environmental challenges.

Abbott and Monsen (1979) developed a Social Involvement Disclosure (SID) scale to measure firms' CSR. Ernst & Ernst, one of the "Big 8" accounting firms, produced annual CSR reports covering categories such as the environment, equal opportunity, personnel, community involvement, and products. Idowu and Towler (2004) identified ten key characteristics of CSR reports, such as being standalone reports, having a

director responsible for CSR, being listed on indices like FTSE4Good and the Dow Jones Sustainability Index, and supporting named charities.

KPMG's (2005) survey found that 70% of G250 and 50% of N100 companies issued standalone CSR reports. Golob and Bartlett (2007) highlighted common standards used in CSR reporting, including ISO standards, the Accountability AA1000, the UN Global Compact, and the Global Reporting Initiative (GRI). Nielsen and Thomsen (2007) created an analysis model of CSR reporting based on four dimensions: stakeholders, context, perspectives (people, profit, and planet), and ambitions.

Here listed some popular standards for CSR reporting:

- AA 1000 Assurance Standard (AA 1000 AS) issued by Account. Ability in 2008.
- International Standard on Assurance Engagements (ISAE 3000) developed by the International Auditing and Assurance Standard Board (IAASB) in 2013.
- Sustainability Reporting Guidelines, issued by the Global Reporting Initiative in 2006 (most comprehensive)
- Sustainability Global Reporters Methodology (London)

The factors influencing CSR disclosure include company size, culture, profitability, and ownership. Large companies typically have more shareholders interested in social issues, increasing their focus on CSR (Cowen, 1987). Studies by Trotman, Bradley, and Patten (1981) indicated that company size, industry, and country influence CSR disclosure, with larger companies being more transparent. However, Davey (1982) and Ng (1985) found no relationship between company size and CSR disclosure. Similarly, Cowen (1987) found a link between profitability and CSR disclosure, while Gray (1995) and Ng (1985) reported contradictory findings. Adams and McNicholas (2007) noted that ownership could affect CSR policy, while Sweeney and Coughlan (2008) found that industry sector impacts CSR reporting.

Although CSR reports disclosure is not mandatory for every company, specifically, it's mandatory that these organizations give insights about how they're taking care of environmental, social and personnel concerns. Diversity and inclusion, respect for human rights, and the fight against corruption and bribery inside businesses and within value chains are issues that must be contextualized too. Consequently, specific organizational data needs to be provided about the policies being pursued, as well as their outcomes. The main organizational risks identified and how they're being

managed, together with the financial indicators used must be presented as well. This kind of information helps consumers, investors, policymakers and other stakeholders to evaluate the non-financial performance of large companies and encourages organizations to develop sustainable business strategies that can be up to the expectations. Based on that, it may clear about the major information of the CSR report. However, the financial report is standardized globally. But CSR reports are not and even no widely accepted reporting standards to regulate.

### **3.4 CSR research in the Chinese logistics industry**

#### **3.4.1 CSR literature from Chinese researchers**

As it introduced earlier, the concept of "corporate social responsibility"(CSR) originated in Western developed countries, and it is still relatively new concept in China. The academic research for CSR in China was mostly started in the 1990s.

Li Honggui (1995) emphasized that enterprises should adopt a responsible attitude during production, aligning their behavior with social standards, and actively participating in solving various social issues. Li further specified that this responsibility extends to consumers, shareholders, the state, and authorities.

Lu DaiFeu (2002) expanded this view by suggesting that CSR includes responsibilities for employees, consumers, creditors, environmental protection, and social welfare. Tan Shen and Liu (2003) discussed the CSR challenges faced by multinational corporations, particularly regarding labor conditions such as low wages and poor working environments, which have sparked movements for improved corporate behavior.

Li Liqing and Li Yanling (2005) argued that enterprises have an interactive and interdependent relationship with the environment, and neglecting social responsibility hinders long-term development. From an economic law perspective, Ji Xiaonan (2007) analyzed how economic law could promote CSR by aligning corporate actions with social standards, balance, and sustainability.

Zhao Yun (2008) argued that companies should proactively assume social responsibility, with the government, non-governmental organizations, and the public

collaborating to ensure proper oversight and development. Zhao proposed a cooperative model between these stakeholders to foster CSR.

In summary, while CSR research by Chinese and foreign scholars is well-established, specific studies focused on CSR within the chemical logistics sector are sparse. Some studies address warehousing, agriculture, or road transport logistics, but most lack depth, a comprehensive perspective, and an adequate evaluation index system to assess CSR fulfillment. This gap highlights the need for further research, particularly in the niche markets of the logistics industry such as chemical logistics.

### **3.4.2 The background for CSR research in Chinese Logistics industry**

As a special industry, the characteristics of logistics industry are different from other industries. With the expansion of domestic demand and the promotion of deepening reform in China in recent years, the logistics enterprises have developed rapidly. But in the process of its development, it is full of conflicts between economic interests and social value, public security and environment protection.

Logistics industry is an important industry of national economy in China. Transportation production is a continuation of the production process in the circulation process and an important link of the social reproduction process. Therefore, in the process of building a harmonious society, the logistics enterprise has a special status and role, and its social responsibility has been paid more and more attention. To undertake diversified social responsibilities, logistics enterprises must pay attention to the rights and interests of stakeholders, social interests, green, low-carbon, energy saving and environmental protection and consider sustainable development while pursuing economic interests. In these areas, there are many difficult problems to be solved.

In the macro aspect, it is shown as:

1). Logistics enterprises are big consumers of energy. Transportation is currently the largest energy consumption and the fastest growing energy consumption industry; the energy consumption of logistics industry has accounted for the total social energy consumption. Mr. Zhou Haitao(2010), chief engineer of the Ministry of Transport, said on the "Development of Modern Transportation Industry Support Technology Seminar"

held in Shanghai 2010, "that data showed that the average fuel consumption per 100 kilometres of all kinds of cars in China was more than 20% higher than that of developed countries, and the fuel consumption per 100 kilometres of truck transportation was nearly 50% higher." At the same time, China's oil resources are tight, and its dependence on foreign countries is increasing year by year.

2) The impact of logistics on the environment is becoming more and more serious. Car exhaust, particulate matter, noise and other pollutions are the important influencing factors of causing environmental pollution. China is already the world's largest emitter of sulphur dioxide, and second only to the United States in carbon dioxide emissions. Excess levels of carbon monoxide are present in traffic-clogged urban areas, and photochemical smog is potentially dangerous. In a big city Emissions from vehicles have become a major cause of air pollution in China.

3) Safety has become one of the prominent problems concerned by the whole society in China. In recent years, with the rapid development of China's economy and society, the number of motor vehicles, drivers and road traffic flow has increased significantly, the road traffic pressure is increasing day by day so as to getting more and more serious safety issue. For instance, according to the CFLP data in 2011, just take road traffic accident to look at, in 2010, there were 238,351 road traffic accidents in China, resulting in 67,759 deaths. The number of fatalities in road traffic accidents ranks first in the world, with direct property losses of 910 million yuan, including 24 cases of serious road traffic accidents in which more than 10 people were killed in one case.

4) The problem of integrity is significant. Some enterprises have very serious integrity problems, for the loss of goods caused by transportation. The companies may choose the way of evasive action, and it is quite frequent situation for them to defraud delivery goods and then totally "evaporate" from the market.

At the micro level, logistics enterprises, as a link in the value chain, are closely connected with consumers, investors, suppliers, the relationship between creditors, the government, and the public is also increasingly exposed as a problem in terms of unpaid wages and poor working conditions. For example, Shoddy deception of investors, without reason to occupy investors' funds; fraudulent practices against consumers; Failure to pay debts to creditors on time; Failure to pay the government's

taxes legally and on time; If specifically on the chemical logistics market, the safety problems are the giant pandemic, which is the great threats to people's lives and property and so on.

At the micro level, logistics companies interact with stakeholders such as consumers, employees, and the government. The unresolved issues of unpaid wages, poor working conditions, and safety risks—especially in chemical logistics—are tied to the lack of CSR. Addressing CSR can help logistics companies navigate these challenges, ensuring protection for stakeholders and supporting sustainable development.

### **3.4.3 The Contents of CSR in the Chinese Logistics Industry**

Based on the literature review of CSR categories (referenced in section 2.2.2), the contents of CSR in the Chinese logistics industry encompass various responsibilities tailored to its unique nature as a service sector.

Different from other industries such as manufacturing industry, logistics industry belongs to service industry, which mainly changes the spatial state of transportation objects. According to the different transport goods, it can be divided into two major categories, passenger transport and cargo transport. From the difference of cargos, the cargo road transport industry can be divided into various subsectors, such as the transport of ordinary goods, the transport of bulk goods (such as automobiles, construction machinery, etc.), the transport of fresh cold chain, the transport of dangerous chemicals and so on. Based on the research aim and objectives, this research focus specifically on chemical logistics industry which is one of the niche segments of logistics industry.

- The contents of CSR in logistics industry

The social responsibility of the logistics companies is determined by the nature of the logistics company and the nature of the logistics industry. First of all, as a profit-making organization, the goal of logistics enterprises is to pursue profit maximization. Therefore, for the enterprises themselves, the primary responsibility is economic responsibility. Secondly, the logistics industry has the nature of service industry to some extent, and the operation behaviour of the logistics enterprises must be in line with the overall interests of the society under the constraints of law and morality, so

as to provide services for the social and economic development. Profit maximization goal of it is the duty of logistics enterprise to investors. Logistics enterprise has the obligation to protect the interests of the stakeholders, they should realize the goal of profit maximization and the performance of the balance between the dimensions of social responsibility.

Referred to the CSR definition in the earlier parts of this paper, the CSR of logistics companies means that the companies must take the initiative to maintain and promote the responsibility to the environment, society and stakeholders while pursuing the maximization of their own economic interests and realizing their own good development. The content of corporate social responsibility is very extensive. It can be divided into two categories: direct CSR and indirect CSR. For the logistics enterprises, all the followings belong to its CSR category: maximising profit, reducing transport costs, improving transport service level, promoting the development of logistics industry, stimulating the development of national economy, to strengthen road public safety, paying taxes according to law, undertakings public welfare, environmental protection and so on.

#### 1) Contents of direct CSR of logistics industry

The direct social responsibility of the logistics enterprises mainly refers to the economic responsibility, that is, to create profits for the enterprises and realize their own good development. The economic responsibility is the most basic, the most direct responsibility of the enterprise, the enterprise's life depends on its maintenance. The most basic purpose of logistics enterprises to provide transportation services to the society is to seek maximum profits for shareholders, and at the same time to meet with most of the stakeholders' economic requirements.

The main object of direct social responsibility of logistics enterprises is shareholders. Shareholders are entitled to share the ownership and control rights of the logistics enterprise in order to obtain profits from the investment in the logistics enterprise and provide financial support to the logistics enterprise. Therefore, they pay great attention to the relevant business performance indicators of the enterprise.

#### 2) Contents of indirect CSR of logistics industry

The indirect social responsibility of logistics enterprises mainly refers to the protection of the legitimate rights and interests of employees, the provision of public services and protection the natural environment and the promotion of the social image of the enterprise, that is, the legal responsibility and moral responsibility for employees, to provide safe transport service for the public, the responsibility to protect the natural environment, to provide emergency assistance for social emergencies. The subject of indirect social responsibility of logistics enterprises involves various market subjects, including enterprise members in the industry, consumers, the natural environment and society.

- Employees

The economic relationship between the logistics enterprise and the employee is established through the contract. The enterprises employ and pay wages for their employees, enjoy the value created by labour, and bear the associated risk, thus forming the corresponding corporate social responsibility for employees. It mainly includes two aspects: certain legal responsibility and moral responsibility. Legal responsibility is mainly to maintain the economic relationship between the enterprise and its employees, while moral responsibility is that the logistics enterprise has certain responsibility for the development and improvement of its employees, and reveals the relationship between mutual respect and mutual trust between them

- Consumers

The object that logistics enterprise provides transport service is consumer, namely freight consignor, and logistics profit realization depends on the consumer's choice of a logistics enterprise, and this choice in the current Chinese logistics industry is especially under the buyer's market, if consumers satisfied with the service from the logistics enterprise, then they will form a conscious consumer preference for the enterprise, and to change this preference need consumers pay a cost, thus consumers preference of an enterprise and once they are formed within the acceptable range will not easily change their preference. Therefore, logistics enterprises should also take consumers as the main object of indirect social responsibility. The most basic responsibility of logistics enterprises to consumers is to provide consumers with safe and reliable transport services, along with the improvement of people's living standard, consumers have higher requirements for transportation service level. Consumers buy

services provided by businesses is to meet their needs, and if the logistics enterprises cannot provide safe and reliable services to consumers, consumers' property safety will suffer losses, which requires the logistics enterprises to be responsible for consumers.

- The environment

Harmonious society requires that logistics enterprises must co-exist with human beings and nature. While creating wealth for the society, logistics enterprises are constantly consuming all kinds of natural resources, and their production and management activities are the main ways for human beings to acquire and consume natural resources. Natural resources are scarce, and the wealth creation ability of logistics enterprises depends on the quantity and quality of natural resources to a great extent. Therefore, the development of logistics enterprises is closely related to the natural environment. Only by achieving the harmonious development with nature, can the sustainable development of logistics enterprises be realized, and the harmonious development between man and nature can be finally realized. The main contents of CSR for logistics enterprises is to fulfil the responsibility of environmental protection include abiding by environmental protection laws and regulations and fulfilling environmental protection the duty of care, this is the bottom line of responsibility; Consciously protecting the environment and conserving resources is the middle line of responsibility. The third level is to develop environmental economy, implement cleaner production, prevent pollution, protect the ecology, through the active fulfilment of environmental protection responsibility to build up the logistics enterprise good image, win the development opportunity, this is the responsibility high line.

- Social public

Emergent public crisis emergency rescue events and logistics enterprise social responsibility is inseparable. Although correctly in China the primary responsibility of crisis emergency rescue events should lie in the effective management of public crisis emergency rescue events by the government. However, as a logistics enterprise must not neglect and give up the social responsibility for public crisis. The CSR for the logistics enterprise in this section is to make a quick response in the first time for the public emergent rescue. Undertake social responsibility and establish a good

corporate image, brand image will achieve the win-win situation of logistics enterprises and the social harmony for the target of sustainable development.

In 2020, researchers Shen, Liu, and Liu examined CSR reporting in the Chinese logistics industry, identifying three major CSR reporting standards. These standards emphasize transparency and accountability in how logistics companies manage their social responsibilities.

**Table 3.3 Three major CSR report standard in Chinese Logistics Industry**

|                      | <b>SA8000 Standard</b>  | <b>AA1000Standard</b>  | <b>G3 Standard</b>  |
|----------------------|---|--|---|
| <b>Authority</b>     | Social Accountability International (SAI)   | Institute for Social and Ethical Responsibility (ISEA)   | Global Reporting Initiative (GRI), CERES  |
| <b>Core Basis</b>    | The rights of workers   | Accounting, Audit on social/ethic responsibility   | Comprehensive performance of CSR  |
| <b>Main Contents</b> | Child Labour, forced Labour, safety and health, discrimination, punishment, working hours, wages, etc.  | Disclosure of employee, investor, environmental, community issues from a stakeholder perspective | Overall management policy. The indicators covering economic, environmental and social areas |
| <b>Focus</b>         | Review and report on labor production environment and working conditions  | Safeguard and reflect the interests of relevant stakeholders                                     | sustainable development system construction   |
| <b>Common Ground</b> | safeguard the rights and interests of stakeholders and encourage enterprises to fulfil their social responsibilities; Lack of unified certification standards and standardized reporting procedures |  |   |
| <b>Advantage</b>     | More professional and authoritative than employee and Labour liability standards  | Stakeholder management concept and total process control   | Comprehensive and systematic technical specification  |
| <b>Disadvantage</b>  | Focusing only on labor rights does not fully reflect CSR  | It focuses on authentication and management and has weak normative standards for reporting       | Certification standards and procedures need to be improved                                  |

Source: *National Social Sciences Database*

### **3.5 Exploring the Relationship Between Risk Management and CSR Within the Context of Sustainability**

The integration of Corporate Social Responsibility (CSR) with risk management practices within the context of sustainability is an emerging area of interest in both academic research and corporate strategy. This relationship highlights how companies can leverage CSR initiatives to mitigate risks and enhance sustainable development. By incorporating CSR into risk management, firms can address social, environmental, and governance (ESG) risks more effectively, ensuring long-term sustainability and resilience.

#### **3.5.1 Risk Management Research development in China**

Risk management is the process of identifying, assessing, and controlling financial, legal, strategic, and security risks to an organization's capital and earnings. The goal of risk management for a company is to reduce risks to the lowest possible cost through effective management, which includes several aspects: risk identification, risk assessment, and risk response. Henri Fayol of France was the first to introduce risk management into business management, mentioning the concept in his 1916 book *General and Industrial Management*. The United States introduced mathematical statistics and probability theory into risk management in 1963, mentioned in an article titled "Enterprise Risk Management" published in the *Insurance Handbook*. This publication brought significant attention to risk management in Europe and America.

In October 1988, the first world congress on risk management was sponsored by the International Federation of Risk and Insurance Management Associations (IFRIMA). Today, the association has 22 members worldwide. In 1992, COSO (Committee of Sponsoring Organizations) issued the "Internal Control – Integrated Framework," which provides a risk management framework with five parts: the internal and external environment of risk management, risk evaluation, risk management activities, information communication and exchange, and risk monitoring (COSO, 1992). Since the 1990s, many multinational companies have applied the comprehensive risk management theory proposed by COSO in business management.

Ming-Chih Tsai (2008) discussed logistics management from both the planning and implementation levels, emphasizing that the implementation level should be the focus of risk management. Elahi (2013) notes that proper risk management can help companies achieve competitive advantages. His research underscores the importance of risk management by showing that effective risk management allows companies to achieve high-risk and high-profit business outcomes.

In China, Zhou Shifu (1980) was the first to mention "risk" in his article "Decision Analysis Methods in Economic Management," which initiated the research of risk management in the country. On June 6, 2006, the State-owned Assets Supervision and Administration Commission of the State Council issued the Guidelines for Comprehensive Risk Management of Central Enterprises, the first comprehensive risk management document in China, marking a new era for the field. Deng Jin'e (2006) classified and analyzed risks from legal, investment, contract, and logistics perspectives and proposed risk management countermeasures for enterprises.

Relevant research on risk management of logistics enterprises highlights several issues faced by logistics enterprises in China, such as weak awareness of risk management, inadequate risk control systems, and insufficient employee risk management capabilities (Fu, 2010). Liu Changxiu (2010) emphasized that logistics costs are a core part of enterprise logistics management and that reducing corporate liability risks is one aspect of controlling logistics costs. From the perspective of research content, risk factor identification and control dominate, while risk assessment and monitoring remain underdeveloped. Some well-known logistics companies, such as Maersk, have set up independent risk management departments to improve their risk control capabilities by establishing information systems.

### **3.5.2 Risk management in Chemical Logistics Industry**

With the continuous acceleration of China's industrialization process, as well as the long-term sustained and stable and high-speed growth trend of China's petroleum industry and chemical industry, the demand for hazardous chemicals in various

industries of China's industrial production is showing an increasing trend. As an important branch of China's modern logistics and transportation business activities, the importance of dangerous chemicals logistics and transportation business activities in China's modern hazardous chemicals production and sales business has gradually attracted widespread attention. Although the overall proportion of safety accidents occurring in the transit transportation of hazardous chemicals in China is low, however, the consequence from the hazardous chemical logistics accidents is bound to cause extremely serious social effects. Generally Dangerous goods refer to articles with physical, chemical or biological characteristics, generally with explosive, flammable, corrosive, radioactive and other dangerous characteristics, and are easy to cause damage and injury to people and property in the process of production, transportation, storage and use. Dangerous goods logistics refers to the logistics behaviour of special transportation of dangerous goods, which is qualified for dangerous goods transportation under the premise of specially organizing or technical personnel using equipment and technology that can ensure the safety of the transportation of goods and passing the strict review of relevant regulations.

The transportation of dangerous goods should not only meet the transportation conditions of general goods, strictly prevent overloading, speeding and other situations that endanger driving safety, but also meet special transportation conditions according to the physical and chemical properties of the goods. Its professionalism is mainly manifested in: vehicle specialization, personnel professionalism and other aspects. Hazardous chemicals have characteristics such as being explosive, flammable, or corrosive, which make their transportation highly risky (Lu, 1995).

The risk management for dangerous goods logistics and chemical logistics has a strong professional and technical important and difference, the management process focuses on safety, transportation control is very necessary, because its safety will affect the country's public safety.

Countries like the United States, Japan, and Germany have developed comprehensive legal frameworks for dangerous goods logistics management. In the U.S., the "Interstate Commercial Explosives and Other Dangerous Goods Safe Transport Promotion Act" was enacted in 1908, and the "Code of Federal Regulations No. 49" in

the 1990s added detailed regulatory standards (Pan and Xie, 2012). In comparison, China's system remains underdeveloped. Wang Lirong and Zhao Ying (2011) identified the major challenges in China's dangerous goods logistics, including ineffective government supervision and inadequate emergency response mechanisms.

For example, Liu Yongsheng and Zhang Haidi (2011) pointed out that establishing a systematic early warning system for hazardous chemicals logistics is essential to strengthening risk management. Pan Shu'e and Xie Kun (2012) illustrated how technologies like RFID and ADSL have been applied in warehouse management to reduce risks. Thus, to further develop China's hazardous goods logistics industry, the government must improve industry standards and leverage global research and practical experience.

### 3.5.3 The integration of CSR and Risk Management within the context of sustainability

Within the context of sustainability, the integration of risk management and Corporate Social Responsibility (CSR) is pivotal for businesses aiming to achieve long-term success while fulfilling their obligations to society and the environment. Risk management strategies are essential for identifying, assessing, and mitigating potential threats to a company's sustainability goals, including environmental degradation, supply chain disruptions, and reputational damage. By incorporating CSR principles into risk management frameworks, organizations can proactively address social and environmental risks, thereby enhancing their resilience and fostering sustainable practices.

Below listed some benefits from the integration of CSR and Risk management:

- Identifying and Mitigating ESG Risks

CSR initiatives play a crucial role in identifying and mitigating ESG risks. For instance, environmental risks such as climate change, resource scarcity, and pollution can significantly impact a company's operations and profitability. By adopting sustainable practices, such as reducing carbon emissions and waste, companies can mitigate these risks and enhance their long-term resilience. Research by Eccles, Ioannou, and Serafeim (2014) indicates that firms with strong sustainability practices tend to have lower risk profiles and better financial performance.

Similarly, social risks related to labor practices, human rights, and community relations can be mitigated through CSR initiatives. Companies that invest in fair labor practices, community development, and stakeholder engagement are better positioned to avoid reputational damage and operational disruptions. For example, the Rana Plaza disaster highlighted the importance of CSR in managing supply chain risks and the need for responsible sourcing practices (Amengual & Chirot, 2016).

- Enhancing Transparency and Accountability

CSR enhances transparency and accountability, which are critical components of effective risk management. By publicly reporting on their CSR activities and sustainability performance, companies can build trust with stakeholders and demonstrate their commitment to ethical practices. Transparency in reporting allows stakeholders to assess a company's risk exposure and management strategies, leading to more informed decision-making.

Furthermore, CSR reporting frameworks, such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB), provide standardized metrics for assessing and communicating ESG risks. These frameworks enable companies to identify potential risks, set targets, and track progress over time, thereby enhancing their ability to manage risks proactively (Eccles et al., 2014).

- Building Resilience and Competitive Advantage

Integrating CSR with risk management can build organizational resilience and create a competitive advantage. Companies that proactively address ESG risks are better equipped to adapt to changing market conditions, regulatory requirements, and stakeholder expectations. For instance, firms that invest in renewable energy and sustainable supply chains can reduce their vulnerability to fluctuations in energy prices and supply chain disruptions.

Moreover, CSR initiatives can drive innovation and create new business opportunities. By focusing on sustainability, companies can develop innovative products and services that meet the growing demand for environmentally and socially responsible solutions. This not only mitigates risks but also positions companies as leaders in the sustainability space, enhancing their competitive advantage.

Despite the benefits, integrating CSR with risk management poses several challenges. One key challenge is the difficulty in measuring and quantifying ESG risks. Unlike

traditional financial risks, ESG risks are often qualitative and can be challenging to assess. Additionally, the lack of standardized metrics and reporting frameworks can hinder the comparability and reliability of CSR disclosures.

Future research should focus on developing robust methodologies for assessing ESG risks and integrating them into risk management frameworks. Additionally, studies should explore the long-term impact of CSR on risk management and sustainability, considering different industry contexts and geographic regions(Elahi,2013).

One key aspect of integrating risk management and CSR is the recognition of the interconnectedness between financial risks and non-financial risks, such as those related to environmental and social factors. For example, climate change poses significant risks to businesses in terms of physical impacts, regulatory changes, and shifts in consumer preferences. By adopting CSR initiatives aimed at reducing greenhouse gas emissions, promoting renewable energy sources, and supporting climate resilience measures, companies can not only mitigate environmental risks but also contribute to long-term business sustainability. Furthermore, effective risk management practices can help companies identify opportunities for innovation and competitive advantage through CSR initiatives. For instance, investing in sustainable supply chain practices can reduce operational risks associated with resource scarcity, while also enhancing brand reputation and attracting environmentally conscious consumers. By integrating CSR considerations into risk assessment processes, companies can align their business objectives with broader societal and environmental goals, thereby fostering a culture of responsible and sustainable business practices.

#### 1) Literature Review for CSR Driven Risk Management

Corporate Social Responsibility (CSR) has evolved beyond being a philanthropic endeavour to become an integral aspect of organizational strategy. In recent years, scholars have increasingly focused on the intersection of CSR and risk management, recognizing that ethical, social, and environmental considerations play a pivotal role in shaping the resilience and sustainability of businesses.

- The Evolving Paradigm of CSR-Driven Risk Management:

Garriga and Mele's (2004) classification of CSR theories identified Ethics as one of the key pillars. Building on this foundation, researchers have explored the integration

of CSR into risk management, recognizing that ethical considerations are inseparable from effective risk mitigation.

According to Freeman's (1984) Stakeholder Theory, organizations operate within a network of relationships, and ethical lapses can lead to reputational damage and increased vulnerability to risks. Scholars argue that viewing risk management through a CSR lens enables organizations to align their practices with stakeholder expectations, fostering a proactive and comprehensive approach to risk mitigation.

- **Reputational Risk and CSR:**

Reputation has emerged as a critical asset for organizations, influencing consumer behaviour, investor decisions, and employee morale. Fombrun and Shanley (1990) highlight the importance of reputation in the corporate context, emphasizing that it is shaped by both financial performance and non-financial factors, including CSR.

Research by Barnett (2007) and Morsing and Schultz (2006) delves into the concept of reputational risk management through CSR. They argue that organizations actively engaging in socially responsible practices build a reservoir of goodwill, which acts as a buffer during times of crisis. Conversely, the absence of CSR initiatives or ethical misconduct amplifies reputational risks, potentially resulting in long-lasting damage.

- **Legal and Regulatory Compliance:**

Legal and regulatory compliance has traditionally been a cornerstone of risk management. However, the landscape is shifting towards a broader consideration of CSR-related regulations. Research by O'Rourke (2003) and Waddock and Bodwell (2004) emphasizes the need for organizations to proactively integrate CSR into their risk management strategies to navigate the evolving regulatory environment.

The work of Scherer and Palazzo (2007) delves into the concept of 'CSR Regulatory Fit,' suggesting that organizations demonstrating a genuine commitment to CSR are better positioned to navigate and comply with emerging regulations. This literature underscores the integral role of CSR in anticipating and addressing legal and regulatory risks.

- **Supply Chain Resilience and CSR:**

Global supply chains are susceptible to disruptions arising from ethical lapses within the network. Carter and Rogers (2008) highlight the importance of CSR in supply chain management, emphasizing that responsible sourcing and ethical supplier relationships contribute to resilience. The integration of CSR into supply chain risk

management involves mapping the social and environmental impact of the entire supply chain. This proactive approach, as suggested by Pagell and Shevchenko (2014), enables organizations to identify vulnerabilities and establish mechanisms to address ethical concerns, contributing to a more resilient supply chain.

- Financial Performance and Investor Relations:

The link between CSR and financial performance has been a subject of extensive research. The work of Margolis and Walsh (2001) and McWilliams and Siegel (2000) underscores the positive correlation between CSR practices and financial outcomes. Extending this perspective, researchers like Flammer (2013) and Eccles and Serafeim (2013) explore the role of CSR-driven risk management in attracting socially responsible investors.

By aligning business strategies with Environmental, Social, and Governance (ESG) criteria, organizations not only enhance their reputation but also mitigate the risk of divestment due to ethical concerns. The literature suggests that CSR-driven risk management contributes to a broader investor base, positively influencing financial performance.

- Human Capital and Employee Engagement:

Internal stakeholders, particularly employees, are crucial to an organization's success. The literature on CSR-driven risk management emphasizes the significance of aligning organizational values with those of employees. Research by Turker (2009) and Glavas (2016) explores the impact of CSR on employee engagement and satisfaction.

CSR-driven risk management in the context of human capital involves fostering an ethical corporate culture, promoting diversity and inclusion, and ensuring fair labor practices. The work of Shen and Benson (2016) suggests that organizations actively addressing social and ethical responsibilities experience reduced turnover and increased employee loyalty, mitigating risks associated with talent attrition and dissatisfaction.

- Embracing Proactive CSR Strategies:

While traditional risk management tends to be reactive, scholars advocate for a more proactive stance when integrating CSR into risk management strategies. Zeng and Xu (2012) propose a model for proactive CSR risk management, highlighting the importance of leveraging CSR initiatives as opportunities for innovation, differentiation, and competitive advantage. By adopting a proactive approach, organizations not only

identify potential risks but also position themselves as ethical leaders, fostering sustainability and long-term success. The literature emphasizes the need for a cultural shift within organizations, promoting a mindset where CSR is viewed as an integral part of risk management rather than a separate, discretionary activity.

The literature on CSR-driven risk management signifies a shift from traditional risk assessments to a more comprehensive, proactive, and ethical approach. As organizations navigate an increasingly complex and dynamic business environment, the integration of CSR into risk management strategies is not only a strategic imperative but also a moral obligation. By embracing CSR-driven risk management, businesses can foster sustainability, resilience, and long-term success in an ever-evolving global landscape. The existing body of literature provides a foundation for future research and practical implementations, encouraging organizations to consider CSR as a fundamental aspect of risk management strategies.

2) Demand for CSR Driven Risk management in Chinese Chemical Logistics Industry

Although there are several kinds of traditional risks for the company, such as marketing risk, liquidity risk, operational risk, default risk, etc. for the chemical dangerous logistics companies, these risks are associated and could lead to linkage accidents. Furthermore, From the research literature above, the current characteristics of dangerous goods logistics operation enterprises are generally in small scale, under low logistics efficiency, large number of phenomena that do not conform to standards, standardization, and low technical level. All these has the high demand for comprehensive risk management. CSR is related to corporate risk management through two means: by providing intelligence about what those risks are, and by offering an effective means to respond to them. The key to both, as implied in the CSR definition, is more effectively “managing stakeholder relationships (Kytte, B & Ruggie J.G.,2005). Managing stakeholder relationships is a key dimension of effective CSR programs. The key to both CSR and risk management, as implied in the above definitions, is more effectively “managing stakeholder relationships. Managing stakeholder relationship is important for Chinese chemical logistics companies because any stakeholders could impact the business running. For example, Any dangerous chemical linkage accidents may finally cause serious social risks and lead

the company to either great penalty or lose the license for running chemical logistics business. Social risk is a rising area of concern for dangerous chemical logistics industry. To some extent, to manage all these risks need to manager all the related stakeholders in the whole business. A corporate stakeholder can be any person, group or organization that can place a claim on a company's attention, resources, or output. It is quite true in the Chinese chemical logistics industry because it is under the supervision of numbers of different government sectors, customers and employees with strong domination position, public attentions on operation and environment concern, etc. Under such circumstance, even though the companies are very familiar with the traditional risk management, for example economic, technological, and political risks, the increasing complexity of chemical logistics industry also means that risks are much probably to mix and crosscut their categories. Especially the emergence case happens, for example, the delayed rescue for one road accident may not only cause economy risk but also get media involvement and lead to public or social risks. The emergence of a social risk with the emergence accident may still have wide range impacts on various aspects of business from the stakeholder dynamics.

The goal of corporate risk management is to create a reference framework for companies to handle risk and uncertainty. Risk is present in any economic activities. The risk identifications, assessment and management should be part of the companies' strategy plan and be put at the level of company strategy target. Meanwhile, Same as risk management, CSR also needs to develop for the strategic level and get the support from the board of the company. For the complex and evolving area of social risk, CSR represent an excellent mechanism for addressing the various challenges in the Chemical logistics industry. Risk management should be adapted to include CSR programs. CSR provides the framework and principles for stakeholder engagement, supplies a wealth of intelligence on emerging and current social issues/groups to support the corporate risk agenda, and ultimately serves as a countermeasure for social risk. Nike is an example of one of the pioneer companies to link a comprehensive CSR program with risk management as part of its overall approach to business performance. (Kytte & Ruggie,2005) In 1996, Nike developed its first department for managing its supply chain partner' compliance. In year 2005, BASF

launched its “1+3” programme to invite the suppliers to join their CSR programme which indicated that only the perform CSR well to be the qualified BASF supply chain supplier. After 2020, The logistics suppliers need to comply the Tfs (Together for Sustainability) audit to check its supply chain partners’ compliance. Right now, 40 TfS member companies represent over Euro 600billion global turnover and spent over Euro 400billion. Almost all of them has the factories in China and created stable and great amount of chemical logistics demand. In October 2021, TfS member company BASF launched “Sustainability Covalence”, an alliance of 14 founding partners to promote sustainable growth by taking joint actions in areas of low-carbon development, circular economy, and societal engagement across the value chain of key industries. China aims to peak CO<sub>2</sub> emissions by 2030 and strive for carbon neutrality by 2060. These global companies face the new reality that has changed the traditional risk and risk management: the emergence of the social risk in the Chinese chemical logistics industry cannot be managed by traditional method especially the current “Double Carbon” Target. The linkage of CSR to core business process can improve a company’s overall approach to risk management by improving strategic intelligence and knowledge of social issues. It will help the company to not only design better risk management at current stage but also lead to long term sustainability. (Kytte & Ruggie,2005).

In conclusion, the integration of risk management and CSR within the context of sustainability is essential for businesses to navigate the complex challenges of the modern operating environment while simultaneously creating value for society and the environment. By proactively addressing social and environmental risks and seizing opportunities for sustainable innovation, companies can enhance their resilience, competitiveness, and long-term viability in a rapidly changing world. Both risk management and CSR targets to manage the various stakeholder’s relationship and need the attentions from the strategy level. Furthermore, practically, the risk management in form of CSR is promoting by the key chemical suppliers which are the important customer for the Chinese chemical logistics companies. Without doubt, both CSR and risk management will need the initial input financially and other resources for achieving the long-term sustainability. Although there is always the argument if CSR will cause profit losing or lead to long term sustainability, the expression

sustainability is most described as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs,” which is the definition of sustainable development by the UN’s Brundtland Commission in 1987. How to manage the associated financial demand for this purpose under the sustainable development target? The study in the next section focus on the Green Finance development to explore the direction for the research.

### **3.6 Effects of Corporate Social Responsibility on Corporate Performance**

#### **3.6.1 Review for the relationship between CSR & Corporate Performance**

Corporate Social Responsibility (CSR) has become a critical focus for companies aiming to enhance their competitive advantage and overall performance. The relationship between CSR and company performance is multifaceted, encompassing various dimensions of CSR activities and their impact on financial, operational, and market performance. This section reviews the existing literature to explore how different aspects of CSR influence corporate performance. By examining these dimensions, this review aims to provide a comprehensive understanding of the complex interplay between CSR and corporate performance.

- **Financial Performance**

Numerous studies have investigated the link between CSR and financial performance, yielding mixed results. Some research indicates a positive relationship, suggesting that CSR activities can enhance profitability through improved reputation, customer loyalty, and operational efficiencies (Margolis & Walsh, 2003; Orlitzky et al., 2003). For instance, a meta-analysis by Orlitzky, Schmidt, and Rynes (2003) found a positive correlation between CSR and financial performance, highlighting that socially responsible firms tend to perform better financially. One of the primary mechanisms through which CSR influences financial performance is by enhancing corporate reputation. Companies that are perceived as socially responsible are more likely to attract and retain customers, which can lead to increased sales and market share. Studies by McWilliams and Siegel (2001) have demonstrated that CSR can serve as a form of advertising, differentiating a firm from its competitors and creating a favorable public image. This enhanced reputation can translate into customer loyalty, allowing companies to charge premium prices and reduce marketing costs.

Moreover, CSR can lead to cost savings through improved operational efficiencies. For example, initiatives aimed at reducing energy consumption or minimizing waste can lower operating expenses. According to research by Hart and Ahuja (1996), firms that reduce their emissions and waste often see significant cost savings, which can directly impact their bottom line. Additionally, CSR activities related to employee welfare, such as providing better working conditions and benefits, can reduce turnover rates and increase productivity, further contributing to financial performance (Turban & Greening, 1997). Investments in CSR can also attract socially responsible investors, thereby increasing access to capital. Eccles et al. (2014) found that companies with strong sustainability practices tend to have higher stock valuations and lower capital constraints. This is because socially responsible investors are increasingly looking for companies that align with their values, creating a favorable investment climate for firms with robust CSR programs.

However, the relationship between CSR and financial performance is not always straightforward. Some studies have reported neutral or even negative effects, suggesting that the costs associated with implementing CSR initiatives may outweigh the benefits in certain contexts (Friedman, 1970; Vance, 1975). This discrepancy can be attributed to various factors, including the type of CSR activities undertaken, the industry in which the firm operates, and the firm's overall strategy and resources. Therefore, while the general trend points towards a positive relationship, the specific outcomes can vary widely based on contextual factors.

- **Operational Performance**

CSR initiatives can also impact operational performance by promoting efficient resource use and waste reduction. Companies that engage in environmentally sustainable practices often experience cost savings and improved operational efficiencies (Hart & Ahuja, 1996). Furthermore, CSR can enhance innovation as firms invest in sustainable technologies and processes, leading to long-term operational improvements (Porter & van der Linde, 1995).

Environmental sustainability initiatives, such as reducing energy consumption, water usage, and waste generation, can lead to significant cost savings. For instance, General Electric's "Ecomagination" initiative, which focuses on creating environmentally friendly products and reducing its own environmental impact, reportedly generated billions in revenues and cost savings (GE, 2014). By investing in

energy-efficient technologies and sustainable practices, companies can reduce their utility bills and waste disposal costs, thereby improving their operational efficiency.

Additionally, CSR can drive innovation by encouraging companies to develop new products and processes that address social and environmental challenges. Porter and van der Linde (1995) argued that environmental regulations and CSR initiatives could spur innovation by pushing firms to find more efficient ways of operating. This "innovation offset" can lead to the development of new technologies and business models that not only comply with environmental standards but also enhance competitiveness and operational performance.

Employee engagement and productivity can also benefit from CSR initiatives. Programs focused on improving working conditions, providing training and development opportunities, and fostering a positive work environment can lead to higher employee morale and productivity. Companies that prioritize CSR often report lower employee turnover rates and higher levels of employee satisfaction and engagement (Turban & Greening, 1997). For example, Google's commitment to CSR, including its focus on sustainability and employee well-being, has been linked to high levels of employee satisfaction and productivity, which in turn contribute to its operational success.

- Market Performance

CSR activities can influence market performance by differentiating a company from its competitors. Firms with strong CSR reputations may enjoy higher market valuations and increased stock performance (Waddock & Graves, 1997). Investors increasingly consider CSR performance as a criterion for investment decisions, which can drive up the stock prices of socially responsible companies (Eccles et al., 2014). Market differentiation through CSR can enhance a company's brand value and customer loyalty. Consumers are becoming more conscious of the social and environmental impact of their purchases, and they tend to prefer brands that align with their values. For example, companies like Patagonia and Ben & Jerry's have built strong brand identities around their commitment to social and environmental causes, which has helped them attract and retain loyal customers. Moreover, CSR can positively affect stock performance by attracting a growing segment of socially responsible investors. These investors seek to align their investment choices with their values, favoring companies with strong CSR records. Eccles et al. (2014) found that companies with

robust sustainability practices tend to have better stock market performance and lower volatility, as they are perceived to be better managed and less risky.

The market performance of CSR-engaged companies can also be influenced by the growing trend of ESG (Environmental, Social, and Governance) investing. ESG criteria are increasingly being integrated into investment analyses and decision-making processes. Firms that score highly on ESG metrics often attract more institutional and retail investors, leading to increased demand for their shares and higher stock prices (Friede, Busch, & Bassen, 2015).

However, the impact of CSR on market performance can be contingent on various factors, including the industry context, the specific CSR initiatives undertaken, and the overall economic environment. While CSR can enhance market performance by differentiating the firm and attracting investors, the extent of this impact can vary. Companies operating in industries with high social and environmental impacts may see more pronounced benefits, while those in less sensitive sectors might experience less significant market differentiation from CSR activities (Surroca et al., 2010).

### 3.6.2 Theoretical Perspectives

Corporate Social Responsibility (CSR) is the comprehensive consideration of societal, economic, and environmental stakeholders' interests in corporate decision-making. Its role is to have a positive impact on all stakeholders, which is crucial for a company's survival. CSR is a concept where companies voluntarily contribute to society and the betterment of their own enterprises, creating a cleaner environment. Motivations for engaging in CSR may include improving financial performance, enhancing customer loyalty, and fostering environmental development, driven by pressures from consumers, civil society, and corporate objectives. Since CSR is typically voluntary, each company independently determines the scope of its CSR activities. While CSR has the potential to make positive contributions to society and business, in practice, fulfilling CSR often requires additional investment costs and may not yield immediate returns. For instance, logistics companies may need to invest in equipment upgrades for environmental responsibility or purchase advanced equipment to enhance employee safety and comfort, thus incurring additional costs. As a result, there are

differing opinions and debates among business managers and scholars regarding whether fulfilling CSR positively impacts company performance.

The relationship between Corporate Social Responsibility (CSR) and Corporate Financial Performance (CFP) has been a central focus of scholarly inquiry and debate, attracting significant attention from researchers, practitioners, and policymakers alike. CSR encompasses a wide range of voluntary activities undertaken by corporations to address social and environmental concerns, going beyond legal obligations to contribute to the well-being of society. In contrast, CFP encompasses various financial metrics used to assess a company's profitability, growth, and value creation for shareholders.

Early studies investigating the CSR-CFP relationship produced inconclusive findings, with some scholars reporting positive associations between CSR activities and financial performance, while others found no significant correlation (McGuire et al., 1988; Waddock & Graves, 1997). These disparate results sparked further exploration into the mechanisms and conditions under which CSR may influence CFP, leading to the development of various theoretical perspectives and empirical methodologies. One prominent theoretical perspective is the "good management" hypothesis, which posits that companies engaging in CSR activities demonstrate superior management quality, leading to improved financial performance (Margolis et al., 2007). According to this view, CSR initiatives such as environmental sustainability, ethical governance, and stakeholder engagement contribute to operational efficiency, risk mitigation, and enhanced reputation, thereby generating long-term value for shareholders.

Another theoretical perspective is the "stakeholder theory," which emphasizes the importance of considering the interests of all relevant stakeholders in corporate decision-making (Freeman, 1984). Proponents of this perspective argue that CSR activities can enhance stakeholder relationships, build trust, and create shared value, ultimately contributing to improved financial performance. By addressing the needs and concerns of employees, customers, suppliers, and the broader community, companies can enhance their competitiveness and resilience in the marketplace.

The Triple Bottom Line (TBL) theory, introduced by Elkington (1997), represents a significant departure in how corporations evaluate their performance, advocating for a holistic assessment that transcends traditional financial metrics. TBL underscores the interconnectedness of economic, social, and environmental dimensions in corporate decision-making. According to this framework, businesses should not only be held accountable for their economic outcomes but also for their impacts on society and the environment. By embracing the triple-bottom-line perspective, companies can identify opportunities to generate value for all stakeholders while minimizing adverse environmental and social effects.

In contemporary discourse, Corporate Social Responsibility (CSR) is often synonymous with the triple bottom line. This integrated approach to business performance recognizes the interdependence of social, environmental, and economic factors. The objective of adopting a triple bottom line approach is to ensure that businesses operate in a manner that is socially responsible, environmentally sustainable, and economically viable. Corporate Financial Performance (CFP) encompasses the extent to which a firm achieves its financial objectives and is a critical aspect of financial risk management. It involves measuring the outcomes of a company's policies and operations in monetary terms, providing insights into the firm's overall financial health over a specific period. Various metrics are used to assess profitability in accounting, including gross operating profit, net profit margin, return on assets, return on equity, return on sales, and return on capital employed, among others. It is imperative for companies to prioritize their financial performance, as profitability is essential for their continued existence and success. Without generating profits, businesses would struggle to sustain their operations and fulfill their obligations to stakeholders. However, the triple bottom line framework emphasizes that financial success should not come at the expense of social and environmental well-being. Instead, businesses should strive to achieve a balance that ensures sustainable value creation for all stakeholders.

Overall, the integration of CSR and the triple bottom line approach reflects a broader understanding of business success—one that goes beyond short-term financial gains to encompass long-term societal and environmental impacts. By embracing this

holistic perspective, companies can position themselves as responsible corporate citizens while also securing their financial viability in the marketplace.

Measuring Corporate Financial Performance (CFP) entails the use of either accounting-based or market-based measures. Accounting-based measures, such as Return on Assets (ROA), Return on Equity (ROE), Return on Sales (ROS), and Earnings Per Share (EPS), provide insights into a firm's financial health by analyzing its operational and financial efficiency. These metrics offer a direct assessment of the company's profitability and operational effectiveness over a specified period, making them valuable tools for evaluating CFP. On the other hand, market-based measures offer a different perspective, relying on investors' perceptions of a company's performance as reflected in its stock price and market capitalization. Market-based measures include Price Per Share, EPS, and Market Value-Added (MVA). Price Per Share represents the market value of a company's shares and reflects investors' expectations regarding its prospects. EPS measures the portion of a company's profits allocated to each outstanding share of common stock, providing insights into shareholder returns. MVA assesses the value created for shareholders by comparing a company's market value to its invested capital, reflecting its ability to maximize shareholder wealth through efficient resource allocation. While market-based measures are less susceptible to manipulation and offer real-time assessments of a company's performance, they primarily focus on shareholder interests, potentially overlooking other stakeholders' concerns. In contrast, accounting-based measures provide a comprehensive analysis of a firm's financial performance, taking into account various stakeholders' interests beyond shareholders. As such, many studies adopt accounting-based variables, such as ROA, ROE, ROS, and EPS, to assess CFP, recognizing the importance of considering a broader range of factors in evaluating corporate financial performance.

### 3.6.3 CSR and company performance in the industry practice context

In contemporary business discourse, Corporate Social Responsibility (CSR) stands as a pivotal concept, offering avenues for positive contributions to societal development and fostering sustainable business practices. Today, CSR is often intertwined with the notion of the triple bottom line, which epitomizes an integrated approach to evaluating

business performance. The triple bottom line underscores the interconnectedness of social, environmental, and economic considerations, advocating for a balance that ensures businesses operate in a manner that is socially responsible, environmentally sustainable, and economically viable.

Within this framework, Corporate Financial Performance (CFP) assumes a critical role, encompassing the extent to which financial objectives are achieved and serving as a cornerstone of financial risk management. CFP involves the measurement of a firm's policies and operations in monetary terms, providing insights into its overall financial health over a specified period. Profitability, a key component of CFP, is assessed through various accounting metrics such as gross operating profit, net profit margin, and return on assets, among others. Given its pivotal importance, maintaining financial viability is imperative for businesses, as profitability is essential for their sustenance and growth.

However, contemporary corporate management practices emphasize that business operations should extend beyond mere profit-making endeavors. Instead, managers are urged to consider the interests of diverse stakeholders—including employees, business partners, customers, shareholders, and society at large—in their decision-making processes. This inclusive approach not only enhances stakeholder satisfaction but also offers the best guarantee for consistent profitability in the long run. In the context of industries like chemical logistics, achieving financial success is contingent upon delivering services that enable firms to generate sufficient profits. However, profitability is influenced by a myriad of factors, both internal and external. Among the external factors are operational disruptions stemming from interactions with host communities. Concerns over negative environmental impacts and potential societal conflicts have prompted the advocacy of CSR as a means of addressing these challenges. While CSR presents a promising avenue for resolving conflicts and fostering sustainable relationships between industries and communities, challenges remain regarding its implementation and the quantification of its benefits for both parties involved.

Empirical studies have provided valuable insights into the relationship between CSR and Corporate Financial Performance (CFP), shedding light on the potential benefits and complexities associated with CSR initiatives. Supporting the "good management"

hypothesis, research suggests that companies with robust CSR practices often reap financial rewards. Orlitzky et al. (2011) and Eccles et al. (2014) have found that firms demonstrating strong CSR performance tend to experience higher profitability, lower costs of capital, and increased shareholder value. These findings underscore the notion that CSR can be a driver of financial success, signaling to investors and stakeholders alike that the company is managed effectively and operates with integrity. Furthermore, CSR has been identified as a source of competitive advantage, fueling innovation, enhancing customer loyalty, and facilitating market differentiation. Porter and Kramer (2006) argue that CSR initiatives can create value for companies by addressing societal needs and challenges in ways that align with their business objectives. By integrating social and environmental considerations into their strategies, companies can enhance their reputation, attract talent, and foster long-term relationships with customers and communities.

Nevertheless, the relationship between CSR and CFP is multifaceted and contingent upon various factors. Industry characteristics, firm size, and geographic location play significant roles in shaping the nature and magnitude of this relationship. Margolis and Walsh (2003) suggest that different industries may derive varying degrees of benefit from CSR initiatives, with some sectors experiencing greater financial gains than others. Similarly, the size and resources of the firm can influence its capacity to invest in CSR and realize tangible financial returns. Larger, more resource-rich companies may have greater flexibility and capability to implement CSR programs effectively. Moreover, cultural and institutional differences across countries can impact the expectations and motivations for CSR, leading to diverse outcomes in different contexts. Aguilera et al. (2007) highlight the importance of considering the socio-cultural environment in which companies operate as cultural norms and institutional frameworks shape stakeholders' perceptions and responses to CSR initiatives. As such, the effectiveness of CSR in driving financial performance may vary across national boundaries, requiring companies to tailor their approaches to suit local conditions and stakeholder expectations.

Although there are empirical evidence suggests that CSR can have a positive impact on Corporate Financial Performance, providing companies with opportunities to enhance profitability, gain competitive advantage, and strengthen stakeholder relationships. However, the complex and context-dependent nature of the CSR-CFP

relationship underscores the need for further research and nuanced understanding of the underlying mechanisms and dynamics involved. While research on CSR and Corporate Financial Performance has been conducted in various industries, including pharmaceuticals, empirical studies in this domain, particularly in China, remain relatively scarce. Despite China's significant presence in global chemical logistics, there is a dearth of research examining the impact of CSR on the financial performance of quoted chemical logistics firms. Hence, there is a pressing need to investigate this relationship to contribute to the existing body of knowledge in this field. By examining the effect of CSR on the financial performance of chemical logistics firms in China, this study aims to extend the frontier of knowledge and shed light on an area that warrants further exploration. Previous studies have yielded mixed results, with some reporting a positive effect of CSR on financial performance, while others have found negative effects. These discrepancies underscore the complexity of the CSR-CFP relationship and highlight the need for further research in this area.

### 3.6.3 Critics of CSR and company performance relationship

Critics of the CSR-CFP relationship raises valid concerns regarding the potential limitations of focusing solely on financial metrics. They argue that prioritizing financial performance may lead to a narrow assessment of corporate success, overlooking the broader societal impacts of CSR initiatives. Critics caution against viewing CSR solely as a tool for achieving financial gain, as this instrumentalization may undermine the genuine commitment to social and environmental responsibility. Scholars such as Matten and Moon (2008) stress the importance of adopting holistic performance measurement frameworks that encompass both financial and non-financial dimensions of corporate value creation. By integrating social, environmental, and governance factors into performance evaluation, companies can more accurately assess their overall impact on society and the environment, ensuring a more sustainable and responsible approach to business practices. Thus, while CSR may offer potential financial benefits, critics emphasize the need for a balanced and comprehensive approach that considers the broader implications of corporate actions on stakeholders and the planet.

In conclusion, the relationship between CSR and company performance remains a complex and multifaceted phenomenon, with implications for corporate strategy, governance, and stakeholder engagement. While evidence suggests that CSR can contribute to financial performance under certain conditions, the nature and magnitude of this relationship are subject to various contextual factors and managerial decisions. Moving forward, research should continue to explore the mechanisms underlying the CSR-CFP relationship and develop comprehensive approaches to measuring and managing corporate value creation in an increasingly interconnected and interdependent world. The exploration of CSR and its relationship with company performance in this literature review highlights the dynamic and multifaceted nature of corporate social responsibility. From the early days of philanthropy to the contemporary emphasis on sustainability, CSR theories have adapted to societal changes and business realities. The integration of diverse perspectives, the evolution of theories over time, and the consideration of cultural variations provide a rich tapestry for understanding the complexities of CSR. While each theory contributes valuable insights, the ongoing challenge lies in translating these theories into actionable strategies that create positive impacts on society. The future of CSR research and practice will likely involve greater collaboration between academia, businesses, and policymakers to address the evolving challenges and opportunities in the pursuit of responsible and sustainable corporate behaviour.

## **Chapter 4 Green Finance and Sustainable Development**

### **4.0 Introduction**

This chapter continues the literature review and explore the Green Financing and its relationship with sustainable business development. First of all, the literature review for Green Financing development including how is the research development for Green Finance in the global market and how is the situation in China, what theories are available for Green Financing; Secondly, the research need to look into what are the green finance for the logistics industry and study its potentials together with CSR and sustainability.

#### **4.1 Research for Green Finance and Sustainability**

##### **Green Finance**

Green finance is one of a few terms used to describe activities related to the two-way interaction between the environment and finance and investment. It has become a familiar expression over the last decade, partly due to the creation of many national green investment banks and a rapidly growing green bond market.

##### **Green Finance Definitions**

Although the term of Green Finance is increasingly used in many countries across the world, there is no precise and commonly agreed definition of what constitutes green finance. From different organisations, there are lots of working definitions. Researchers sort from related organisations' official website for green finance contains different context (Zhang, W. and Zhao, D. 2024), refer to the below table 3.4:

**Table 3.4 Green Finance Working Definitions**

| Organisations   | Working Definitions   |
|---|---|
| Organisation for Economic Co-operation and Development (OECD) | GF is finance for achieving economic growth while minimising waste and improving efficiency in the use of natural resources                                 |
| Green Finance Initiative                                      | Funding any means of reducing carbon emissions or raising resource efficiency.  |
| G20 Green Finance Study Group (G20 SFSG)                      | Financing of investments that provide environmental benefits in the broader context of environmentally sustainable development.                             |
| Bank of China   | A series of institutional arrangements to attract investment into green industries through financial services, including green bonds, shares and insurance. |
| European Banking Federation                                   | GF includes but not limited to 1) Environmental aspects 2) Climate change-related aspects.  |

Although there is no single and fixed definition of green finance, but most definitions focus on the role of the financial system in supporting the environment, preventing environmental damage and managing environmental risks. But Höhne / Khosla / Fekete / Gilbert (2012) insisted green finance is a broad term that can refer to financial investments flowing into sustainable development projects and initiatives, environmental products, and policies that encourage the development of a more

sustainable economy. To this extent, such definition is somewhat similar with Sustainable finance which considers not just environmental but also social, economic and governance issues.

There are also majority of green finance definitions related or linked to providing the service of *investment* towards “green’ sectors which protect or enhance the environment. Zadek and Flynn (2013) indicated that green finance is often used interchangeably with green investment. However, in practice, green finance is a wider lens including more than investments as defined by Bloomberg New Energy Finance and others. Most important is that it includes operational costs of green investments not included under the definition of green investment. Most obviously, it would include costs such as project preparation and land acquisition costs, both of which are not just significant but can pose distinct financing challenges.

Green finance can also be a whole-organization approach, driving strategy, culture, and business process throughout a financial services firm. Price Waterhouse Coopers Consultants (PWC) define it (Berensmann, K. & Lindenberg, N., 2019), “For the banking sector, green finance is defined as financial products and services, under the consideration of environmental factors throughout the lending decision making, ex-post monitoring and risk management processes, provided to promote environmentally responsible investments and stimulate low-carbon technologies, projects, industries and businesses”.

From the above review, green finance is a growing phenomenon in the world especially with the global transition to a low-carbon economy under the global call for carbon peak and carbon neutrality. There are several related terms like Responsible investment (RI), Environmental, Social and Governance (ESG), Sustainable finance and climate finance. Such terms used to label activities related to the two-way interaction between the *environment* and *finance* and *investment*. A key element of GF is sustainable investment and banking, where investment and lending decisions are taken based on environmental screening and risk assessment to meet environmental sustainability standards. (Ulrich Volz et al., 2015)

#### **4.1.1 Green Finance Research in the global market**

Green finance has been recognized earlier in the international market other than in China, and most of them focus on the environmental risks and assessment caused by the financial industry.

1) The perspectives on green finance. On the one hand, from the various definition for green finance, it leads to the understanding that it is environmental financing which is to readjust the business philosophy, management policies and business processes of the financial industry from the perspective of environmental protection, to achieve sustainable development. In 1980, the United States "Superfund Act" (CERCLA) required that enterprises must take responsibility for the environmental pollution caused by them, so that banks must pay high attention to and seriously prevent the potential environmental risks that they may cause. American scholars T.E. Graddel and B.R.Allenby (2003) argued from the perspective of industry and environment that environmental damage has become a negative consequence of the entire economic activity, especially for those developed countries where the service industry dominates the economy. On the other hand, finance itself as a service industry, it has been included in the theoretical framework of service industry and environmental protection, so the research on finance and environmental protection should be pushed to a new stage. Therefore, the research on environmental performance indicators of financial industry, the relationship between the main business of financial industry and sustainable development, and the research on "environmental management of financial institutions" should be strengthened.

2) Research on green financial environment assessment indicators. The Export-import Bank of the United States environmental assessment policy, suggest making decisions after considering the environmental impact of the projects; Centre for Sustainable Investment formulated a set of environmental risk assessment scheme, as the environmental risk rating of the enterprise. It suggested that such assessment needs to be worked from the internal management process of the financial industry, and to do through multiple index evaluation in the process of "green" performance, in a more objective and more comprehensive. The green finance performance shall be assessed, supervised, and managed jointly.

3) Comparative study on green investment and mainstream investment. As early as 1991, the Association of American Banks surveyed its 1741 members and found that

62.5% of the banks had rejected loan applications due to possible environmental debts. According to INSEAD, there were about 45 green ventures in Europe and America in 2002, with a total investment of 100 million euros, mainly investing in renewable energy, water, and clean technology equipment(Zhang, W. and Zhao, D. 2024).

4) Development for various green finance Instrument with the green finance grows rapidly. Green finance comprises not only just financing of all forms of investment or lending that consider environmental impact and enhance environmental sustainability, but also financing of public green policies, green financial system. Although there are various kinds of green loans, insurance to support the sustainable development, the common GF instrument is the green bond. By the Davos Agenda, globally the green bonds market could be worth \$2.36 trillion by 2023, the top 3 green bond issuers are the US, China and France (World Economic Forum, 2021)

#### **4.1.2 Green Finance Research in China**

In China, the research for green finance is mainly studied from the aspects of the resource protection from financial industry to the economy, and sustainable development of finance and economy, which is embodied in the following aspects.

1) The connotation of green finance.

Yu Yongda, Guo Peichuan, Zhang Wenzhong, Li Xiaoyan, Wang Linping, Zheng Hairong et al. (2007) conducted a comparative study on green finance and its related concepts. In China Green finance has been first in the news since 1991, but at that time green finance was just a synonym for post savings, "green" represented the color of post office, and "finance" represented the emerging post saving business. Ken Gang (1995) endowed green finance with new connotation and believed that finance should play a guiding role in environmental protection. Qiao Haishu (1999) and Deng Ying (2002) called green finance ecological finance and studied the relationship between finance and environmental protection and the relationship between finance and sustainable development of nature. In January 2004, Lei, L. and Gao, H., put forward the concept of financial ecology, that is, to introduce related concepts and principles of ecology into the analysis of financial development problems and study

the coordination between financial subjects and financial ecological environment, that is, the relationship between finance and sustainable social development.

## 2) Green Finance and sustainable development

He XiuXing and Gao Jianliang (1998), tried to use the theory of sustainable development, study the effects of financial resource allocation activities on the environment. In their study, green finance includes various green policies from the directions of the loan policy, the object of loan, the loan conditions, and the type of loan to support green industry. The priority may as the way of long term credit, premier interest rate etc. Du Liqun (1999) believes that the goal of sustainable investment is to reduce poverty and improve the average living standard of human beings. Technological innovation and effective policies should be adopted to change the investment environment and make the price closer to the social cost of production rather than the private cost. Bai Qinxian et al. (2001) raised the sustainable development of the finance. They took "finance" as a special resource and holding that the development and utilization of financial resources is an important component of expanding the resource base and improving the efficiency of resource utilization in the social economy. Deng Ying (2002) believes that green finance can objectively promote enterprises' environmental awareness and behavior, and greatly reduce the expenditure on remediation after pollution occurs. Yu Yongda and Guo Peiyuan (2003) believed that as a part of the economic system, the financial industry's internal operation and related businesses are closely related to environmental problems. Zhang Wenzhong (2005) believes that green finance can promote the coordinated development of environmental resources protection and economy. Li Hongzhong, Yu Xiangyong (2007) believe that green finance can promote the upgrading and transformation of resource economy to circular economy. Guo Yingying(2009) believes that commercial banks' fulfillment of environmental responsibility is an important part of their undertaking of corporate social responsibility, which is consistent with the development of "green finance". Green finance could help the finance industry to fulfil their environmental responsibility which lead to business sustainability in the long run.

3) Environmental risks of green finance. Gao Jianliang (1998) thinks the financial sector and the government's environmental protection ministry should actively

cooperate and implement national environmental protection policies and regulations, and the government environmental protection departments should also take the initiative to provide related information to financial departments and cooperate with financial departments to implement "green finance" and strive to prevent the potential environmental risk. Yu Yongda, Guo Peiyuan(2003), Zhang Wenzhong(2005) think that green venture capital is a type of financial capital service. Wang Yuzhuo, Jiang Hangxiang(2006) did the research on the environmental risk management of green finance. It is considered that the risk is mainly the risk that the bank needs to bear the customer to lose the ability to repay the loan due to environmental problems. The joint liability due to the customer's environmental problems, and the risk of environmental problems may affect the bank's reputation as well. The finance industry shall pay attention to risks and changes related to the environment in its business and establish a system that includes identification, assessment, and control and minimization environmental risks.

4) Environmental assessment and system construction of green finance. Qiao Haishu (1999) holds that the core of green finance is to measure the environmental loss by environmental value or economic value through evaluation and calculation, and then to allocate of resources and to do the evaluation of financial activities. Sun Hongqing (2001) believes that the financial industry in China shall consider the "green factor" especially issuing the bank credit and considering the profit statistical assessment index system. The completed green finance system shall be constructed from the sections of bank credit, enterprise listing and green culture, including indirect financing system of green finance, direct financing system of green finance and green financial system of the finance industry itself. Wang Lixin (2001) believes that commercial banks shall play a unique role in the whole macro marketing system from the ability to support environmental resources, self-development ability and balance ability to reflect the characteristics of their green marketing. Li zhi ping (2004) considered that the financial industry is relatively slow and passive in responding to environmental problems. Financial business related to environmental protection must integrate the concept and requirements of sustainable development strategy into the legislation. The legal guaranteed system of green finance should be established to realize the innovation of China's financial law.

#### **4.1.3 Theoretical base for green finance development**

##### **1) Sustainable development theory.**

Sustainable development is not simply an environmental protection issue, but from all aspects of the human social life and long-term development. Back in 1998, the World Commission on Environment and Development issued a report of “our Common Future” and indicated that sustainable development is to meet both the needs of the present and the needs of future generations and not constitute a harm to long term development. It has three key points: one is to meet the needs of contemporary people, that is, no matter the country is rich or poor, no matter the people is rich and poor, all of them have the right to subsistence and development; the second is to achieve the fairness between now and future generations; the third is to consider the bearing limit of environment and resources. Over the past decades, the theory of sustainable development has exerted extensive and far-reaching influence on the development of world economy and society.

Sustainable development theory mainly includes sustainable development model and evaluation index system, environment and sustainable development, economy and sustainable development, social and sustainable development, and regional and sustainable development. As the social and economy development, the impact of human society on the environment has been greatly enhanced, and environmental pollution and destruction have become increasingly serious. Therefore, the theory of sustainable development is to seek the coordinated development of economy, society and natural ecological environment, reduce the occurrence of major natural disasters, so as to maintain a new balance between economy development and environment.

The theory of sustainable development attracts more and more attention of the international society. In 1994, the Chinese 21<sup>st</sup> Century Agenda holds that while maintaining rapid economic growth, Chinese government should constantly improve the development by relying on scientific and technological progress and improving the quality of laborers and promote moderate consumption and clean production, control environmental pollution, improve the ecological environment, and maintain sustainable development. It also set the target of circular economy to establish "low energy consumption, high return, low pollution, high benefit". Sustainable

development also was written into the Chinese “ninth five-year plan” and 2010 annual vision target plan to be the strategic policy of Chinese development.

## 2) Circular economy theory.

The theory of circular economy uses the laws of ecology or environmental protection rather than the laws of mechanical theory to guide the economic activities of human society. It is consistent with the economic growth model satisfying the concept of sustainable development. Circular economy is working under the sustainable development theory. Economic activities are grouped into the cycling process of "resource - product - consumption - renewable resources" and it takes the efficient utilization and recycling of resources. The characters are low energy consumption, low emissions and high efficiency. Circular economy is a kind of ecological economy. It takes ecological thinking as the whole process of economic activities, so that economic activities like an ecosystem, self-regulating control of the flow of energy and material cycle, to achieve a comprehensive repeated use of resources. While improving economic benefits, change the end of pollution treatment to the source of elimination or the most minimize pollution, protect the natural environment, thereby producing maximum social and ecological benefits. The circular economy mode is seeking to break through the resource and environmental constraints of sustainable development. Developing circular economy is critical strategic direction for Chinese government to build resource-saving and environment-friendly society and realizing sustainable development. Therefore, the development of circular economy not only means the transformation of economic form in China, but also means a profound economy, social and cultural changes.

## 3) Theory of financial development

The theory of financial development comes into being with the emergence of development economics. It started between 1960-1970s, a group of economists like Raymond W Gold, Gurley and E.S Shaw, Ronald McKinnon, developed the theory of financial development. Financial development theory mainly studies the relationship between financial development and economic growth. It believes that there are mutual promotion and restriction relations between system and economic development. In one hand, a sound financial system can lead the savings funds effectively to

productive investment, thereby promoting economic development; On the one hand, a well-developed economy can also be improved through the increase of national income to stimulate the development of the financial industry, thus forming a good cycle of mutual promotion of finance and economic development. It also pointed out that financial deepening is manifested in financial growth, namely, the continuous expansion of financial scale, the variability of financial instruments, and the standard improvement of the financial market system. These three aspects influence and affect each other (Gurley, J.G. and Shaw, E.S., 1967).

To sum up, sustainable development theory and circular economy theory, development finance theory provided the theoretical support for this study on green finance and its development in the logistics industry.

## **4.2 Green Financing practical application and development**

### **4.2.1 Green Finance System Construction in various global countries**

In June 1972, the United Nations Conference on the Human Environment was held in Stockholm, Sweden, which was the first international conference globally to discuss contemporary environmental issues, and countries began to pay attention to the global problems brought about by environmental problems and explore the associated solutions. In 1974, the Federal Republic of Germany established the world's first policy-oriented environmental bank, which specifically provided financing project support for environmental protection and social and ecological businesses, becoming an early international exploration of green finance. Subsequently, led by developed countries, governments, non-profit organizations, financial institutions, etc. began a variety of attempts and explorations, accumulating certain practical experience for the subsequent development of green finance. In 1980, the United States introduced the Superfund Act, which requires companies to deal with potential or occurring environmental damage. The promulgation of this bill has important reference significance for countries around the world to solve environmental-related problems through legislation. In 1992, the United Nations Environment Program (UNEP) issued the Declaration of the Banking Community on Environmental Sustainability, and in the same year, the Financial Action Agency (UNEP-FI) was established at the Rio Summit to urge the financial systems to support sustainable development such as

environmental pollution and climate governance. In 2003, Citi, ABN AMRO, Barclays, and other major banks around the world took the lead in formulating a set of voluntary green credit principles, the Equator Principles (EPs), which became an international non-mandatory norm for measuring social and environmental risks. In 2007, the European Investment Bank (EIB) issued the world's first green bond, the "Climate-Aware Bond", to investors in the 27 member states of the European Union, which promoted the internationalization of green bonds and accelerated their expansion. In 2016, at the G20 Summit, China advocated the development of green finance and provided suggestions for the development of green finance in various countries, so China has increasingly become a major player and promoter in the field of green finance in the world ( Qianzhan (*Forward Economist*) ,2022)

While vigorously promoting the construction of the green financial system, various countries are also actively exploring the application of green financial technology and using scientific and technological means to promote the development of green finance. Such as exploring the introduction of digital currency to support clean energy and promote green production; Reduce risks in green investments through Blockchain technology and Big Data Analysis; Accelerate the development of online financial development in the market, etc.

#### Comparison of the Green Finance development in the major developed countries:

At this stage, the green financial system of developed countries such as Europe and the United States is relatively mature, especially the development of green finance represented by the European Union is relatively taking the lead. The green finance of developed countries in Europe and the United States has formed a relatively complete system from the aspects of legal system, market entities and green financial instruments. In terms of green finance policy system, governments and central banks have continuously strengthened the top-level design of green finance, formulated relevant bills and policies, and formed a relatively mature product system in the field of green bonds, green credit, green insurance, green funds, and other products. At the same time, international financial institutions also play an important role in the issuance and practice of green products.

#### **EU- Long history with relatively mature system**

The EU has a long history with a relatively mature system in green finance. The EU is a main participant and forerunner in the development of green finance, boasting a relatively perfect and mature top-level design. The EU first adopted the Action Plan on Financing for Sustainable Development as a guiding document, stipulating the classification of sustainable activities, sustainable investment funds, sustainability indices, and other aspects (European Commission, 2018). Secondly, the European Green Agreement is a programmatic document proposing to achieve carbon neutrality by 2050 and making corresponding recommendations for the policy direction of sustainable transformation in EU countries (European Commission, 2019). In addition, the EU's sustainable finance development policy has higher requirements for the classification standards and information disclosure of green financial activities, such as the EU Sustainable Finance Classification Scheme, the EU Green Bond Standard, and the Climate Benchmarks and Information Disclosure Norms, which provide defining standards and reference examples for the development of green environment-related fields (European Commission, 2020).

At the same time, the policy support and guidance of EU governments play a vital role in the development of green finance. For example, Germany and other countries promote the development of green environmental protection projects through tax incentives and government guarantees. Meanwhile, policy-oriented financial institutions and financial funds are encouraged to drive and attract social capital to increase investment in green finance (Federal Ministry of Finance, Germany, 2021).

### **UK- The first country to promote low-carbon development.**

In 2003, the UK proposed to promote low-carbon development and introduced the Climate Change Act in 2008 and the Loan Guarantee Scheme in 2009, which further strengthened the top-level design of green finance in the UK (UK Parliament, 2008; UK Government, 2009). The development of green finance in the UK is largely driven by the main players and participants in the financial market and has accumulated rich experience for the development of green financial products and risk management. At the same time, the British government is also coordinating financial institutions, including the London Stock Exchange and the Bank of England, to use financial means to promote the development of the green environmental protection industry, and guide social funds to invest in new technologies and new materials (London Stock Exchange,

2021; Bank of England, 2021). The UK government established the Green Investment Bank in 2012 to attract social capital investment through market-oriented means and promote the transformation of the UK's green economy (Green Investment Group, 2012).

In addition, the UK is actively exploring and innovating in climate risk management to promote risk management in green finance. On 30 June 2021, the UK Treasury and the UK Debt Management Office (DMO) published the UK Government Green Financing Framework, which describes how the UK Government plans to issue Green Wire Bonds (Green Gilt) and retail Green Savings Bonds to finance; the proceeds from these financing instruments are expected to be used to address climate change and other environmental challenges, finance much-needed infrastructure investments, and create more green jobs in the UK. The framework specifies how green projects are identified, selected, validated, and reported. Eligible projects can receive financing from the proceeds of these financing instruments (UK Treasury and UK Debt Management Office, 2021).

### **Germany- Sophisticated Green Finance legislation system**

The development of the green economy in Germany begins with the high attentions from the public and the government to environmental issues and ecological awareness. Since the promulgation of *the Waste Disposal Act* in 1972, the Government has successively introduced a series of environmental protection-related policies, laying the foundation for the development of green finance, making it one of the most sophisticated green finance legislations in the world. At the same time, the government supports the capital market to develop corresponding financial products, to provide low-interest loans for environmental protection projects. For example, Germany's most influential policy bank, KfW Bank, has launched projects such as the "Ecological Building Plan", "Old House Energy Conservation Renovation Plan", "Renewable Energy" and "Solar Power Generation Plan" in recent years, helping Germany enter a comprehensive energy transition stage.

### **USA- a wealth of innovative green finance products**

The development of green finance in the United States takes the "super fund" as the starting point, which stipulates the source of the fund, the support project and direction, the division of responsibility, compensation, clean-up and government emergency response, etc., and includes government environmental protection agencies, environmental damagers, and individuals into environmental protection, further clarifying the implementation guidelines for green economic development, and providing a model for most countries to establish a soil pollution management system. Since then, the US Federate government and state governments have successively begun to build their green financial systems and established special green finance organizations - national environmental finance centers, environmental advisory committees and a network of environmental finance centers to promote the implementation of green finance laws and policies and support the development of green finance. The U.S. banking industry also pays attention to the environmental factors in the business process of enterprises and provides loan support to green industry enterprises. At the same time, the United States also pays attention to the use of green industries to promote green finance, such as providing guarantees for clean energy and high-end vehicle manufacturing projects. In addition, the United States has a wealth of innovative green finance products, for example, in terms of green credit, it develop the unsecured preferential loans to support the project of fuel-saving technologies; Setting Green banks in New York, Connecticut and Hawaii, and using innovative business models to attract private investment in the green sector; In terms of green insurance, a professional environmental protection insurance company was established to innovate in compulsory insurance methods, personalized insurance design, and government guarantees.

### **Australia – incentive policy for green finance development**

In 1998, the Australian government established a personal income tax reduction policy for investors in the Forestry Management Investment Scheme (MIS), which promoted the rapid growth of MIS investment amounts and plantation area (Australian Government, 1998). Launched in 2003, the New South Wales Greenhouse Gas Abatement Scheme (NSW GGAS) made Australia one of the first countries in the world to implement a mandatory gas reduction program (New South Wales Government, 2003). Australian banks have also launched a series of highly distinctive

green loans, such as the "Go Green" car loan that requires lenders to plant trees to absorb the emissions of private cars, and mortgage loans specifically for green homeowners (Commonwealth Bank of Australia, 2020). In 2020, the Australian Sustainable Finance Initiative (ASFI) developed and published the Sustainable Finance Roadmap, providing financial services institutions with development recommendations, policies, frameworks, and more to help them transition to a more sustainable direction (Australian Sustainable Finance Initiative, 2020). In addition, at the climate management level, the Australian Prudential Regulation Authority (APRA) has established an assessment system for prudent financial risks to respond to climate change, thereby creating a complete and risk-resistant green financial system (Australian Prudential Regulation Authority, 2020).

### **Japan- the highly active green finance market in Asia**

Japan's green economy began in the 1970s due to the impact of environmental pollution, prompting the government to place great importance on environmental protection legislation. A series of environmental protection policies were introduced, such as the 1970 Waste Disposal Act to curb the discharge of waste and the Air Pollution Control Act of 1986, which specifies facilities for the incineration of domestic waste (Japanese Ministry of the Environment, 1970; 1986). Since then, the Japanese government has actively explored the economic benefits of green development.

Japan integrates the environmental protection industry and financial market in two main ways to play the role of green finance. On one hand, funds are used for investment and financing of environmental protection undertakings, such as increasing the total amount of energy and environment-related investment and loans from the government level (Japanese Ministry of Finance, 2020). On the other hand, environmental rating financing and socially responsible investment facilitate financing for low-carbon enterprises. Japan's Ministry of the Environment has established a department for environmental financing loans, and the Japan Financial Treasury developed the Environmental and Energy Countermeasure Fund to promote green credit at the national level, guiding more enterprises to participate in the development of green finance by providing low-interest loans for small and medium-sized enterprises (Japanese Financial Services Agency, 2020). In addition, Japanese

commercial banks utilize the environmental rating system to evaluate and supervise commercial loans, thereby improving investment efficiency.

Through extensive exploration and practice, Japan's green financial market is highly active, with the number of green bonds issued being the second largest in Asia (Asian Development Bank, 2020). Japan also excels in the field of green insurance, particularly in addressing natural disasters and the risk of climate change. Additionally, to achieve its commitment to carbon neutrality by 2050, Japan has made climate finance a key development component and developed a clear strategic plan at both national and international levels

### **Singapore- Clear action plans for Green Finance development**

In the early stage of green finance development, it usually faces multiple challenges and difficulties, and Singapore has achieved remarkable development by improving the top-level design to guide the sustainable transformation of the economy and the development of green finance. For example, based on the United Nations Sustainable Development Goals (SDGs), new strategies for the development of clean energy and environmental pollution control have been formulated, and new legislative and regulatory measures have been introduced. At the same time, as a major driver of green finance development, *the Monetary Authority of Singapore* (MAS) elaborated on Singapore's green finance vision and development strategy in *the Green Finance Action Plan* launched in November 2019 and set up the Green Finance Industry Working Group (GFIT). Since then, the Financial Working Group has accelerated the development of green finance by the Guidance Document on *The Disclosure of Information on Climate Finance for Financial Institutions* (FCDD) and the Know-How Framework to help banks enter Green Trade assessments. With the strong support of the government, the Singapore Management University (SMU) has set up the Singapore Green Finance Centre (SGFC) to conduct green finance research and talent development, and promote the rapid development of green loans, green bonds, and other products and green fintech platforms. In February 2021, the Singapore government announced the blueprint for the development of the 2030 Green Plan, which regards the development of green finance as a key word and an important

means and hopes to build a leading green finance center in Asia and the world in the future. (Monetary Authority of Singapore, 2019).

#### **4.2.2 Green Finance Development in China under the “Double Carbon” target**

##### **1) Carbon peak and Carbon neutral - carbon peaking by 2030 and carbon neutrality by 2060**

Global climate change, environmental pollution, resource shortage and other issues are becoming increasingly prominent, and the development mode that only aims at economic growth and ignores environmental impact will be difficult to sustain and is not conducive to sustainable development. Especially after COVID-19 pandemics, countries have re-examined past development patterns and reassessed the implications of sustainable development, with a further increased focus on environmental, social and governance (ESG). KPMG's 2021 survey of CEOs of the world's most influential companies confirms this global trend. According to the survey, with the 26th United Nations Climate Change Conference (COP26) this year, 49% of CEOs plan to implement stricter ESG practices, the vast majority (89%) of CEOs will take steps to lock in the ESG results they have achieved during the epidemic, and almost all (96%) of global executives want to increase their attention to ESG, especially the social sector (KPMG, 2021).

In September 2020, President Xi Jinping of P.R. China stated in the general debate of the 75th session of the United Nations General Assembly that China will increase its nationally determined contribution, adopt more powerful policies and measures, and put forward the "Double Carbon" goal of achieving carbon peaking by 2030 and carbon neutrality by 2060. He further announced at the UN Climate Determination Summit in December 2020 that China's carbon dioxide emissions per unit of GDP will be reduced by more than 65% compared with 2005 by 2030. The proportion of non-fossil energy in primary energy consumption will reach about 25%, the forest stock will increase by 6 billion cubic meters compared with 2005, and the total installed capacity of wind power and solar power generation will reach more than 1.2 billion kilowatts (Xi, 2020).

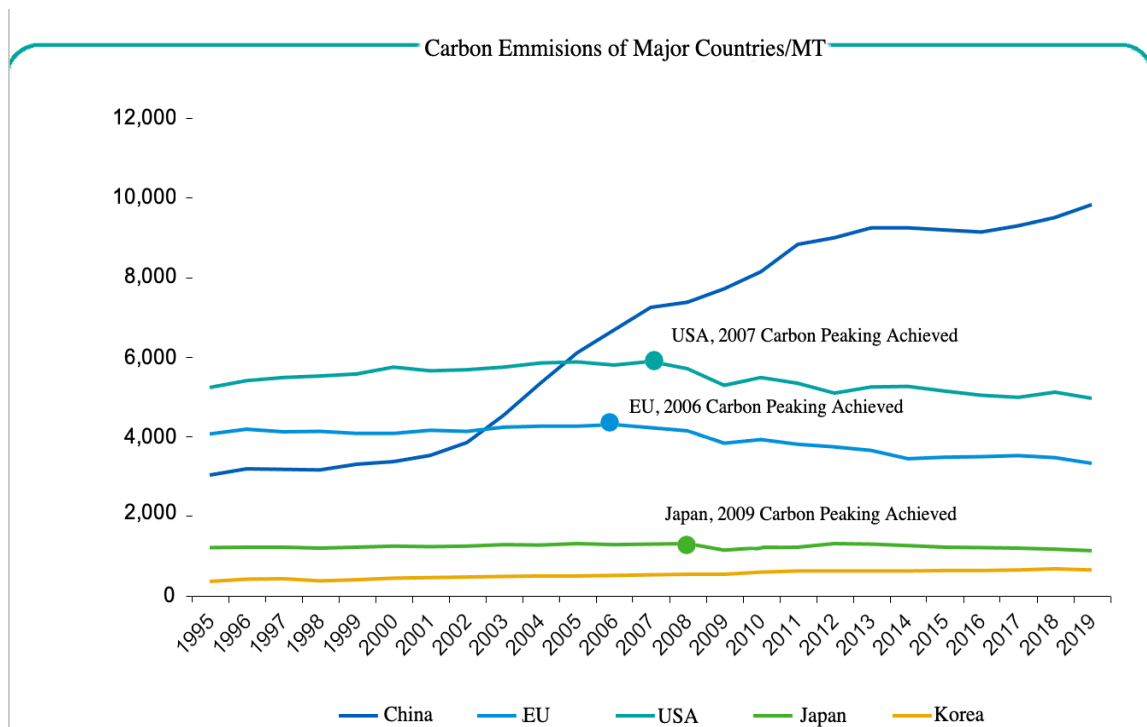
Achieving this ambitious goal will not be easy. China is currently the world's largest emitter of carbon dioxide, with a total emission of about twice that of the United States

and three times that of the European Union. Taking 2019 as an example, China, the United States, and the European Union emitted 98.3, 49.6, and 3.33 billion tons of carbon emissions respectively, accounting for 28.8%, 14.5%, and 9.7% of the total global emissions, respectively (World Bank, 2020). According to the World Bank, the world's manufacturing value added accounted for 28% of the world's manufacturing in 2018, which was basically the same as the world's share of 30% of carbon dioxide emissions in that year (KPMG, 2021).

In terms of per capita carbon emissions, the average carbon emissions of Chinese, while growing faster since the beginning of the century and surpassing those of the European Union, are still well below the per capita level of the United States. In 2019, China, the United States, and the European Union had per capita carbon emissions of 7.1, 16.1 and 6.6 tons respectively, and the average carbon emissions of Chinese were less than one-half of that of the United States. In addition, historically, China's cumulative greenhouse gas emissions since the Industrial Revolution have remained significantly lower than those of major advanced economies, about half of those of the United States and about 60 percent of those of the European Union (KPMG, 2021).

Under above situation, China's active commitment to achieve the "double carbon" goal is an inevitable choice for China's transformation to high-quality and sustainable development. However, there are only 30 years from the peak of carbon to the completion of carbon neutrality in China, which can be said to be "pressure, tight time and heavy task" compared with the world's major carbon emitting countries. In the case of the European Union, the United States, and Japan, among the major developed countries, there are at least 40 years from peaking carbon to achieving carbon neutrality. BP's 2020 Energy Outlook provides a detailed analysis of global carbon emissions by country, highlighting the significant differences and trends across regions. Refer to the blow figure 3.4 to understand the general picture of each country carbon emissions plan and can clearly see the ambitious target of China:

Figure 3.4: Carbon Emissions of Major Countries



Source: *BP Energy Outlook*, 2020

The P.R. China 14th Five-Year Plan released in March 2021 and the 2035 Long-Term Goal formally include the realization of the "Double Carbon" goal, emphasizing that green development is an important part of China's new development concept, and putting forward specific requirements for carbon emissions intensity and non-fossil energy (National Development and Reform Commission, 2021). Carbon intensity refers to carbon dioxide emissions per unit of GDP. The 14th Five-Year Plan clearly proposes to reduce carbon emission intensity by about 18% in the next 5 years. China also announced at the Climate Ambition Summit that the target is a 65% reduction in carbon emissions per unit by 2030 compared with 2005 levels (Xi, 2020). Meanwhile, to achieve the Chinese 'Double Carbon' target, the energy consumption structure is set to be modified as well. The 14th Five-Year Plan proposes to increase the proportion of non-fossil energy in total energy consumption to about 20% by 2025, and President Xi Jinping also announced at the Climate Ambition Summit at the end of 2020 that China's non-fossil energy will account for about 25% of primary energy consumption by 2030 (Xi, 2020).

Achieving energy structure optimization, energy conservation, and emission reduction requires a significant amount of financial support, with the demand potentially reaching

10 billion Yuan. For example, according to the National Climate Strategy Center (NCSC, 2019), to achieve the "30-60" double carbon target, by 2060, the scale of investment demand in China's new climate sector will reach about 139 trillion Yuan, with an average annual amount of about 3.5 trillion Yuan. This accounts for more than 3.4% of GDP in 2020 and about 6.7% of the total investment in social fixed assets, with a long-term funding gap of 1.6 trillion Yuan each year. Given such a massive demand for funds, government funds may only cover a small part, with most requiring compensation using market funds through the financial system. This necessitates the establishment and improvement of a green financial policy system to guide and encourage the financial system to support green investment and financing activities in a market-oriented manner (NCSC, 2019).

## 2) Green Finance Development in China

China's green finance study the advanced experiences from the world leading countries from research on the theoretical system and practical examples as well. But unlike the development from financial organizations to the top government level in some other countries, China is now constructing its own green financial system mainly driven by policies support from the central government. Therefore, although China's green finance started late, after continuous exploration and practice, great progress has been made in the green finance policy system, incentive mechanism, disclosure requirements, product system, regulatory system and international cooperation.

- Strategic Policy supporting from Chinese central government:

In 2015, China launched a series of important policies on environmental pollution control. For example, the *"Opinions of the CPC Central Committee and the State Council on Accelerating the Construction of Ecological Civilization"*, issued in May, proposes to promote financing such as green credit and mortgage of pollutant discharge rights, and carry out pilot projects of environmental pollution liability insurance. The *"Overall Plan for the Reform of the Ecological Civilization System"* released in September of the same year proposes to establish a green financial system from various aspects such as green credit, green bonds, green funds, and

disclosure of information by listed companies, which provides a pioneering policy practice for the comprehensive and rapid development of green finance in China. 2016 is often considered to be the "first starting year" of China's green finance, the establishment of a green financial system was written into China's "13th Five-Year Plan", and the government also issued the "Guiding Opinions on Building a Green Financial System". Since then, China has accelerated the construction of green financial policies and gradually improved the construction of green financial infrastructure in terms of green investment and the division and definition of green industries. In the 14th Five-Year Plan in 2021, it is proposed to "vigorously develop green finance", which will be the main starting point for achieving the "double carbon" goal and usher in rapid development. At present, China has constructed a comprehensive policy framework in terms of macro-top-level design and micro-evaluation criteria for green finance and has become the first country in the world to establish a systematic green finance policy framework. The following major government documents were sorted out from the government. These are the major policy guide from the strategic level for the Green Finance development in China.

Table 3.5: Major Strategic Documents on GF in China  
(sorted from related department official website)

| Table 1: Chinese Major Strategic Documents on Green Finance |  |   |   |
|---|--|---|---|
| Date Published  | Publishing Unit  | Document Name   | Main Content  |
| Sept, 2015  | State Council  | <i>Overall Plan for the Reform of the Ecological Civilization system</i>  | This plan is the top-level design and deployment of China's ecological civilization reform, and for the first time, it clearly proposes to build a basic institutional framework for the green financial system strategy.   |
| Aug, 2016   | The Central Bank, the Ministry of Finance and other seven ministries and commissions jointly issued        | <i>Guiding Opinions on Building a Green Financial System</i>              | Clarifies the definition, incentive mechanism, development direction and risk monitoring measures of green finance. It marks the establishment of the top-level framework system of green finance in China and accelerates the construction of China's green finance policy system. |
| June, 2017  | The central bank, the former Banking Regulatory Commission, the Securities Regulatory Commission and other | <i>Financial Industry Standardization System Construction Development</i> | The construction of green financial standards will be listed as the key project of financial industry standards during the "13th Five-Year Plan" period, from system standards, working mechanism   |

|                |  |  |   |
|----------------|--|--|---|
|                | five ministries and commissions jointly issued   | <i>Plan (2016-2020)</i>  | standards, and information disclosure standards. Promote the unification of green financial standards in five aspects: green credit rating standards and product standards for financial institutions.  |
| Nov, 2018      | Asset Management Association of China  | <i>Green Investment Guidelines (Trial Implementation)</i>  | The connotation, investment objectives and principles of green investment, as well as the basic methods, are clarified. It provides guiding guidance for investors to make responsible investments and plays an important policy guidance role in the formulation of China's green investment information disclosure system, the quantification and design of green indicators. |
| March, 2019    | Jointly issued by the National Development and Reform Commission (NDRC) and other seven departments  | <i>Green Industry Guidance Catalogue (2019 Edition)</i>  | The detailed division and definition of green industry is the cornerstone of China's green industry scope standard system.  |
| October, 2020  | Jointly issued by the Ministry of Ecology and Environment, NDRC, the Central Bank, the Banking and Insurance Regulatory Commission, and the Securities Regulatory Commission | <i>Guidance on Promoting Investment and Financing for Climate Change</i>   | Emphasize climate finance as an important part of green finance. It clarifies the definition and scope of support for climate investment and financing, and explains the policy system, standard system, social capital, local practices, and international cooperation to promote climate investment and financing.  |
| February, 2021 | State Council  | <i>Guiding Opinions on Accelerating the Establishment of a Green and Low-Carbon Circular Development Economic System</i> | It is proposed to vigorously develop green finance, cultivate a green trading market mechanism, improve the green standard system, and ensure the realization of carbon peak and carbon neutrality goals.   |
| March, 2021    | National People's Congress   | The 14th Five-Year Plan  | It is clearly proposed to vigorously develop green finance, accelerate the construction of green finance standard system, strengthen information disclosure requirements, and improve incentive mechanisms.   |

- Incentive mechanisms for green finance development

With the construction of the strategic policy system of green finance, from central to local, China has gradually developed a series of multi-level and innovative incentive mechanisms. For example, the central bank has included green bonds and green loans in the scope of qualified collateral for the central bank's loan facilitation, and the

Agricultural Development Bank is actively exploring green rights and interests such as pollutant discharge rights, energy use rights, and carbon emission rights, and pollutant discharge rights mortgages have been practiced in many banks in Shaoxing City, Zhejiang Province as early as 2008. In addition, the People's Bank of China issued the "*Green Finance Evaluation Plan for Banking Financial Institutions*" in June 2021, which will comprehensively evaluate the development of green financial business of financial institutions in China and implement incentive constraints in the future, and the evaluation results will also be included in policies and prudential management tools.

- Green Finance Products Development

At present, China has formed a multi-level green financial products and market system, of which green credit and green bonds have developed rapidly, the system is relatively mature, and the scale is at the forefront of the world. In addition, based on China's national and industry conditions, China have developed financial products such as green funds, green insurance, and green PPPs which could fit for the Chinese market. In July 2020, the Ministry of Finance, the Ministry of Ecology and Environment and the Shanghai Municipal People's Government jointly initiated the establishment of the National Green Development Fund Co., Ltd. The Agricultural Development Bank said it will speed up the replenishment and improvement of green credit products serving the three rural areas and small and micro enterprises. Many provinces and cities have carried out the practice of green PPP, covering river sewage treatment, watershed treatment, waste incineration and other fields. In addition, green financial products for individuals are also being launched, such as low-carbon credit cards launched by banks such as the bank of Everbright and the bank of Industrial Development, and the "Green Walker - Green Travel Incentive Platform" launched by the Beijing Environment Exchange.

- Supervision system for green finance development

China has basically formed a government-led, self-discipline supplemented supervision system, under the leadership and coordination of the Central Bank, the Banking and Insurance Regulatory Commission, the Securities Regulatory Commission and relevant administrative departments perform their duties; Financial institutions, industry associations, etc. have also joined the supervision of green

finance. For example, the Central Bank set up a green finance professional committee. Also, at the area of green credit, green securities, the specialized committee were set up to supervise the green finance industry. At the same time, different regulatory measures are adopted for different products, such as financial institutions issuing green credits need to submit special statistics on green loans to the Financial Statistics Monitoring and Management Information System as required. In addition, China is gradually establishing a mandatory information disclosure system, requiring listed enterprises to compulsorily disclose information such as major environmental pollutants, main processing facilities and processing capacity in the production process, especially after 2016, the Securities Regulatory Commission, the Interbank Dealers Association, the Central Bank and other institutions have successively issued documents to clearly stipulate the obligation of information disclosure and regulate the relevant content links of information disclosure; Listed enterprises in the science and technology innovation version are also required to disclose the fulfillment of social responsibilities.

- International cooperation on Green Finance works:

Since vigorously promoting green finance, China has deeply participated in the development of international green finance. Based on strengthening international exchanges with multinational and bilateral channels such as the Group of Twenty (G20), the Central Bank has also participated in and initiated cooperation with various platforms such as the Green Finance Network and the International Platform for Sustainable Development Finance and continued to promote the international development of green finance. For example, Central Bank lead the project of GIP (the Belt and Road Green Investment Principles) in 2019. Right now, there are 39 large institutions signed the GIP. In terms of the opening up of the green financial market to the outside world, the Central Bank plans to facilitate the participation of international investors in China's green financial market by unifying the access standards and procedures for the interbank and exchange bond markets, so that foreign investors can entrust qualified domestic custodian banks to conduct asset custody, either directly or through their overseas custodian banks, so as to facilitate international investors' participation in China's green financial market.

Not only just the Central Bank, lots of Commercial banks also actively adopt international principles and participate in the formulation of international standards. For example, Industrial Bank began to adopt the Equator Principles in 2008, carrying out service provision, monitoring, reporting and public disclosure as required, and actively participated in the review and revision of the new Equator Principles, the International Finance Corporation (IFC) Performance Standards and other international banking standards, and now green finance has risen to its corporate governance level. As a member of the Banking Working Group, ICBC participated in the formulation of the "*Principles for Sustainable Banking in the Global Banking Industry*" initiated by the United Nations Environment Program Financial Initiative (UNEP FI), which was officially released in 2019, and has been adopted by 230 banks around the world, accounting for more than one-third of the global banking industry(ICBC,2020).

- Green financial technology development:

The use of financial technology support is also one of the important development directions of green finance in China. Under the active advocacy of the policy, the industry uses digital and technology to solve the difficulties of green finance development and accelerate the development of the industry. For example, Li Dongsheng, former deputy governor of the Central Bank, advocated at the "2020 New Era Financial Development Summit" to expand the application of science and technology in green finance scenarios; Use big data and the Internet of Things to enhance green fintech regulatory capabilities; Promote the digital construction of green financial infrastructure based on blockchain and cloud computing; Establish and improve the green financial technology composite talent training system. At present, domestic green financial technology is still in the innovation pilot, to be further improved, to give play to the positive role of financial technology in the development of green finance.

### **4.3 Major Green Finance Applications**

At present, the main green finance areas include green credit, green bonds, green insurance, carbon financial products, green funds, green trusts, green notes and other financial instruments. This study will introduce five areas that are currently more

mature and large-scale in use: green credit, green bonds, green insurance, carbon emission trading markets, and ESG investment.

#### **4.3.1 Green Credit**

Green Credit is the pillar product of green finance, also known as sustainable financing or environmental financing, which means that banks take compliance with environmental monitoring standards, pollution control effects and ecological protection as important assessment conditions for credit loans in the loan process. Green credit is of great significance to the practice of green development: on the one hand, green loan plays a role in promoting the green transformation of financial institutions, industries and enterprises in the development of green finance, and is conducive to promoting the development of green economy; On the other hand, commercial banks, as the main participants of green credit, can achieve the purpose of win-win social and economic benefits through the development of green credit.

##### **1) Development of Green Credit in the international market**

At present, the most representative and widely used in the world is the "***Equator Principle***". In addition, the "***Green Credit Principle***" and the "***Sustainable Development Related Loan Principle***" have also been formed as important criteria for the development of green credit products and projects.

- **Equator Principles:** The Equator Principles (EPs) were developed by different banks such as Citi, ABN AMRO, Barclays and others in 2003, and the fourth edition was released in 2019. The Equator Principles require financial institutions to conduct a comprehensive assessment of the potential environmental and social impacts of financing projects and to use financial leverage to support project financing to promote sustainable social development. The institutional system of the "Equator Principles" is relatively comprehensive and the implementation system is also more stringent. Banks that accept the Equator Principles (Equator Bank) need to consciously submit to external independent supervision and review, project evaluation by external independent institutions and social experts during the life of the loan, and environmental assessment reports by external independent institutions and social experts. At the same time, Equator Bank also requires borrowers to

establish public disclosure and complaint mechanisms for environmental assessment information. The "Equator Principle" is widely used in international green credit practices, and at present, 123 financial institutions in 37 countries around the world adopt the "Equator Principle", including China's Industrial Bank, Bank of Chongqing, Bank of Guizhou, Bank of Jiangsu, and Bank of Huzhou (Equator Principles, 2021).

- **Green Credit Principles:** The Green Credit Principles (GLP), another important international standard for green credit, was jointly issued in 2018 by the Lending Market Association and the Asia-Pacific Trade Market Association, providing a high-standard guiding framework for financial institutions to provide a high standard of green credit for financial institutions. It mainly refers to the "Green Bond Principles" (GBP) to develop a standard framework from four aspects, including the use of loan funds, project evaluation and selection, loan fund management, and information disclosure reporting. Unlike the Equator Principles, the Green Credit Principles detail the types of green projects and make clear requirements for institutional constraints on loan fund management, which can effectively guide banks to flow funds to green industries by issuing green loans.
- **Sustainability Linked Loan Principles:** In 2019, the Loan Market Association, the Asia-Pacific Trade Market Association and the Loan Syndicate Trade Association jointly issued the Sustainable Linked Loan Principles, which provide further framework guidance for the sustainable lending market. Under this principle, sustainability performance indicators (SPTs) are used to measure the sustainability performance of borrowers, including key performance indicators, external ratings, and other equivalent indicators. The focus is on linking loan terms to borrowers' predetermined SPTs, thereby incentivizing improved sustainability performance of borrowers.

Financial institutions are the main driving force for the development of international green credit and have rich experience in product innovation and risk prevention.

- **Product innovation:** International commercial banks attach great importance to the innovation of green financial products, and the main areas of innovation involved are housing, automobiles, credit cards, etc. Innovative products have

played a good role in financial "guiding" the real economy, which is conducive to guiding consumers to form a green consumption concept.

- Environmental and risk assessment mechanism: International financial institutions mainly strengthen the risk prevention of green credit from three aspects, providing strong support for the development of green credit. First, develop a scientific and rigorous assessment mechanism and credit review mechanism, representing representatives such as Citibank; Second, set up professional green credit institutions or departments, such as the United Kingdom set up a dedicated environmental finance department for risk management products to guide banks in risk assessment of loans; Third, environmental risks are quantitatively assessed through environmental stress tests, such as the Bank of England.

## **2) Development of Green Credit in Chinese market**

Green credit is the earliest, fastest developing and most mature policy system in the development of green finance in China. Starting from the policy, the Chinese government has introduced a number of policies to encourage commercial banks to participate in the development of green credit and accelerate the expansion and diversification of green credit in China.

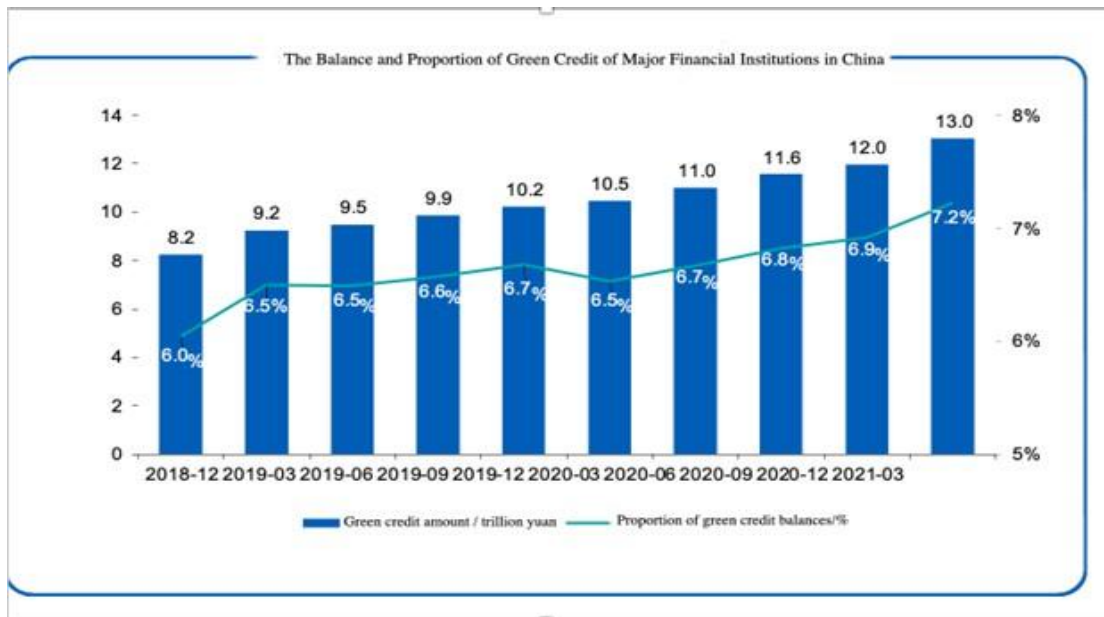
In July 2007, the People's Bank of China and other three ministries and commissions jointly issued "*the Opinions on Implementing Environmental Protection Policies and Regulations*" to Prevent Credit Risks, emphasizing the importance of using credit means to protect the environment, and requiring strengthening the coordination and cooperation of credit management and environmental protection, and strengthening environmental supervision and management. The release of this policy marks that green credit has fully entered the main battlefield of China's pollution reduction by means of economic means. Subsequently, the state has continuously introduced policies requiring the vigorous development of green credit and the green transformation and upgrading of key industries and fields. After years of development and exploration, China's green credit standards have gradually improved, and a policy framework including top-level design, statistical classification system, assessment and evaluation system and incentive system has been formed (Shi. Y, 2021).

*The "Green Credit Guidelines"* is a programmatic document for China to explore the statistical system and evaluation and evaluation of green credit and has played an effective normative and guiding role in the development of green credit by financial institutions. To further promote the implementation of the document, the CBRC issued "the Key Evaluation Indicators for the Implementation of Green Credit" in 2014, which provided the basis and basis for the subsequent rating of green banks. From 2017 to 2018, the China Banking Association and the Central Bank of China successively issued "*the Implementation Plan for the Evaluation of Green Banks in China's Banking Industry*" (Trial Implementation) and "*the Notice on Carrying Out Green Credit Performance Evaluation of Depository Financial Institutions in the Banking Industry*", requiring banks to carry out green credit self-assessment from two dimensions: quantitative and qualitative. The implementation of this work system is strict, and all banks need to provide detailed evidence and supporting documents when conducting self-evaluation, and the former CBRC formed a green credit evaluation team to conduct verification and spot checks. It is worth noting that in June 2021, the Central Bank issued the "*Green Finance Evaluation Plan for Banking Financial Institutions*" (hereinafter referred to as the "Evaluation Plan"), which further expanded the scope of green finance assessment business based on the "*Notice on Carrying out Green Credit Performance Evaluation of Banking Depository Financial Institutions*" and included green bonds and green credit in quantitative assessment indicators at the same time. In the qualitative indicators, more attention is paid to the construction and implementation of the green financial system of the assessment institutions. In addition, the "*Evaluation Plan*" expands the scope of participating banks and based on the original assessment of banking institutions such as large commercial banks, joint-stock banks, and policy banks, urban commercial banks are included in the scope of assessment(Ma & Sun, 2020).

In terms of incentive mechanism, China has previously introduced a series of incentive measures, such as the central bank's green re-loan product, green MPA assessment, etc., and incorporated the assessment results of green credit business into the MPA assessment system. In addition, some local governments have also carried out guarantees and discounts for green projects.

In the development of recent years, the scale of green credit in China has shown a gradual upward trend. Many research based on the WIND database provided pictures to help on the understanding of green finance development in China. WIND is a leading provider of financial information services in China, and an indispensable partner for lots of securities companies, fund management corporations, insurance companies, banks, investment firms, and media. Globally, Wind is also favored by widely used by qualified foreign institutional investors (QFII) approved by China Securities Regulatory Commission. Wind's clients also include well-known financial academic research institutions and media agencies. Wind's data is also frequently cited by authoritative Chinese and English media, research reports, and academic papers. In the field of financial data, Wind has built a complete and accurate large-scale financial engineering and financial data center on financial and securities data in China. Wind's data covers stocks, bonds, funds, foreign exchange, financial derivatives, commodities, macroeconomics, and financial news. Per to the data from WIND database, KPMG China sorted the below figure regarding to the development of Green Credit in China. By the end of 2020, China's green credit balance is nearly 12 trillion Yuan, and the stock scale is the largest in the world. As of the first quarter of 2021, the balance of green loans reached 13 trillion Yuan, an increase of 9% over the previous quarter. In addition, the proportion of green credit in the total credit of Chinese financial institutions has also maintained a steady growth. As of the end of the first quarter of 2021, the proportion of green credit in China has reached 7.2%, an increase of 1.2 percentage points from the end of 2018.

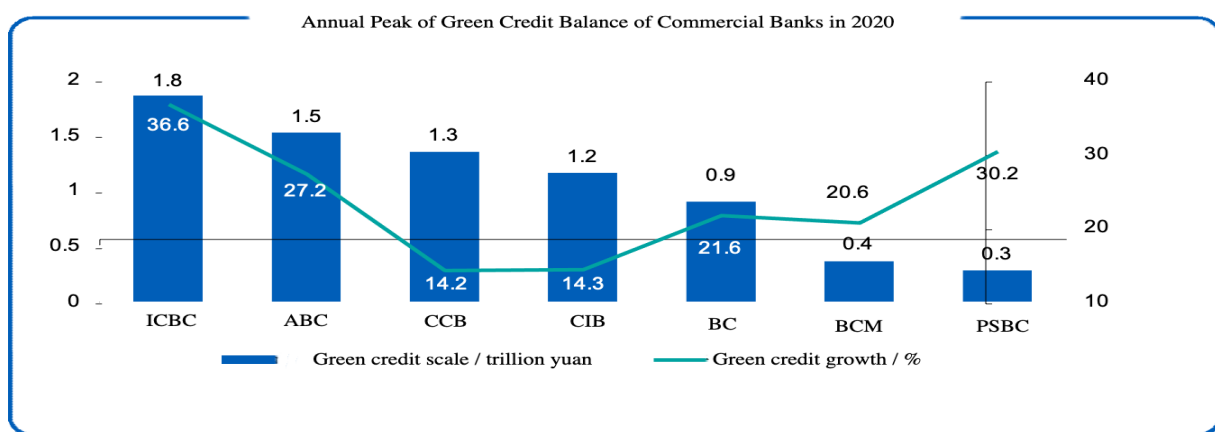
Figure 3.5: The Balance and Proportion of Green Credit of Major Financial Institutions in China



Source: WIND database, 2021 sorted out by KPMG China

From the perspective of credit delivery entities, commercial banks are the participants in green credit, of which the green credit balance of large and medium-sized listed commercial banks occupies half of the amount. Per to the analysis of KPMG China, At the end of 2020, the total scale of green credit of some commercial banks has reached 7.4 trillion Yuan, an average increase of more than 23% over the same period last year (Figure 8). At the same time, the annual reports of many commercial banks show that green finance is still an important development direction in the future, and banks will actively practice the concept of green development, explore green financial products and services, and build a green credit system (KPMG China, 2021).

Figure 3.6: Annual Peak of Green Credit Balance of Commercial Banks in 2020

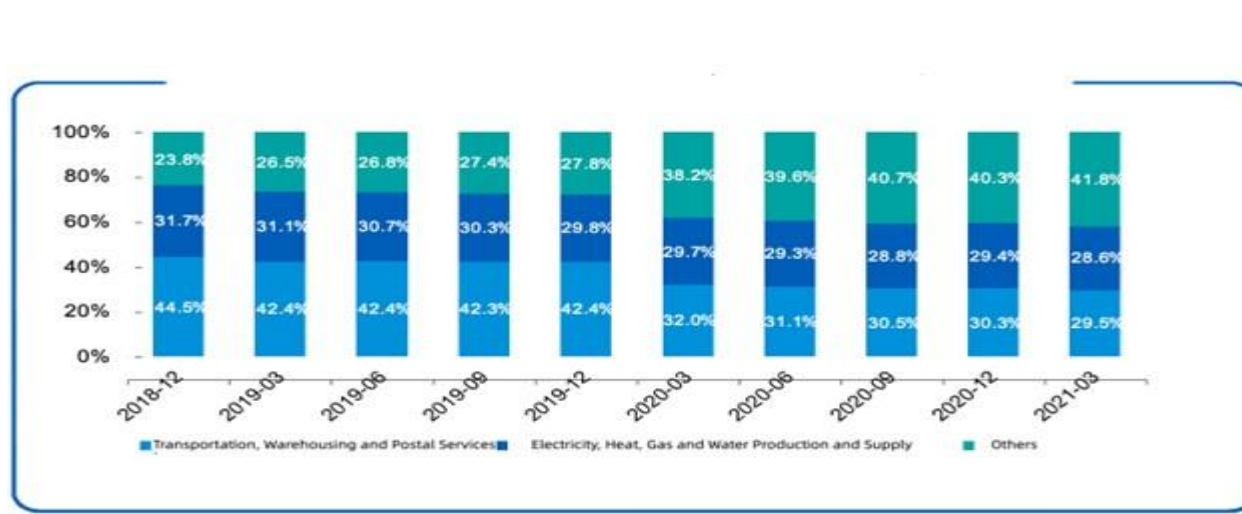


Source: Bank Annual report by KPMG

The WIND data also found that from the perspective of the involved benefiting industry, green credit is currently mainly concentrated in transportation, energy and other industries, accounting for more than 50%. As of the first quarter of 2021, the balance of green loans in the transportation, warehousing and postal industries reached 3.85 trillion Yuan, accounting for 29.5%; it was followed by green loans for electricity, heat, gas and water production and supply, with a loan balance of 3.73 trillion Yuan, accounting for 28.6%. In recent years, the proportion of green loans in the transportation and energy sectors has declined, but the proportion of green credit in other industries has continued to grow, increasing by 18 percentage points at the end of the first quarter of 2021 compared with the end of 2018, and the industry distribution is gradually diversifying(KPMG China, 2021)..

Figure 3.7: Distribution of Green Loan Balance Structure of Major Financial Institutions in China

Source: KPMG sorted data from WIND,2021



After years of development, China Green Credit has become the world leader, in addition to the gradual maturity and improvement of the system, the gradual expansion of the market scale, in product innovation and climate and environmental risk management are also constantly exploring and practicing.

With the increase in policies and the expansion of the scale of the green credit market, the innovation of green credit products and services has become more and more abundant. Financial institutions combine the characteristics of industrial development in different regions to develop innovative green credit products in multiple industries

and increase the intensity of green credit. At present, innovative green credit products have covered manufacturing, new energy automobile industry, green parks, green agriculture, and other fields. However, at this stage, most of the innovative green credit products are promoted in the pilot area, and they still need to be further improved and enriched.

#### **4.3.2 Green Bond**

##### **1) Development of International Green Bonds**

Internationally, green bonds usually refer to various types of bond instruments that use the raised funds to provide partial or full financing and refinancing for new or existing qualified green projects. In addition to assessing the general financial indicators of the debt (such as maturity, coupon rate, price and issuer credit, etc.), investors in green bonds also evaluate the specific environmental objectives of the projects that the bonds intend to support (International Capital Market Association, 2018).

##### **● Before 2013: The Initial Stage**

In July 2007, the European Investment Bank (EIB) issued the world's first green bond, climate-aware bonds, to investors in the 27 member states of the European Union, with a size of 600 million Euros (about 6.2 billion Yuan), mainly for renewable energy and energy efficiency projects. In November 2008, The World Bank issued the first truly standardized green bond, independently underwritten by Sweden's Nordic Bank of Scandinavians, for approximately SEK 3.35 billion (about 3.06 billion Yuan) to support climate projects by the Scandinavian National Pension Fund(World bank,2015).

The European Investment Bank and the World Bank's attempts at green bonds have attracted widespread attention in various circles, especially in the field of climate change. In 2009, the Climate Bonds Initiative (CBI) was established to facilitate investment in projects and assets needed to rapidly transform a low-carbon and climate-resilient economy. Subsequently, the United Nations Framework Convention on Climate Change established the concept of climate finance, the G20 and the International Monetary Fund officially recognized the importance of the green bond market, and the Organization for Economic Cooperation and Development and the

International Energy Agency also recommended green bonds as one of the solutions to climate change financing problems (Hainan Provincial Green Finance Research Institute, 2021).

Green bonds at this stage are still in their infancy, the market lacks complete green bond screening criteria and an open and transparent fundraising management mechanism. As an international financial institution, the multilateral development bank has the characteristics of high credit security and stable investment returns, etc. Through its green bonds, the green bonds issued by them can ensure the green specialization and compliance of the use of funds to a great extent, so multilateral development banks such as the European Investment Bank, the World Bank, and the International Finance Corporation have become the issuers of green bonds at this stage.

#### ● **After 2013: Rapid Development Stage**

In June 2013, the U.S. state of Massachusetts issued the first labeled municipal green bond; In October, Gothenburg, Sweden, issued its first Green City Bond. In November of the same year, Swedish asset company Vasakronan issued the world's first corporate green bond, which became an important turning point in the international green bond market, marking the official entry of corporate issuers, including Toyota, Apple and other multinational companies and industrial and commercial banks of China and other large commercial institutions have participated in the issuance of Green Bonds (Climate Bonds Initiative, 2020). In 2014, according to the data from World Bank, global green bond issuance was more than three times higher than in 2013. Since then, the global issuance of green asset-backed bonds and sovereign green bonds has further increased the diversity of green bond issuance.

In 2014, the International Capital Market Association (ICMA) issued the Green Bond Principles (**GBP**), one of the most important industry certification standards, laying the foundation for the unification of global green fixed income asset standards and the development of intermediary identification systems, and institutionally promoting the development of green bonds (World Bank, 2015). During this stage, the green bond was developed dramatically with the various types of innovations, and diversified issuing parties to join in.

## 2) International Standards for Green Bonds

Several international green bond organizations have issued criteria for the recognition of green bonds, such as the Green Bond Principles (**GBP**) developed by the International Capital Markets Association (ICMA), the Climate Bond Standard (**CBS**) issued by the Climate Bond Organization (CBI), and the **EU Taxonomy** scheme launched by the European Commission's Technical Expert Group (TEG). And Transportation industry is the area of these three criteria covered.

- *Green Bond Principles (GBP)*

GBP is the world's most widely applicable green bond standard. The first version of GBP, released on 31 January 2014, was developed by the major market participants in green bonds and coordinated by the International Capital Markets Association as the secretariat, and is a set of voluntary process guidelines. The document clarifies for the first time the definition and classification criteria for green bonds and aims to provide advice on transparency and disclosure for the development of the green bond market, and to outline a clear bond issuance process and information disclosure framework (Green Bond Principles, 2018).

- *Climate Bond Standards (CBS)*

CBS is one of the most common criteria for issuers and investors of climate bonds to determine whether the funds raised by their bonds are climate-efficient and meet the requirements for issuing climate bonds. CBS was issued by the Climate Bonds Initiative at the end of 2011 to describe the criteria for climate bond certification. The Climate Initiative has formed an international committee of experts composed of academic experts, specialized research institutions, development banks, investor representatives, etc., and has developed more detailed implementation standards in various fields (Climate Bonds Standard, 2018).

- *EU Taxonomy*

The EU Taxonomy, published in June 2019, is an important part of the EU Sustainable Development Financing Program Action, which aims to provide policymakers, sectors, and investors with practical tools to identify which economic activities are environmentally sustainable and to help capital markets identify investment

opportunities that are conducive to achieving environmental policy objectives. The European Union has further promulgated the Taxonomy Regulation and the EU Taxonomy Climate Delegated Act, which provide legal support and guarantee for the actual implementation of EU Taxonomy (European Commission,2020).

### 3) Green Bond in the Global market

According to public data from the Climate Bonds Organization (CBI), since 2014, the issuance volume and scale of international green bonds have increased year by year, and the issuance scale has increased significantly in 2017 and 2019 (Figure 3.8). Overall, Europe is the largest region to issue green bonds, with \$156 billion in green bond issuance in 2020, more than half of the world's total issuance; It is followed by North America and Asia Pacific, which accounted for 21.2% and 18.3% of the world in 2020, respectively. Judging from the data in 2020, the total issuance of green bonds in the three places accounts for 93.3% of the world. At the national level, the United States is the world's largest country in terms of total green bond issuance, with a total of \$223.7 billion issued since 2014; China and France rank second and third in the world with a total issuance of US\$129.6 billion and US\$124.3 billion respectively (Climate Bonds Initiative, 2021).

Figure 3.8: Green Bond issuance by major region of the world in 2020 (Sources: CBI,2021)

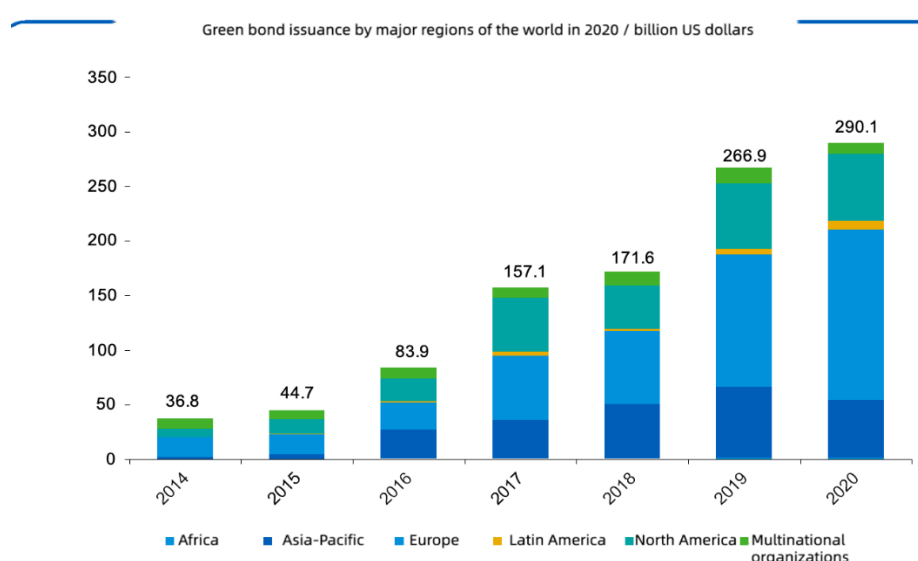
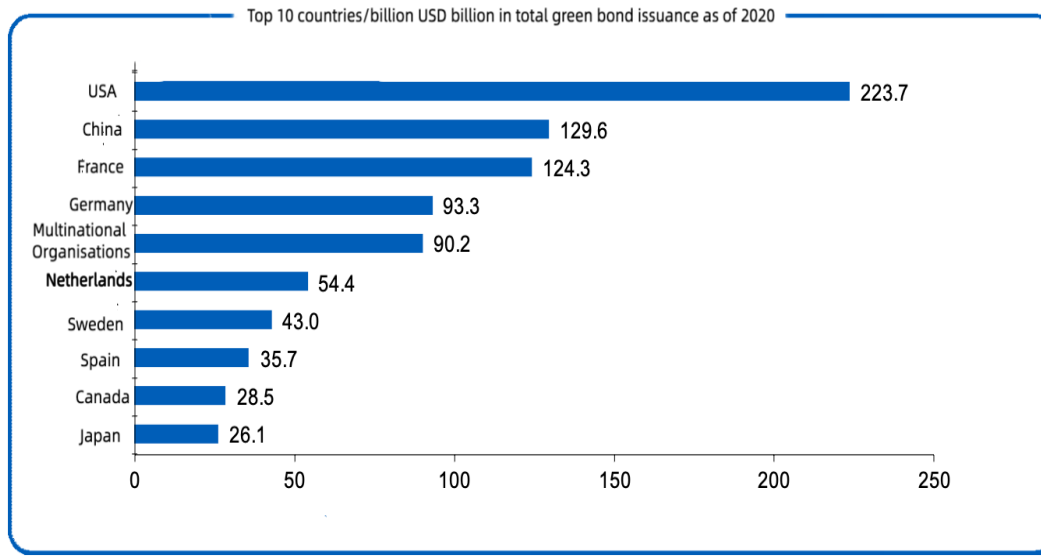


Figure 3.9: TOP 10 countries in total green bond issuance as of 2020



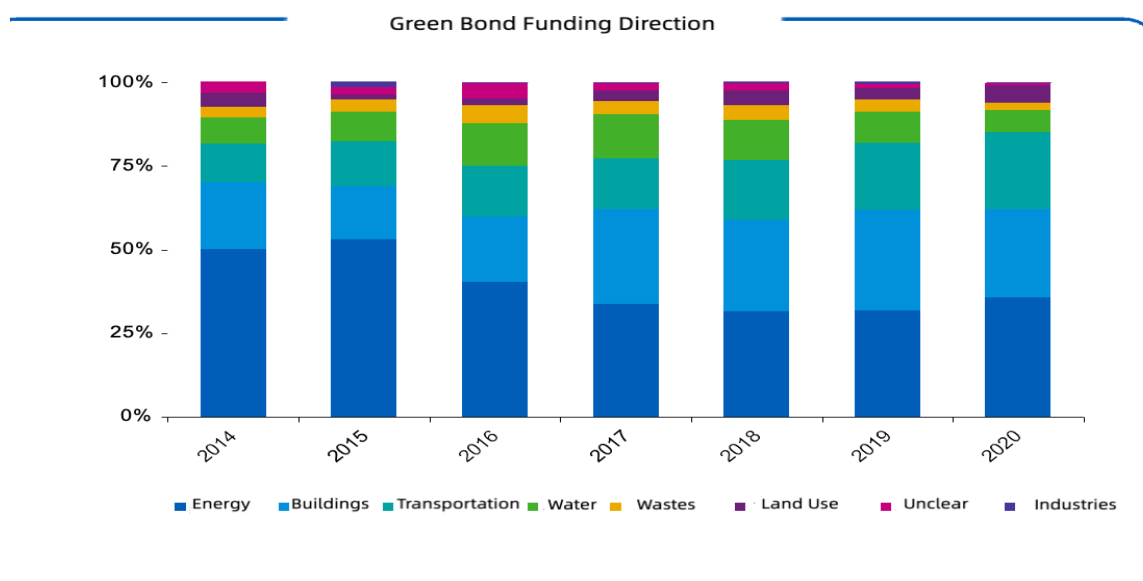
Source: CBI,2021

From the perspective of Green Bond issuers, private issuers usually include asset-backed bonds (ABS), financial institutions and non-financial institutions, and on the other hand, public issuers include development banks, government-backed entities, local governments, and the state. In recent years, the private entities in the green bond market have developed rapidly, and the proportion of their issuance scale in the global total scale has increased from 43.9% in 2014 to 58.9% in 2017, and has continued to remain above 50% since then, showing a year-on-year growth trend. Financial institutions and non-financial institutions occupy the most important position among private issuers. In addition to 2018, the scale of green bond issuance by public issuers has increased year by year, and government-supported institutions have played an important role in it, and their green bond issuance scale has increased by 84.6% and 78.3% in 2019 and 2020, respectively. In addition, since 2016, the state has also participated in the issuance of green bonds and increased its issuance scale year by year. (Data source: CBI,2021)

In terms of green bond capital investment direction, the energy, construction, and transportation sectors are hot areas, about 80% of the green bond funds are used in these three areas every year, and the scale of funds used for projects in the energy and transportation sectors has maintained year-on-year growth since 2014.

Figure 3.10: Green Bond Funding Direction

Source: CBI,2021



#### 4) Green Bonds Development in China

##### *Two Stages in the Development of the Green Bond Policy System*

**The first stage: From 2015 to 2019, the green debt policy system was initially established.** In July 2015, China's first green bond was successfully issued. On December 22, 2015, the People's Bank of China issued *the Announcement on Matters Related to the Issuance of Green Financial Bonds in the Interbank Bond Market* and issued *the Catalogue of Green Bond-Backed Projects*, which guided the issuance of green financial bonds, established the norms and policies for green bonds and officially launched China's green bond market. On 31 December 2015, the National Development and Reform Commission (NDRC) issued *the Guidelines for the Issuance of Green Bonds*; In March and April 2016, the Shanghai Stock Exchange and the Shenzhen Stock Exchange respectively issued *the Notice on Carrying out the Pilot Project of Green Corporate Bonds*; On 22 March 2017, the China Interbank Market Dealers Association (CBEC) issued *the Guidelines for the Business of Green Debt Financing Instruments for Non-Financial Enterprises*, which has achieved full coverage of the bond market through green bond policies.(CBEC,2017)

**The second stage: Since 2020, the green debt policy system has been continuously improved.** In 2020, with the "carbon peak, carbon neutrality" target proposed, a number of policies on green bonds have been intensively introduced. On 8 July, the People's Bank of China, together with the National Development and Reform Commission (NDRC) and the China Securities Regulatory Commission, jointly issued *the Notice on Printing and Distributing the Catalogue of Green Bond-Backed Projects (2020 Edition)* (Draft for Solicitation of Comments), which unifies the domestic green bond-backed projects and areas; On November 27, the Shanghai Stock Exchange and the Shenzhen Stock Exchange successively issued announcements to regulate the relevant business behaviors of green corporate bond listing applications. On April 21, 2021, the People's Bank of China, the National Development and Reform Commission and the China Securities Regulatory Commission jointly released *the Catalogue of Green Bond-Backed Projects (2021)* (hereinafter referred to as the "New Edition Catalogue"). This is the first update of China's green bond-backed project catalogue, and it is also an important document marking the unification of green bond classification standards, which reflects positive significance in unifying domestic green bond project standards, improving operability and integrating with international standards. The 2021 catalogue was officially launched on July 1 2021(Catalogue of Green Bond Supported Projects, 2021) .Compared with the 2015 catalogue, the new 2021 catalogue has made progress mainly in the following areas:

**Unified the definition of green bonds.** Previously, various regulatory authorities have given the definition of various types of green bonds such as green financial bonds and green corporate bonds in several documents, lacking a unified definition. The document clarifies that "green bonds refer to securities that are exclusively used to support green industries, green projects or green economic activities that meet the prescribed conditions, and issue and repay the principal and interest in accordance with statutory procedures, including but not limited to green financial bonds, green corporate bonds, green corporate bonds, green debt financing instruments and green asset-backed securities."

**Unified green bond definition criteria.** Prior to the release of the new 2021 catalogue, green financial bonds, green corporate bonds and green debt financing instruments are subject to the 2015 edition of the Catalogue of Green Bond-Backed

Projects, and corporate bonds are required to follow the Catalogue of Guiding Green Industries (2019). The introduction of the new version of the catalogue integrates two documents and combines factors such as China's economic and social development stage, industrial status, and ecological and environmental characteristics to unify the definition criteria of green bonds, no matter what type of green bonds, they only need to follow the 2021 edition of the catalogue to be identified as green bonds.

**Enhanced green bond-backed projects.** The 2021 edition of the catalogue divides green projects into six major areas: energy conservation and environmental protection industry, cleaner production industry, clean energy industry, ecological environment industry, infrastructure green upgrading, and green services. In terms of the specific scope of support, the new version of the catalogue has added the categories of green industries related to the key development of the country in the new era, such as green agriculture, green buildings, sustainable buildings, water conservation and unconventional water resources utilization, and the support for the field of green equipment manufacturing has also been extended from the production end to the support of related trade activities. At the level of specific support projects, green projects for carbon dioxide capture, utilization and storage, and green projects for clean heating in rural areas have been added, and the effective support of green bonds for carbon neutrality has been expanded.

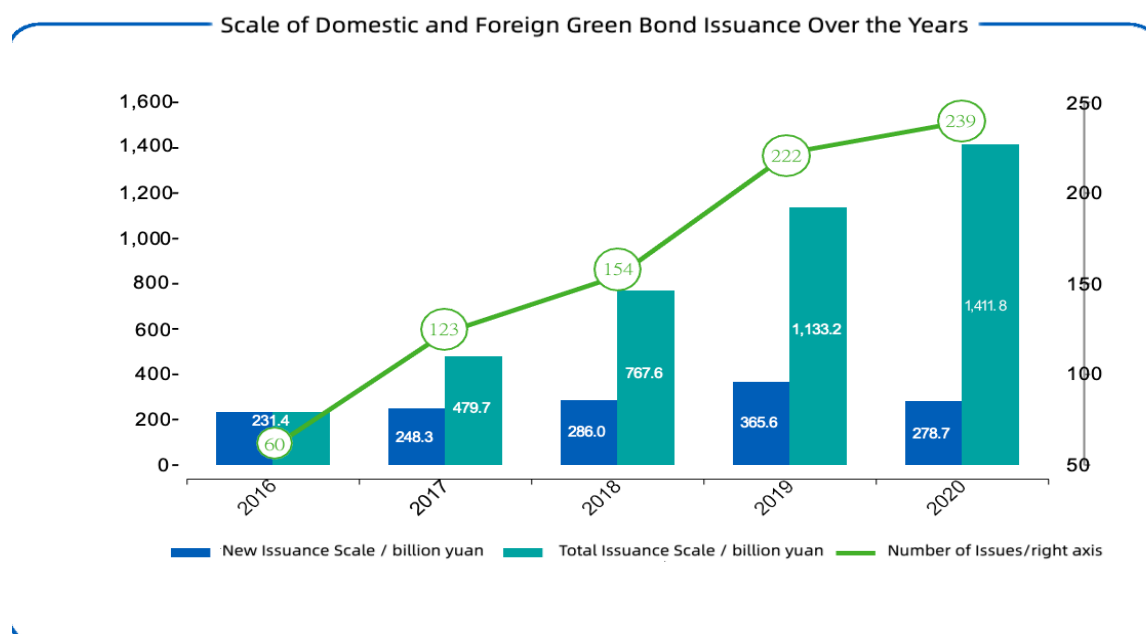
It is worth noting that the new version of the catalogue no longer includes coal and other fossil energy clean utilization projects in the scope of green bond support in the four-level classification, which is further converged with the international green debt standard. Therefore, in sum, during this stage, the development of green bond in China is going forward and close to the international standard.

The achievement of the "double carbon" target and the green transformation of China's economy require a lot of capital support, but the nature of green projects themselves has increased the difficulty of financing them to a certain extent. For the common green item, at present, green industry projects are still facing industry problems such as low returns, long capital recovery cycles, and low degree of marketization, and most investors do not have the ability to identify green industry projects. Bonds, as a relatively longer-term and more stable source of financing, can help green industry projects reduce the risk of term mismatches. As bonds that have been labeled, and a

considerable part of them have been certified by third-party assessment, green bonds have greatly improved the accuracy and reliability of investors in identifying green industry projects.

According to Central Bank data, as of the end of 2020, China's green bond stock was 813.2 billion yuan, ranking second in the world, and there were no cases of default. According to the green finance data released by the International Research Institute of Green Finance of the Central University of Finance and Economics, the scale of green bond issuance in China's bond market in 2016 was 231.418 billion yuan, and a total of 60 bonds were issued, including financial bonds, corporate bonds, medium-term notes, international institutional bonds and asset-backed securities, which showed an upward trend year by year. By 2020, the cumulative scale of domestic and foreign issuance has exceeded 1.4 trillion yuan, although due to the impact of the COVID pandemic, the scale of new issuance in that year was smaller than that in 2019, but the number of issuances increased year-on-year, and product innovation was more diverse (Central University of Finance and Economics International Institute of Green Finance, 2021).

Figure 3.11: Scale of Domestic and Foreign Green Bond Issuance Over the years

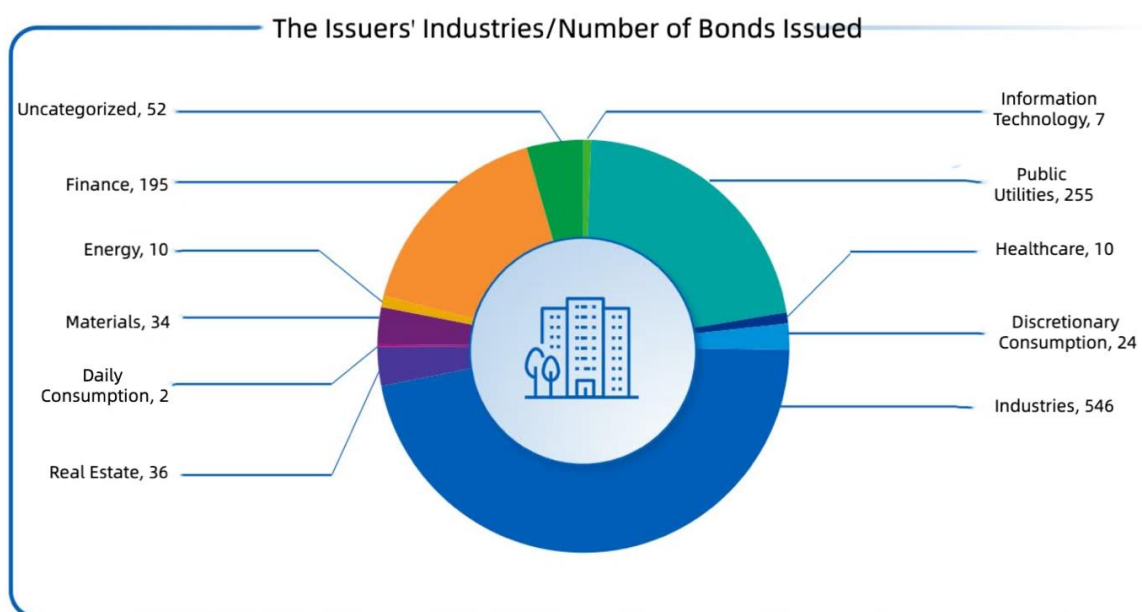


**Source:** Research Institute of Green Finance of the Central University of Finance and Economics

According to Wind data, more than half of green bonds are rated AAA by China's domestic rating agencies. Specifically, 352 bonds were rated AAA with an issue value of 706.41-billion-yuan, accounting for 57% of the total issuance. There are 385 remaining A-grade and AA-grade bonds, with an issue value of 298.40-billion-yuan, accounting for 24% of the total amount issued. There are 7 bonds rated B, with a total issuance of \$2.71 billion, accounting for a relatively small proportion(WIND, 2021).

In terms of issuing section, the bond issuers belong to a wide range of industries, mainly concentrated in the industrial and utility sectors, with 546 and 255 respectively. Among them, the issuers belonging to the industry are mainly concentrated in the industrial machinery, construction engineering and electrical equipment industries, while the issuers of the public utilities category are mainly in the energy industry such as water, electricity, and gas. It was put into figure chart as bellows:

Figure 3.12: The issuers' Industries of Bonds Issued (source: WIND data,2021)



The domestic market is the main listing place for green bonds in China. Wind data shows that the Shanghai Stock Exchange, the Interbank Market, and the Shenzhen Stock Exchange are the main listing places in China, and a total of 1119 green bonds have chosen to list in these three places, accounting for 96% of the total number of green bonds.

The largest number of green bonds issued for 5-10 years, with a total of 540, accounting for 46% of the total number of issuances; Secondly, within 5 years, there are 514, accounting for 44%; Green bonds over 10 years old are relatively few, with a total of 117.

### **4.3.3 ESG Investment**

ESG is an abbreviation of Environmental, Social and Governance, which is an investment philosophy and corporate evaluation standard that focuses on the environmental, social and governance performance of enterprises. Globally, ESG is increasingly attracting attention. Especially with the awareness of global climate change, epidemic prevention and control, energy conservation and environmental protection deeply rooted in the hearts of the people, ESG investment is rising rapidly. The issuance of ESG theme funds has become one of the main ways for investment institutions to practice the ESG concept.

#### ***International Development of ESG Funds***

In recent years, international ESG investment has shown a rapid development trend. According to the U.S. Sustainable Responsible Investment Forum (US SIF), sustainable investment in the U.S. in 2020 is close to \$17.1 trillion, up 42 percent from 2019. Among them, exchange-traded open-end index funds (ETFs) are one of the main forms of investment and are developing most rapidly.

#### ***ESG Thematic Fund in China***

Compared with the international community, China's ESG funds are still in the early stages of development, and most of the funds issued are pan-ESG funds. Unlike the "ESG Fund", which comprehensively includes environmental, social, and corporate governance investment concepts in its investment strategy, the "Pan-ESG Fund" may only focus on one aspect of it, such as low carbon and environmental protection. China's earliest pan-ESG public fund was launched in 2005, and since 2015, it has also increased by more than 20 in several years. (China Responsible Investment Annual Report 2020, Dec. 2020)

WIND data shows that as of July 6, 2021, a total of 61 fund companies have released 167 pan-ESG funds, of which the number of fund products clearly defined as ESG

themes is 19. 32 of the 109 fund products that have disclosed information have chosen equipment and new energy, accounting for up to 29%. In addition, food and beverage, pharmaceutical, electronics, computer, etc. are also the heavily invested by the fund. There are no ESG funds for focusing on the transportation industry(WIND,2021).

#### **4.3.4 Green Insurance**

Green insurance is also an important part of green finance and an important means of risk management in the process of achieving the "double carbon" goal. In a narrow sense, green insurance, also known as environmental liability insurance, is an insurance that takes the insured's liability for the pollution of water, land, or air as the insurance object. In a broad sense, green insurance refers to green insurance products such as environmental pollution, catastrophe, or weather risk protection, and includes products that provide risk protection for green energy, green transportation, green buildings, green technologies and other fields. Different from traditional insurance, green insurance pays more attention to integrating the concept of green development into insurance products and services, to achieve the purpose of promoting economic benefits and sustainable social development.

##### **1) Development of International Green Insurance**

Green insurance originated in developed countries in Europe and the United States, and its relevant systems are relatively perfect, mainly represented by environmental pollution liability insurance. In recent years, the service scope of green insurance has gradually expanded, and innovative products have been further enriched, represented by catastrophe insurance, green building insurance, carbon insurance, etc. Different countries in the world have different stages of green insurance development, and at the same time, according to the characteristics of each country, different green insurance system models have also been developed.

##### **● Environmental Pollution Liability Insurance**

As the mainstream product of green insurance, environmental pollution liability insurance is divided into two categories: compulsory insurance and voluntary insurance. Compulsory insurance is mainly for the government to promote enterprises

to apply for liability insurance through various means and measures such as legislation and administrative intervention, mainly representing countries such as the United States, Germany, and Sweden, of which Germany adopts the environmental liability insurance model that combines compulsory liability insurance with financial guarantee. In addition, some countries use a combination of voluntary and compulsory insurance, such as the United Kingdom, France, etc. Under this model, insurance is generally at the discretion of the business, while the law only enforces mandatory intervention in specific circumstances.

Green insurance in the United States began in the late 1970s, and insurance agencies set environmental liability insurance as an independent insurance type, mainly a compulsory insurance model, to solve increasingly prominent environmental problems and reduce environmental damage. After a long period of development, the U.S. government has promoted the development of green insurance through legislation, administrative intervention, and economic incentives. Environmental insurance mainly includes product liability insurance, comprehensive general liability insurance /commercial general liability insurance and professional environmental damage liability insurance. Under this model, compulsory insurance in the United States has three major characteristics: First, the premium is low, prompting enterprises to actively seek risk transfer means to reduce environmental risks during operation. Second, the coverage is wide, including progressive environmental pollution accidents. Third, the government funds the establishment of special policy-based insurance institutions, which are not for profit.

Sweden is another representative country that adopts the compulsory insurance model, which mainly obliges enterprises or organizations to apply for insurance through special legislation to make relevant provisions on environmental damage liability insurance, such as the establishment of *the Environmental Protection Law* and *the Environmental Damage Compensation Law*. Among them, *the Environmental Protection Law* requires enterprises or organizations to pay annual insurance fees in accordance with the price list of the government or government-designated agencies, and the guidance of the institutions is obvious, mainly through the government's mandatory provisions to achieve the purpose of public welfare relief, not for commercial profits. *The Law on Environmental Damage Compensation* specifies the

applicable conditions and judicial procedures for compensation for environmental damage and requires the Government and government-designated agencies to formulate insurance policies in accordance with approved conditions.

Germany mainly adopts a model of compulsory insurance combined with financial guarantees or commercial guarantees. In 1991, it promulgated *the Environmental Liability Law*, which implemented compulsory environmental liability insurance for some facilities and required relevant domestic industrial and commercial enterprises to provide environmental risk guarantees, such as trust funds and letter of credit insurance guarantees. If the relevant enterprise fails to provide insurance or financial guarantee, the government or agency may prohibit the project in whole or in part, and the relevant responsible person shall bear the corresponding penalties. Germany's green insurance model has a certain flexibility, allowing companies to choose different ways to provide financial liability proof, while ensuring that victims can receive timely and reasonable compensation. Under this model, insurance companies have a certain degree of freedom in setting premiums, which may lead to excessive environmental protection costs of enterprises, resulting in the result that the profit purpose is greater than the public welfare. On the other hand, if the government intervenes in the premium, it may affect the flexibility of insurance institutions to formulate premiums according to the financial characteristics and risk control capabilities of the insured and reduce the enthusiasm for insurance.

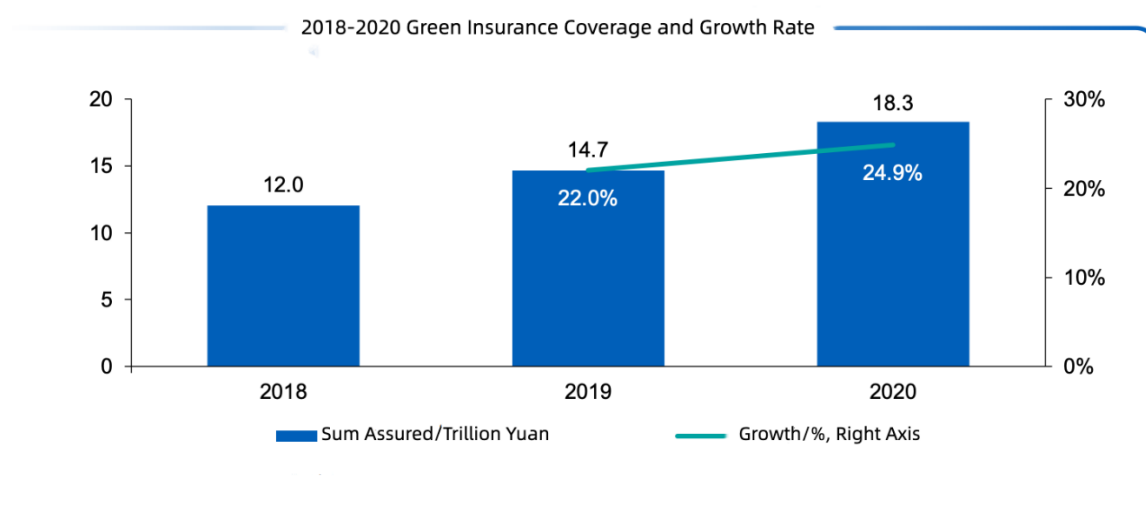
The United Kingdom and France have adopted a model that combines voluntary and compulsory insurance. This model is mainly based on the company's own decision to apply for insurance, supplemented by legal compulsion. As members of the *International Convention on Civil Liability for Oil Pollution Damage*, the United Kingdom and France mainly implement mandatory environmental liability insurance systems for offshore oil pollution damage. In addition, the UK has mandatory insurance on liability for nuclear reactor accidents.

In addition to these traditional green insurance products, it emerges some innovative products such as Carbon insurance, green building insurance, etc.

## **2) Green Insurance development in China**

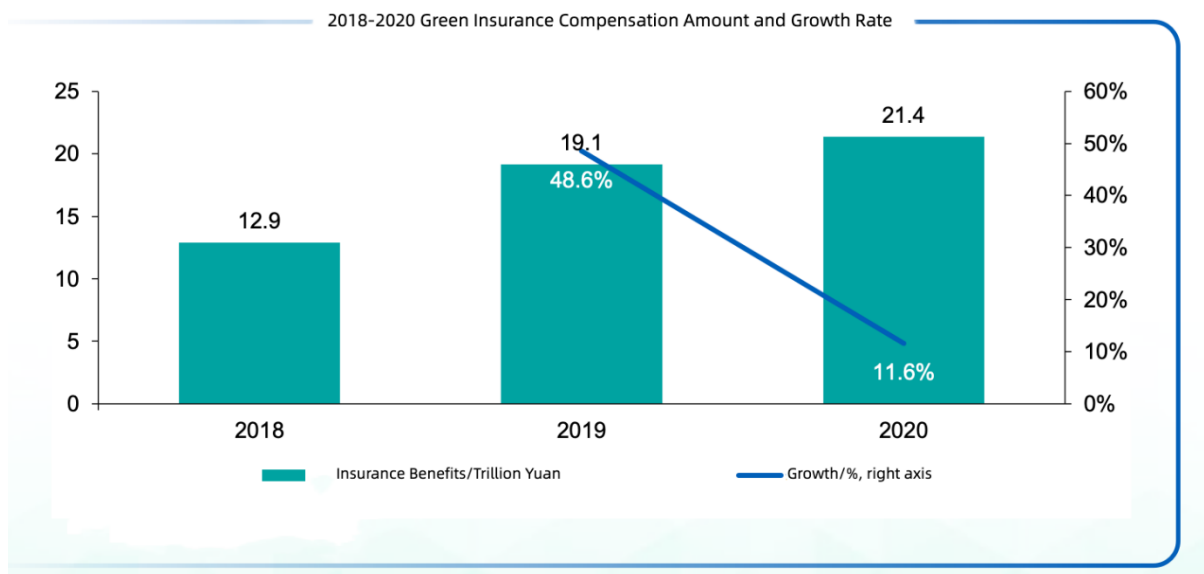
China's green insurance has been rapidly developed and improved through the construction of the policy system and years of practice. According to the data of the Insurance Industry Association, the financial coverage and payment of compensation for green insurance continued to grow from 2018 to 2020, and the efficacy of risk protection continued to strengthen: in the past three years, the insurance industry has provided a total of 45.0 trillion yuan in green insurance (including green energy, green transportation, green buildings, green technologies, catastrophes, weather, green resources, environmental pollution, etc.), with a total of 53.38 billion yuan in compensation. In 2020, the amount of green insurance will reach 18.3 trillion yuan, an increase of 24.9% year-on-year; Claims reached \$21.4 billion, up 11.6% year-on-year.'

Figure 3.13: 2018-2020 Green Insurance Coverage and Growth Rate



Source: China Insurance Association, 2021

Figure 3.14: 2018-2020 Green Insurance Compensation Amount of Growth Rate



Source: China Insurance Association, 2021

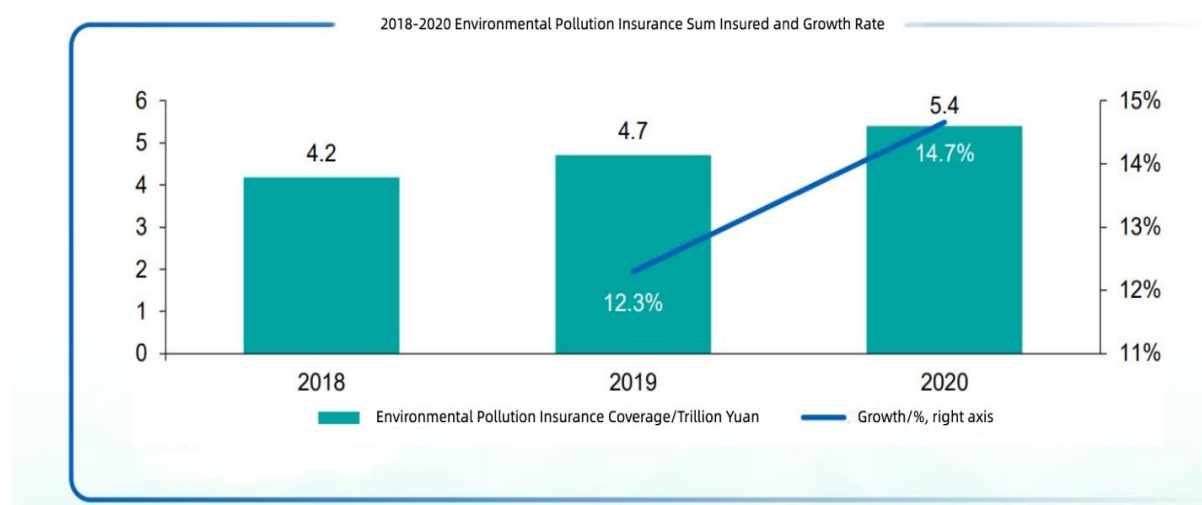
In addition, the investment of China's insurance funds in the green field is also continuing to increase, providing financing support for the green transformation of the industry. According to statistics from China Insurance Association, the stock of insurance funds used in green investment has increased from 395.4 billion yuan in 2018 to 561.5 billion yuan in 2020, with an average annual growth rate of 19.2%, involving urban rail transit construction, high-speed rail construction, clean energy, sewage treatment, ecological agriculture, and other fields.

In terms of green insurance products, environmental pollution liability insurance is the most important and representative green insurance product in China's current governance of environmental risks. In addition, China also promotes the innovation of green insurance types according to the different conditions of each region, such as the development of climate insurance, forest insurance, agriculture, and animal husbandry insurance, etc.

**Environmental pollution liability insurance:** Since the development of green insurance, the state has continued to introduce relevant policies, and local governments and institutions have cooperated to promote the development of environmental pollution liability insurance, especially to strengthen the risk protection of high-pollution, high-emission industries, and enterprises in terms of energy conservation and emission reduction and pollution control. According to the statistics

of the China Insurance Association, since 2018, the scale of environmental pollution liability insurance in China has increased year by year and has provided trillions of yuan of risk protection for tens of thousands of enterprises. As of 2020, the amount of environmental pollution liability insurance has reached 5.4 trillion yuan, with an average annual growth rate of 14.4% (Figure 3.15), and the compensation paid has reached 230 million yuan.

Figure 3.15: 2018-2020 Environmental Pollution Insurance Sum Insured and Growth Rate



Source: China Insurance Association, 2021

**Innovative green insurance products:** In addition to environmental liability insurance, China is also actively promoting the innovation of green insurance product varieties, creating a diversified insurance product system, boosting the green transformation of the industry, and helping to achieve the goal of double carbon. At present, China's insurance industry has provided risk protection for many industries, such as green transportation, green buildings, green energy, climate governance, etc.

In terms of green transportation, China's insurance industry actively develops exclusive insurance products for new energy vehicles and carries out pilot projects for extended insurance of new energy vehicles; At the same time, the insurance companies also actively promote the construction of new energy vehicle infrastructure such as charging piles and charging stations by means of insurance. In addition, in promoting rail transit construction projects, in addition to providing traditional insurance support, insurance companies also provide pre-insurance and in-warranty whole

process risk control services through the form of "insurance + service" to ensure green travel. According to the statistics of the Insurance Association of China, as of 2020, the total amount of green transportation insurance will reach 6.34 trillion yuan, an increase of 3.78 trillion yuan over 2018.

In August 2016, China's first carbon insurance agreement was signed by Hubei Carbon Emissions Trading Center, Ping'an Insurance Hubei Branch and Huaxin Cement Group to help enterprises manage risks in the process of transformation and upgrading. In 2018, the first guarantee insurance for carbon emission rights mortgage loans in China was jointly launched by Guangzhou Huadu CCB, Guangzhou PICC Property Insurance and Guangzhou Carbon Emission Exchange, helping enterprises to use their own carbon emission rights as collateral to achieve financing.

However, China's innovative green insurance products are still in the exploratory stage, and some innovative insurance types, such as agricultural catastrophe insurance, aquaculture environmental insurance, green building insurance, carbon insurance, etc., are still in the pilot process and need to be further improved.

**Green insurance technology:** While the insurance industry encourages and supports the innovation of green insurance product varieties, the state and insurance institutions are also vigorously promoting the development of the digital transformation of green insurance. For example, advanced technologies such as artificial intelligence, cloud computing, are applied to the online transformation of operational processes and the intelligent transformation of services. In May 2020, the Property and Insurance Department of the China Banking and Insurance Regulatory Commission issued the "Guiding Opinions on Promoting the Online Development of Insurance Industry", which clearly requires that the online rate of insurance related business areas should reach more than 80%. It is expected that in the future, the online operation system will run through the entire value chain of the insurance industry, reducing carbon emissions by reducing the use of paper in the operation of the insurance industry. In addition, insurance companies are also actively creating an "insurance + service + technology" model, using the Internet and other technologies, cooperating with third-party environmental protection service agencies, providing environmental risk prevention and control services such as risk assessment, screening of potential risk

factors, and post-event damage identification for insured enterprises and putting forward suggestions for improvement.

The concept of green finance appeared at the end of the 20th century and has become an important starting point for countries around the world to use financial means to ensure the sustained growth of green economy, and it is also a key development area during China's "14th Five-Year Plan" period. Due to the different stages of green finance development in different countries, there are also differences in the definition of the concept, theoretical system construction and mechanism of green finance. In addition, "green" in green finance involves many aspects of the environment, economy and society, and there is also a certain overlap and intersection with environmental finance, climate finance, sustainable finance, carbon finance, etc. Clarifying the concept and connotation of green finance is of great help to understand its development direction, system construction, and mechanism optimization. This chapter focuses on the conceptual definition, development history and development status of international and domestic green finance.

#### **4.4 Intersection of CSR, Green Finance Implementation and sustainable development in Chinese Chemical logistics industry**

##### **1) Green Finance in China's Logistics Sector: Challenges and Opportunities for Sustainable Development**

Although green finance originated in Western countries, it has experienced rapid development in China, gaining significant attention from both academia and industry. Today, China ranks among the top three green bond issuers globally. What started as a niche interest has become mainstream, driving the creation of numerous tools and methods to define green and sustainable investments. Society increasingly looks to the financial sector to foster a sustainable future, with social and governance factors integrated along the value chain, from corporations to financial services firms, and onward to clients and consumers.

In the context of the logistics industry, implementing green finance requires collaboration among the government, logistics companies, customers, suppliers, and

financial services firms. This comprehensive approach is evident in China's efforts to meet its ambitious environmental targets, including peaking CO<sub>2</sub> emissions by 2030 and achieving carbon neutrality by 2060. For instance, the Ministry of Transport has made green and low-carbon transformation a strategic priority in sustainable transport development, highlighted in the "14th Five-Year Plan for the Development of a Modern Comprehensive Transportation System" issued by the State Council in December 2021 (State Council, 2021).

Globally, the logistics industry is a significant contributor to carbon emissions, responsible for 21% of global CO<sub>2</sub> emissions. Road transport, in particular, plays a major role within this sector (IEA, 2019). Measures to improve energy efficiency and reduce emissions include shifting transport modes and adopting new fuels such as biofuels and electric vehicles. Various transport industry associations have also issued carbon reduction plans, such as the IRU's "Green Compact" for the road transport industry (IRU, 2021).

In China, the logistics sector has responded to governmental calls for carbon neutrality. Leading logistics companies have developed specific plans to align with national carbon targets. The National Climate Strategy Centre forecasts that achieving the "3060" carbon target will require an estimated 139 trillion yuan in new climate investment by 2060, with an average annual funding gap of 1.6 trillion yuan. This raises questions about how to meet such financial demands and how green finance mechanisms can practically support industry goals (National Climate Strategy Centre, 2021).

Current regulations and incentives, such as the "Green Finance Implementation Guidebook for the Logistics Industry" and local initiatives like Beijing's "2020 New Energy Light Goods Operation Incentive Plan," offer some support (Beijing Municipal Transportation Commission and Municipal Bureau of Finance, 2020). However, these measures often remain at the principal level and may not fully address the needs of small and medium-sized enterprises (SMEs) in the Chinese chemical logistics sector. Therefore, further research through data surveys and industry interviews is necessary to validate these hypotheses and explore the practical impact of green finance on SMEs within the logistics industry.

Given the current landscape of China's chemical logistics sector and its goals for low-carbon, sustainable development, research focusing on CSR, green finance, and sustainability presents an opportunity for doing the further exploration.

## 2) Exploring the Research Gap: Integrating CSR, Green Finance, and Sustainability in China's Chemical Logistics Industry

As I reviewed in the chapter 3 and this chapter, there are lots of research for these individual concepts: Extensive research has been conducted on CSR, exploring its impact on corporate reputation, customer loyalty, and financial performance. Numerous studies have demonstrated the positive influence of CSR on business outcomes, including enhanced corporate reputation, increased customer loyalty, and improved financial performance (Carroll, 1999; Porter & Kramer, 2006); Green finance encompasses financial activities aimed at fostering environmental sustainability. It includes instruments such as green bonds, green loans, and sustainable investment funds. The field of green finance has been widely studied, with research highlighting its role in supporting environmentally beneficial projects, facilitating the transition to a low-carbon economy, and driving sustainable economic growth; Sustainability seeks to balance economic growth, environmental stewardship, and social equity. Meanwhile, the review in my research also found that CSR, green finance concept and sustainable development concepts are closely associated with each other and there are some common theories and frameworks such as Triple Bottom Line, the Circular Economy theory. Despite the substantial body of research on CSR, green finance, and sustainability individually, the intersection of these concepts remains relatively underexplored. For example, there are relatively few studies on the issue of "green finance and sustainable economic development" in China. Chinese scholars, Li Xiaoxi, Xia Guang and CAI Ning (2016) pointed out that green finance is of great significance in promoting industrial transformation and upgrading, promoting sustainable development of regional economy and accelerating social progress. In terms of quantitative analysis, Zou Yue (2019) divided 31 provinces and cities into four economic zones based on the panel data of 31 provinces and cities in China from 2007 to 2017, explained and analysed the research results of different regions, and

conducted an empirical study on the relationship between green finance and regional economic development through the PVAR model.

This gap in research presents an opportunity to investigate how the integration of CSR and green finance can drive corporate sustainability and contribute to broader societal goals. The Chinese chemical logistics industry as I detailly explored in Chapter 2, with its high-risk characteristics, exemplifies a sector where this research gap is particularly pronounced. The Chinese chemical logistics industry is characterized by high risks due to the nature of the materials it handles, including hazardous chemicals and materials with significant environmental impacts. The industry's complexity and potential for environmental and social harm underscore the importance of integrating CSR, green finance, and sustainability. However, research specifically addressing this integration within the Chinese chemical logistics industry is limited, presenting a unique opportunity for exploration. As the expectations of stakeholders such as consumers, investors, and regulators for corporate accountability and transparency continue to rise, the integration of CSR and green finance into business strategies is becoming ever more crucial. This research aims to fill this gap by combining quantitative and qualitative methods to examine how CSR and green finance can contribute to sustainability in the Chinese chemical logistics industry. By doing so, it seeks to provide insights into how these concepts can be effectively integrated to enhance corporate resilience and promote sustainable development in high-risk sectors especially under the current China “double carbon” target.

## **Chapter 5 Research Methodology**

### **5.0 Introduction**

Last chapters it investigated the various literatures regarding to the corporate social responsibility and green finance for the sustainable development.

This chapter it will go to the research framework and research methodology exploration to discuss the operational aspect of the research. The first sections of this chapter will explain the research framework investigation, especially focus on the CSR and green finance in the Chinese chemical logistics industry. The later sections of this chapter will investigate the research methodology it employed.

### **5.1 Research framework**

This section will briefly introduce the research areas by introducing the market players groups in the Chinese logistics industry. They are categorized into three major types to contextualize the study. In short, they are Chemical enterprise subsidiaries (very minor portion due to the historical reason), Public listed third-party Logistics companies, and Private third- party Logistics companies. Although there are lots of different kinds of classification method, such classification is to identify the particular features of each group. It is also for the purpose of this study to list the related research hypotheses.

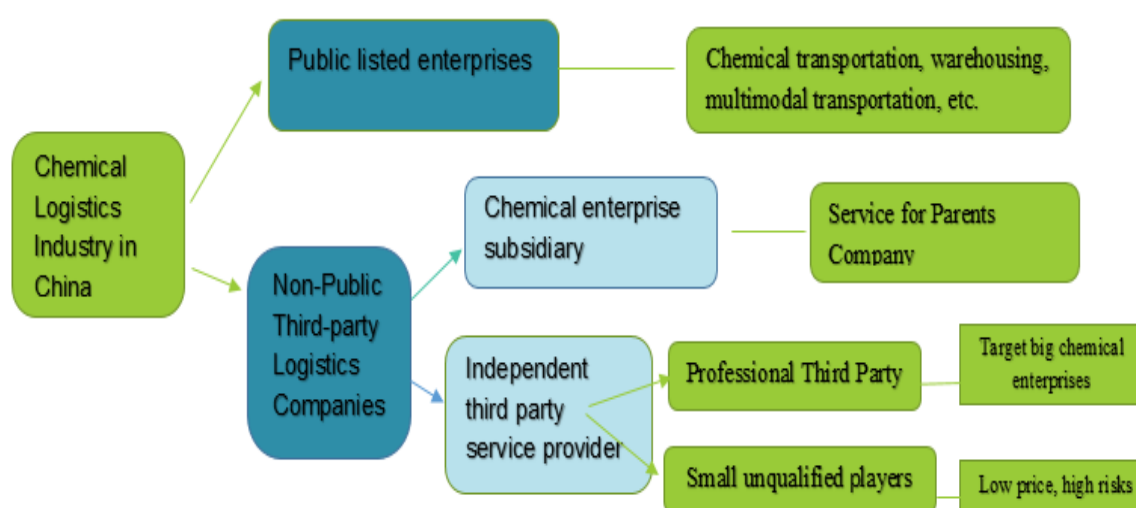
Chemical logistics industry enterprises provide chemical goods circulation and related value-added services. They are somewhat different from the traditional logistics suppliers which each section of logistics business is provided by different service providers. Quite of major Chinese chemical logistics players provide full set of delivery and professional value-added services for the whole link of chemical logistics. It integrates basic logistics services, logistics solution design and logistics consulting to form a one-stop comprehensive logistics service, which including chemical products freight forwarding, storage and transportation business etc. In the basic logistics stage, the company implements basic logistics services by purchasing vehicles, building its own warehouses, and meanwhile outsourcing external fleets and leasing warehouses

during the peak season. All the business are linked through powerful information systems and standardized management. Furthermore, the further stages may involve in the logistics finance or the chemical products trading business.

### 5.1.1 The Clusters for the research

To look at the market participants in the study for Chinese chemical logistics, there are quite a big amount participant per to the previous chapters introduced. I tried to cluster these participants into two large categories based on their similar characteristics.

**Figure4.1: Chart for Chemical Logistics Industry in China**



Source: CFLP (China Federation of Logistics & Purchasing) (2018)

#### Category A: Public listed third- party enterprises in the chemical logistics industry

Some of the public listed chemical logistics enterprises are usually subordinate to the state logistics giants, specializing in providing comprehensive services for the chemical industry, such as road transportation of dangerous goods, storage, multimodal transportation, etc. For such players, they are supported by the big state-owned logistics group which have mature transportation operation system and high safety control experience. For example: Cosco Shipping Chemical Logistics Co., Ltd., Sinotrans Chemical International Logistics Co., Ltd. Some are developed from the market without the backup mother company but grow rapidly by getting the strong

financial support from the stock market by get them public listed in Chinese stock market. For example, Milkway, it was a small vertical chemicals transportation companies, which starts its business from basic logistics services to the further chemical trading business after listed on Chinese stock market in 2018 successfully.

Category B: Non-Public listed third-party companies in the chemical logistics industry

#### 1) Logistics subsidiaries of chemical enterprises

At the very beginning, the logistics subsidiary of the chemical enterprise was only regarded as a service department by the chemical enterprise. Later, due to changes in the structure of the safety management in the chemical industry, it was separated from the company and established a separate subsidiary. This kind of company mainly undertakes the chemical transportation business of the parent company and do not service other company. The parent companies could be stated owned and private as well. For such companies, they do not have profit and margin target because they just work as the subsidiary of the parent company. For example: Zhejiang Juhua Logistics, ENN Energy Logistics, Sinochem Liaoning Co., Ltd. But for this section, the portion is limited and will not get further developed for the better company governance concern.

2) Other than the subsidiary company, the private third-party chemical transportation market is somewhat chaotic. Many professional third-party transportation companies are developed from the subcontractors of state-owned transportation companies, such as Jingbo logistics and Wanchuang Dangerous Goods Logistics Co., LTD., which take the transportation of chemicals as their main business. Meanwhile, there are also quite a lot independent third-party players in the Chinese chemical logistics industry. Different from ordinary cargo transportation, chemical logistics transportation actually has a higher threshold, with strict requirements on drivers, transport vehicles and enterprise licenses. It has so many small players so that the non-compliance players are quite common in the industry. At the same time, the compliance rate is closely related to the level of economic development. For example, in more developed cities such as Beijing, Shanghai and Guangzhou, the compliance rate is between 65% and 75%, or even higher. But in slow-developing areas, compliance rates are less than 50%. For those non-compliance or disqualified players, it is meaningless to put them

into this research scope because for these companies CSR and green finance are too unrealistic to consider at this moment.

Therefore, the public listed third party players in Category A and well compliance for operation medium sized chemical logistics companies in China in Category B are two big sections for this research target.

### **5.1.2 Research Hypotheses Development**

This study is to explore whether the CSR and green finance has positive impact for the long-term sustainability development of Chinese chemical logistics industry. Thus, the study attempts to investigate the CSR and green finance implementation in the Chinese chemical logistics industry to see their potential functions. CSR is the core element to ensure Chinese chemical logistics companies sustain in the market, furthermore, green finance provide the companies to further sustainable development. Therefore, CSR, green finance and sustainable development are the major research variables. From these, I developed a number of sets of hypotheses listed in the following sections.

Two sets of hypotheses are currently considered:

- Risk management in the form of CSR increases profitability of corporations.

Kytle (2005) revealed that CSR is related to corporate risk management through two means: by providing Intelligence about what those risks are, and by offering an effective means to respond to them. The key to both, as implied in the CSR definition, is more effectively “managing stakeholder relationships.” From the literature review for CSR theory, especially in the light of the stakeholder theory, Maignan et al (2000) indicated that CSR practices measured by a 5-point scale scoring by external experts have a positive association with financial performance measured by return on assets (ROA), return on investment (ROI), profit growth, and sales growth. The stakeholder theory stressed the necessity to actively engage in CSR practices because CSR are benefit for the companies. From the perspective of stakeholders, the company has the CSR in practice can enhance their commitment to the firm’s operations and lower the potential risks (Weiss, 2008). Based on the above discussions, I develop the first hypothesis to examine whether CSR can increase profitability of corporations. This

means that the Chinese chemical logistics companies which make compliance management in the form of CSR will gain returns and lead to long term profit and sustainability. The practical compliance management is related on various stakeholders (shareholders, employees, customers, and suppliers, the environment and society)

H 0: In the Chinese chemical logistics industry, Risk management in the form of CSR has no relationship with firm performance. This is the null hypothesis of the research.

H 1: In the Chinese chemical logistics industry, Risk management in the form of CSR has a relationship with firm performance. This is the alternative hypothesis of this research.

The descriptive aspect of stakeholder theory helps us to figure out different groups of stakeholders which are related to companies' CSR performance. Shareholders are the main object of direct social responsibility of logistics enterprises. Shareholders are entitled to share the ownership and control rights of the logistics enterprise in order to obtain profits from the investment in the logistics enterprise and provide financial support to the logistics enterprise. Furthermore, The indirect social responsibility of logistics enterprises also refers to the protection of the legitimate rights and interests of employees, the provision of public services and protection the natural environment and the promotion of the social image of the enterprise, that is, the legal responsibility and moral responsibility for employees, to provide safe transport service for the public, the responsibility to protect the natural environment, to provide emergency assistance for social emergencies. Since the employees of the Logistics Company especially the drivers are higher risks in the process of operation, the logistics companies shall perform the regular health and safety checks for them and also keep the routine EHS training to avoid the potential incidents. Especially, the traffic incidents and also the leakage of chemical cargo in the Chinese chemical logistics industry will cause the serious social influence and could lead great loss for the company. And even to the associated customer and supplier, because CSR has been extended to the whole supply chain. Also, with the stronger attention in China to the environment and health damage, the Chinese logistics companies regard the environment as their important CSR strategy because of the negative influence to their neighbourhood during the chemical container cleaning and waste disposals. However, whether or how the

environmental aspect of CSR influence financial performance are still unclear. Some Chinese researcher (Xu & Wu et al.2018) indicated that environmentally friendly CSR will promote innovation in Chinese organisations through public visibility and transparent management. Under the call for Carbon peak and carbon Neutrality, the Chinese chemical logistics companies also are trying to introduce the new technology and innovative operation model to generate the saving from the operation and minimise the risk, because local government could provide the tax reduce or refund or reward for such carbon reduce programmes. In sum, based on the above discussion, our hypothesis shall examine whether CSR management from various dimensions increase the profitability of corporations.

- Green Finance boosts low carbon economy development and business sustainability. This means that developing Green Finance will strongly support the business development and thus contribute to business sustainability.

H 0: Green Finance has no impact on chemical logistics business development and sustainability. This is the null hypothesis of the research.

H 1: Green Finance has an impact on chemical logistics business development and sustainability. This is the alternative hypothesis of this research.

According to recent publishes (Khan et al, 2020, p586):” some scholars (e.g. Brandi et al., 2020; Li et al., 2019; Nourira et al., 2016) reported that green finance can underwriting environmentally-related regulations and minimizing carbon dioxide (CO<sub>2</sub>) emissions and it will lead to sustainability through raising environmental quality.” It can reduce the consumption of fossil fuels by 26 percent, which can reduce CO<sub>2</sub> emissions by 12.4 percent (IEA, 2017). Green finance is, directly and indirectly, related to various sustainable development goals. (Taghizadeh-Hesary et al., 2019). Although green finance is more and more important than ever, there are no empirical research to examine the green finance impact on chemical logistics business development and sustainability. Therefore, the question arises as to whether the growing green finance could lead to the business sustainability. For Chinese chemical logistics companies, will the target of Carbon peak and carbon Neutrality involve further additional investment? Will it bring benefit for company performance, or alternatively, will green finance intensify the trade-off between green development and sustainable economic

development? The actual relationship between green finance and company sustainable development is still unexplored, despite its high relevance. The goal of this study is to fill this gap with empirical evidence. Thus, through this research, if the research founding is positive, for Chinese chemical logistics industry, whether understanding the consequences of green finance and how to take good use of it could be decisive in encouraging stakeholders to adopt green finance.

The above hypotheses are tested with the secondary data and primary data gathered through the surveys from the interview. I will introduce the research methodology employed.

## **5.2 Research Methodology**

Research methodology simply refers to the practical “how” of any given piece of research. More specifically, it’s about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims and objectives. According to Bryman (2001), research methodology is a general orientation or the research process framework to conduct research. It could be available as quantitative research and qualitative research.

Generally, quantitative research covers approaches which attempt to measure and count social phenomena and the relationships between them. It dominates long time for business research until the 1980s the qualitative research getting more influential. Quantitative research is a research strategy that emphasizes quantification in the collection and analysis of data. The advantage of quantitative research is that it could generate large number of samples and the nature of this method is usually deductive as it implies testing of theory.

Qualitative research is a research strategy that usually emphasizes words rather than numbers in the collection and analysis of data. As a research strategy, it is in general inductive, constructionist, and interpretive, though qualitative researchers do not always subscribe to all of these intellectual positions. (Bell and Bryman, 2015) The major advantage of this method is that it could treat individuals’ inputs as crucial information to validate the whole study. To explore the ‘why’ and identify the motivation and connections between factors during this research, which is what quantitative approach cannot cover.

To achieve the research aim and objectives, it combines the quantitative and qualitative research. For the three sections of the research cluster, the secondary data for the public list companies will more reliable and easier to access, this research will choose the quantitative method to do the secondary data analysis on their CSR data to test the hypotheses. Therefore, I use the quantitative method to explore the first hypotheses because it involves the analysis for large number of financial data. For another two sections, the private logistics companies, and the chemical company's subsidiary, it will mainly do the primary data collection and analysis. Normally, the questionnaire survey method is a method widely used in domestic and foreign social surveys. However, it will not be taken for this study because both the concept of CSR and GR are still aware by very limited senior management in the Chinese Logistics industry. The advantage for questionnaire survey is mainly for the survey group in larger scale and large population sample. Since the study will focus on the senior management level, the interview survey could generate more advantages aims to delve into the more detail respondent's views. The analysis from such part of primary data will be on the qualitative base. Therefore, the use of mixed methods approach that combined quantitative and qualitative research enabled a more rounded and complete picture to be drawn for this research.

### **5.3 Research Strategy**

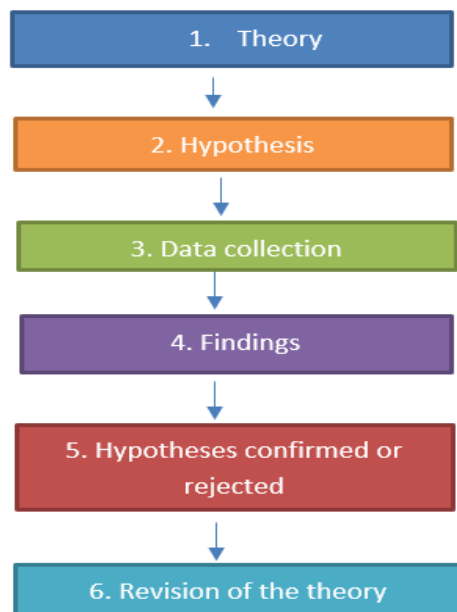
Research strategy is the overall approach that take in the research project. It includes the philosophical assumptions that inform the research design, the choice of research questions, and the methods to use in order to try to answer them. (Bell and Bryman, 2015)

Research strategy has four major approaches: inductive, deductive, and retroductive and abductive which the last two is less familiar. According to Blaikie (2007), the retroductive approach construct hypothetical model of the subject and proceeds with observations and experiments to acquire the reasoning of its existence. The process of retroductive needs to use imagination and analogy since it provides explanations by examining data or model. Regarding to abductive research approach, it does not test theory, it generates new ideas and outcome similar like 'grand theory'. The objective of abductive approach is to discovering new results (Dubois and Gadde, 2002). The abductive approach investigates and understands the social phenomenon

of a subject's motivation by entering into its world to acquire knowledge as to “what” and “why” that leads to the social activities conducted (Blaikie, 2007).

Inductive approach and deductive approach are the two major common employed approach by the researchers. A deductive approach is associated with the relationship between the theory and research. The process of deduction is as follows:

Figure 4.2 the process of deduction



Source: Business Research Methods (Bell and Bryman, 2015)

The deductive research is usually a theory-testing method that uses various tools to analyses mainly secondary data. The Inductive approach allows the data to speak rather than rigidly adhering to a precedent theory or given idea (Vandestoepe and Johnston, 2009). With an inductive stance, theory is the outcome of research. In other words, the process of induction involves drawing generalizable inferences out of observations. However, just as deduction often entails an element of induction, the inductive process is likely to involve some deduction. Deductive and inductive strategies are therefore better thought of as tendencies rather than as a hard-and-fast distinction. (Bell and Bryman, 2015) For this study, since I use questionnaires and interviews to collect and analysing primary data in generating and testing the hypothesis, it adopted an inductive research approach. Meanwhile, I also involve some

deduction to analysis some secondary data such as the company finance data on the relationship between CSR and sustainable development.

#### **5.4 Research Design**

A research design is a framework for generating evidence that is suited both to a certain set of criteria and to the research question that is being addressed. Each research design is considered in terms of the criteria for evaluating the quality of research findings. The research design guides the execution of a research method and the analysis of the subsequent data (Bell and Bryman, 2015). There are lots of different types of research designs, this study will make use of exploratory study design, survey design and case study design in order to get a deep and practical experience and findings on this research.

The reason to take exploratory design for qualitative analysis is to understand the perceptions and practices in a specific bounded system which is expected to achieve an outcome that provides a description and interpretation of the phenomena (Vandestoep and Johnston, 2009). This research is to seek CSR and green finance to support business sustainability. To achieve this research aims, I use the case study design to specifically focus on the single industry- Chinese chemical logistics industry by collecting data through questionnaires and interviews to do the survey. The chemical logistics companies and their customers are all the subject matter in this study makes it a case study. Meanwhile, exploratory research design is to be an appropriate research design for exploring the real practice and feedback of green finance in the Chinese chemical logistics industry. Therefore, the study is constructed as an exploration-oriented case study. Business research and its associated methods do not exist in a vacuum. Regarding the research design for this research, case study will be main and most important research approach. Case Study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a 'real life' context. It is research based, inclusive of different methods and is evidence led. The purpose is to generate in-depth understanding of a specific topic, program, policy, institution of system to generate knowledge and/or inform policy development, professional practice and civil or community action (Simons, 2009). The case study approach is a popular and widely

used research design in business research (Eisenhardt and Graebner , 2007).The reason I choose Case Study as the major research method is based on not only the aims and objectives, and research questions of this study, but also the characteristics of the chemical logistics industry. A 'case study' is the study of the singular, the particular, the unique' (Simons, 2009). Compared with the normal and general logistics industry, chemical logistics is a very unique and particular section due to various complex restrictions from regulations and operational practice. For carrying out this research, it has to do much comprehensive explorations on this industry.

To take a case study method, it will allow to understand the distinctiveness of the case and provide the opportunity to study the selected case or cases in depth. When the predominant research strategy is qualitative, a case study tends to take an inductive approach to the relationship between theory and research (Bryman, 2015). The basic case study entails the detailed and intensive analysis of a single case. As Stake (1995) observes, case study research is concerned with the complexity and particular nature of the case in question. The case study for this research will be for the Chinese market and focus on the Chemical logistics industry. Although the Chinese economy has developed rapidly in recent years, considering the finance tools available in the business market, it is still not well developed. The companies still mostly rely on bank loans and the banks only stick on what mortgages they can get. In considering the chemical logistics industry in China, it could be a mixture of 'danger' and 'opportunity". Due to the historic reason, this industry did not have much of an entry barrier about ten years ago and was full of small players. Meanwhile, since such an industry is so risky, the big players would not take such risk to work on it. However, such a situation caused very bad environmental consequences so that the global chemical factories even cannot find the qualified logistics suppliers in the market. Since the government has issued more and more regulations and restrictions for industry players to comply with, it increased the industry barriers and stands for the higher profit in the future long run and increased scope for the development of strong players because the smaller players have quit the market without enough resources to spend on. However, when these players expand their business for the target of carbon peak and carbon neutrality and set up the countrywide network to reduce costs, from where could they get finance support these costs for the carbon reduction? They urgently need a better solution which goes beyond traditional bank loans. Especially the pressure from the carbon

neutrality and emission peak target in the logistics industry, the call for professional green finance is what the government policy support. Since this research is also concerned with the risk management of Green Finance for Business Development and Sustainability, case study on the Chinese chemical logistics industry is very appropriate. This method will allow us to explore the CSR and Green Finance theories with the business practice by investigating deeply their application in the industry. The research will be carried out on the Chinese chemical logistics industry which is the very special and unique section in the whole logistic market. The case study will focus on this niche industry to do the in-depth exploration.

## **5.5 Research method**

This section describes the chosen method in detail for the empirical work. Furthermore, the perspective from which I carried out this study is presented here as the methods of the data collection, analysis framework, and other relevant factors need to be considered when conducting research of this kind. To draw on multiple sources of data to strengthen findings through triangulation, as introduced, this research will employ a combination of qualitative and quantitative methods implied in evaluative type of research.

Since it is a combined methods research based on case study. This section will further explain the detail methods which will be used in data generation.

### **5.5.1 Data Collection: Secondary data collection**

Secondary data can come from a variety of sources, including government agencies, academic research studies, and private organizations. The aims of the research are to seek the impact of CSR management and green finance for business development to support company performance and business sustainability. The case study will focus on the specific Chinese chemical logistics industry. There will involve quite a lot kinds of secondary data to generate the grand understanding for the Chinese chemical logistics industry. It shall be the official statistics and comes from three major channels:

- Government official websites, including but not limited to annual analysis reports, policies and regulations, etc.

- Industry associations and research institutions, including industry analysis, investigation reports, evaluation reports, etc.
- Financial and non-financial reports of relevant companies in the industry, including the official website and stock market
- Professional database for research use.

One of the purposes of secondary data collection is to build the general understanding for the research case: Chinese chemical logistics industry. The other purpose is for the analysis of public-list company (Category A) CSR report and its impact for the company performance. The Financial statements and CSR reports are either from the related company official website or from, short for China Stock Market & Accounting Research Database (CSMAR) which is a comprehensive research-oriented database focusing on China Finance and Economy. CSMAR was developed by Shenzhen CSMAR Data Technology Co., Ltd based on academic research needs, meeting with the international professional standards. CSR is one of the independent variables of this research. The data of CSR for the public listed third party chemical logistics company is collected from the Hexun CSR database. Hexun CSR database is one of the biggest third-party systems in China providing CSR performance drawn from 38 indicators under five dimensions. Hexun was founded in 1996 and Hexun evaluation databased was launched in 2010. Therefore, Due to this data availability, the research data takes from Year2010-2019. All the Hexun reports (CSR and the annual reports) data are assessed under the framework of stakeholder theory. CSR performance is evaluated through five dimensions of stakeholders which includes shareholders, employees, suppliers and customers, the environment, and society.

Regarding to the reason of choosing Hexun CSR evaluation system, I would like to explain as follows. There are many institutions that will evaluates the social responsibility for Chinese enterprises, mainly including Hexun, Runling, the Research Center for Corporate Social Responsibility of the Chinese Academy of Social Sciences, Golden Bee WTO Economic Herald, Southern Weekend Newspaper, Fortune (Chinese List) and so on. However, only Hexun and Runling do the CSR evaluate for all the public listed companies in China. For example, the Chinese Academy of Social Sciences just evaluates the top 300 Chinese enterprises (top 100 state-owned

enterprises, top 100 private enterprises, top 100 foreign enterprises) and companies with strong economic strength in specific industries, while most other evaluation institutions require enterprises to self-declare for evaluation. It is understandable based on the current CSR acceptance situation in China, for the small or medium sized or weak financial picture companies, they are reluctant to rank CSR as their current focus or target. For empirical analysis that requires extensive and large sample studies of social responsibility performance, the data provided by Hexun and Runling are more widely used. However, Runling only scores companies that publish social responsibility reports, right now, the Chinese companies publish CSR report are quite limited so as Runling data is quite for limited sample size. Hexun does the scores for all the Chinese public listed companies, but still some missing for 2018-2018 data.

Generally, there are six types of CSR measurement methods being used in China: reputation index method, questionnaire survey method, content analysis method, dummy variable method, the accounting index method and the charitable donation method (X.W. SONG,2021). The reputation index method is the most widely used. Both Hexun and Runling are taking reputation index method. The questionnaire survey method was the second largest in use and this method is especially suitable for some research that is difficult to find alternative variables, such as the impact of CSR on customer satisfaction and consumer response. Before 2012, the content analysis method was used more by scholars, but with the popularization of databases such as Runling and Hexun, the application of content analysis method gradually decreased and did not occupy the mainstream. Other methods, such as the dummy variable method, are mainly used in studies on mandatory disclosure and voluntary disclosure, while fewer studies use charitable donation data to represent corporate social responsibility. The reputation index method mainly refers to the subjective evaluation of various relevant policies and social performance of the target company by some influential authoritative institutions to obtain a comprehensive scoring and ranking result. Compared with other methods, the reputation index method is relatively independent and objective, and its advantages are mainly reflected in: First, the CSR evaluation is made by an independent third party, and the evaluator is more objective and fair; Second, the evaluation index of CSR development is relatively

comprehensive, and after extensive discussion, it can be publicly evaluated; Third, when scoring enterprises, there are many channels for receiving information, and many people collect it specifically, and the evaluation method is also objective and fair. Therefore, when the quantity and quality of CSR reports disclosed by listed companies in China are limited, most researchers use the reputation index method.

Different researchers will choose different measurement methods to obtain analysis results. However, whether the measurement methods used by these researchers are consistent is crucial, otherwise, different people use different methods to conduct research, and the conclusions are different or even completely opposite, so that researchers and decision-makers are confused or even misjudged, and thus make completely opposite decisions. X.W.Song took the statistics on 288 journals from CSSCI sources in 2016~2019, and do the exploration on the consistency test of major CSR measurement methods. The result shows that HeXun also has better advantage from consistency test and got the highest score on consistency.

For this research purpose, it took the CSR data for the 18 sample companies which comprises 152 firm-year observations between 2010-2019 (There are 7 sample companies set up later than Year 2010). The study integrate the Hexun CSR data into CSMAR. The samples were taken in the way as below:

- 1) Choose the companies in the logistics section of CSMAR.

| 代码 | 名称          | 涨幅%   | 现价     | 涨跌    | 买价     | 卖价     | 总量     | 涨幅%  | 换手%   | 今开    | 最高     | 最低     | 昨收     |
|----|-------------|-------|--------|-------|--------|--------|--------|------|-------|-------|--------|--------|--------|
| 1  | 600150 百合股份 | 0.44  | 11.39  | 0.05  | 11.39  | 11.40  | 178016 | 100  | 0.66  | 11.36 | 11.52  | 11.02  | 11.34  |
| 2  | 600500 中化国际 | -1.25 | 7.87   | -0.10 | 7.86   | 7.87   | 142401 | 2541 | 0.53  | 7.94  | 8.00   | 7.84   | 7.97   |
| 3  | 600026 中远海能 | -2.25 | 5.65   | -0.13 | 5.64   | 5.65   | 154586 | 1700 | 0.54  | 5.78  | 5.80   | 5.57   | 5.78   |
| 4  | 603871 嘉友国际 | 2.07  | 20.30  | 0.40  | 20.30  | 20.32  | 7957   | 69   | 0.10  | 21.00 | 21.01  | 20.26  | 20.73  |
| 5  | 603713 密尔克卫 | 2.01  | 136.22 | 2.83  | 136.27 | 136.52 | 12431  | 108  | 0.14  | 0.76  | 138.50 | 139.42 | 135.16 |
| 6  | 603329 上海物壮 | 2.63  | 14.42  | 0.37  | 14.41  | 14.42  | 35542  | 531  | 0.00  | 2.30  | 14.45  | 14.03  | 14.10  |
| 7  | 601598 中润资源 | 2.71  | 4.30   | -0.12 | 4.30   | 4.31   | 300025 | 2402 | 0.22  | 4.40  | 4.42   | 4.29   | 4.42   |
| 8  | 600794 招商科技 | 0.31  | 3.21   | 0.01  | 3.20   | 3.21   | 44526  | 197  | 0.00  | 3.20  | 3.22   | 3.17   | 3.20   |
| 9  | 600787 中微股份 | -0.17 | 5.94   | -0.01 | 5.94   | 5.95   | 101864 | 805  | -0.33 | 0.47  | 5.92   | 6.01   | 5.92   |
| 10 | 600603 广汇物流 | -0.74 | 4.02   | -0.03 | 4.01   | 4.02   | 57558  | 199  | 0.25  | 4.05  | 4.05   | 3.96   | 4.05   |
| 11 | 600180 瑞凌股份 | 2.22  | 7.83   | 0.17  | 7.82   | 7.83   | 339951 | 2135 | -0.12 | 3.34  | 7.50   | 8.13   | 7.38   |
| 12 | 600119 长江投资 | -0.26 | 7.71   | -0.02 | 7.70   | 7.71   | 11292  | 96   | -0.12 | 0.56  | 7.72   | 7.90   | 7.68   |
| 13 | 300350 中顺飞  | -1.46 | 6.73   | -0.10 | 6.73   | 6.74   | 119215 | 1111 | -0.14 | 2.90  | 6.82   | 6.92   | 6.70   |
| 14 | 002930 邵阳隆基 | 0.32  | 21.99  | 0.07  | 21.99  | 22.00  | 14569  | 198  | 0.09  | 0.34  | 21.77  | 22.36  | 21.71  |
| 15 | 002889 东方嘉盛 | 0.95  | 26.59  | 0.25  | 26.58  | 26.59  | 8417   | 40   | 0.15  | 0.94  | 26.58  | 26.82  | 26.04  |
| 16 | 002800 天翔股份 | 1.04  | 14.58  | 0.15  | 14.57  | 14.58  | 9992   | 73   | -0.13 | 1.00  | 14.36  | 14.72  | 14.31  |
| 17 | 002769 晋能电力 | -1.12 | 7.06   | -0.08 | 7.05   | 7.06   | 36516  | 269  | 0.43  | 1.38  | 7.10   | 7.20   | 6.97   |
| 18 | 002492 恒盛金业 | 1.74  | 5.85   | 0.10  | 5.85   | 5.86   | 80153  | 1209 | 0.00  | 2.01  | 5.70   | 5.92   | 5.70   |
| 19 | 002210 飞马国际 | 1.25  | 3.25   | 0.04  | 3.24   | 3.25   | 236566 | 2961 | 0.31  | 0.89  | 3.21   | 3.33   | 3.18   |
| 20 | 002183 怡亚通  | 0.18  | 5.72   | 0.01  | 5.71   | 5.72   | 227459 | 2678 | 0.18  | 1.07  | 5.69   | 5.77   | 5.67   |
| 21 | 002010 传化智联 | -1.45 | 6.14   | -0.12 | 6.14   | 6.15   | 128559 | 1192 | 0.00  | 0.43  | 6.21   | 6.30   | 6.06   |

|      |      |      |     |
|------|------|------|-----|
| 煤炭   | 家居用品 | 公共交通 | 互联网 |
| 电力   | 医药   | 水务   | 综合类 |
| 石油   | 商业连锁 | 供气供热 |     |
| 钢铁   | 商贸代理 | 环境保护 |     |
| 有色   | 传媒娱乐 | 运输服务 |     |
| 化纤   | 广告包装 | 仓储物流 |     |
| 化工   | 文教休闲 | 交通设施 |     |
| 建材   | 酒店餐饮 | 银行   |     |
| 造纸   | 旅游   | 证券   |     |
| 矿物制品 | 航空   | 保险   |     |
| 日用化工 | 船舶   | 多元金融 |     |
| 农林牧渔 | 运输设备 | 建筑   |     |
| 纺织服饰 | 通用机械 | 房地产  |     |
| 食品饮料 | 工业机械 | IT设备 |     |
| 酿酒   | 电气设备 | 通信设备 |     |
| 家用电器 | 工程机械 | 半导体  |     |
| 汽车类  | 电器仪表 | 元器件  |     |
| 医疗保健 | 电信运营 | 软件服务 |     |

- 2) Next, Tick out the companies not related to the chemical logistics industry and work out the table of the sample company.

Table 4.1: Sample public listed companies in the Chinese chemical logistics industry

| S/N | CODE   | Name of the company                              |
|-----|--------|--|
| 1   | 600160 | Zhejiang JuHua Co.,Ltd.                          |
| 2   | 600026 | COSCO Shipping Energy Transportation Company     |
| 3   | 600500 | Sinochem international Corporation               |
| 4   | 603713 | Milkway Chemical Supply Chain Service Co., Ltd.  |
| 5   | 603871 | Jiayou International Logistics Co., LTD          |
| 6   | 603329 | Shanghai Yashi Development Company               |
| 7   | 600794 | ZhangJiaGang Freetrade Technology                |
| 8   | 600787 | CMST Development Company                         |
| 9   | 600603 | GuangHui Logistics Company                       |
| 10  | 600180 | Century Commodities Solutions                    |
| 11  | 600119 | YUN Group Yangzi Development Company             |
| 12  | 300350 | HuaPengFei Supply Chain Service Company          |
| 13  | 002930 | GuangDong HongChuan Logistics Company            |
| 14  | 002889 | Shenzhen DongfangjiaSheng Supply Chain Co.Ltd.   |
| 15  | 002800 | XinJiang TianShun Supply Chain Service Company   |
| 16  | 002769 | Shenzhen Prolto Supply Chain Management Co., Ltd |
| 17  | 002492 | Wuhan Hengjidaxin Chemical Storage Co., Ltd.     |
| 18  | 002010 | Transfer ZhiLian                                 |

### 3) Search final sample companies CSR data from Hexun CSR database

| A      | B      | C    | D     | E     | F     | G         | H          | I     | J     | K   | L      | M  | N    | O                            | P      | Q       | R      | S      | T      | U      | V      | W      | X      | Y      | Z      | AA     | AB     | AC     |
|--------|--------|------|-------|-------|-------|-----------|------------|-------|-------|---|--------|--|------|------------------------------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 证券代码   | stock  | year | 评级得分  | 环境得分  | 社会得分  | 治理得分      | 综合得分       | 股东责任  | 盈利    | 净资产收益率  | 总资产收益率 | 资产负债率                                      | 每股股利 | 净资产收益率                       | 总资产收益率 | 净资产收益率  | 总资产收益率 | 净资产收益率 | 总资产收益率 | 净资产收益率 | 总资产收益率 | 净资产收益率 | 总资产收益率 | 净资产收益率 | 总资产收益率 | 净资产收益率 | 总资产收益率 | 净资产收益率 |
| 600160 | 600160 | 2010 | 62.9  | 22.27 | 26.08 | (5.229)   | (95.2358)  | 17.46 | 8.76  | 57%0.00:38%0.00:24%1.2419620991881009143%0.52:    | 1.2    | 58%0.11:15%0.12:71%0.07:73%0.30:20%0.60:   | 4.67 | 23%1.31:59%1.66:59%1.70%:    | 5      | 0.05009 | 2.5    | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2011 | 65.55 | 21.78 | 25.14 | (1.0249)  | (2.0256)   | 24.1  | 10    | 80%0.00:53%0.00:23%0.00:51%0.00:59%1.00:          | 1.02   | 8.85%0.39:44%0.39:21%0.50:82%0.45:03%0.22: | 6.68 | 11%0.00:19%0.12:22%0.22:16%: | 5      | 0.05009 | 0.5    | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2012 | 68.58 | 19.69 | 23.89 | (14.266)  | (179.2824) | 20.73 | 7.63  | 35%1.25:00%0.00:45%1.38943140991851009178%0.51:   | 1.96   | 3.99%0.45:57%0.43:48%0.42:70%0.49:94%0.16: | 5.15 | 74%1.07:35%0.00:56%1.07%:    | 5      | 0.05009 | 1      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2013 | 64.05 | 19.24 | 23.64 | (20.292)  | (374.123)  | 19.83 | 2.88  | 40%0.38:64%0.56:92%0.4091404691490329:26%0.15:    | 1.79   | 1.81%0.32:57%0.29:13%0.45:72%0.44:07%0.10: | 7.15 | 71%1.66:23%0.00:83%1.24%:    | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2014 | 19.01 | 18.24 | 20.08 | (124.329) | 2008.3495  | 13.59 | 1.84  | 24%0.27:81%0.41:08%0.24910902491370599:27%0.10:   | 1.49   | 3.21%0.27:15%0.28:80%0.24:03%0.46:69%0.25: | 5.25 | 50%0.81:92%0.00:92%1.44%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2015 | 18.26 | 19.38 | 20.68 | (161.333) | 2119.2584  | 12.63 | 1.94  | 23%0.30:78%0.44:75%0.21610902791360616:40%0.11:   | 1.44   | 7.29%0.24:49%0.25:47%0.23:93%0.44:78%0.29: | 4.24 | 68%0.65:64%0.21:37%1.53%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2016 | 61.57 | 23.35 | 25.29 | (24.333)  | (295.9670) | 18.06 | 1.51  | 45%0.19:28%0.31:73%0.19107021911400519:42%0.10:   | 2.14   | 7.67%0.50:33%0.50:75%0.50:82%0.47:99%0.17: | 6.41 | 05%0.86:10%0.70:22%2.85%:    | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2017 | 25.84 | 19.01 | 19.28 | (42.331)  | (922.3800) | 19.46 | 5.85  | 64%1.15:22%1.71:99%0.86914411991320569:96%0.39:   | 1.95   | 3.54%0.46:01%0.43:34%0.39:60%0.44:96%0.23: | 6.66 | 09%0.91:01%0.43:25%0.27:51%: | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2018 | 25.27 | 19.99 | 18.73 | (74.331)  | 1191.3792  | 21.22 | 9.68  | 10%0.20:00:02%0.00:78:02:0091680689:80%1.00:      | 2.17   | 1.17%0.50:87%0.50:37%0.50:43%0.45:60%0.22: | 4.38 | 70%0.66:53%1.90:51%1.81%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600160 | 600160 | 2019 | 21.13 | 17.76 | 18.01 | (131.020) | 1821.3765  | 18.11 | 6.58  | 96%1.42:62%0.60:64%1.016138104918300719:47%0.41:  | 2.14   | 3.30%0.50:68%0.48:38%0.50:79%0.46:09%0.20: | 4.38 | 52%0.60:63%0.00:60%1.38%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2010 | 52.4  | 36.87 | 26.08 | (23.62)   | (344.2358) | 15.09 | 6.49  | 60%0.77:22%0.83:23%1.7415013391801009:76%0.82:    | 1.1    | 37%0.08:22%0.07:27%0.06:46%0.32:28%0.57:   | 5.63 | 70%0.00:41%0.00:36%0.63%:    | 5      | 0.05009 | 2.5    | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2011 | 54.47 | 37.19 | 25.14 | (18.68)   | (391.2636) | 18.4  | 4.13  | 43%0.47:03%0.40:61%0.98913108791911009:66%0.41:   | 1.33   | 74%0.11:46%0.10:11%0.13:82%0.25:82%0.72:   | 4.94 | 30%1.56:00%0.00:55%0.39%:    | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2012 | 55.47 | 34.97 | 23.89 | (27.70)   | (524.2824) | 9.85  | 0.41  | 31%0.04:13%0.03:17%0.610320:0091831009:70%0.13:   | 1.45   | 42%0.14:19%0.13:97%0.18:64%0.23:85%0.77:   | 0    | -0.0091-0.0091-0.0091:       | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2013 | 48.96 | 33.91 | 23.54 | (28.74)   | (590.132)  | 3.36  | -5.88 | 83%1.22:01%0.83:17%0.20:88:0.2951161009:89%0.83:  | 1.23   | 40%0.07:40%0.06:27%0.07:07%0.20:25%0.84:   | 0    | -0.0091-0.0091-0.0091:       | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2014 | 5.79  | 20.97 | 20.08 | (82.85)   | 3369.3495  | 9.07  | 1.57  | 42%0.17:47%0.11:51%0.00:00:00:2491181009:56%0.11: | 1.32   | 40%0.08:55%0.07:55%0.10:20%0.19:55%0.88:   | 1.19 | 33%0.44:28%0.50:05%0.24%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2015 | 21.39 | 26.48 | 20.08 | (45.88)   | 1627.3584  | 14.85 | 2.66  | 52%0.21:57%0.14:67%0.81911002991811009:69%0.21:   | 1.35   | 71%0.11:52%0.09:81%0.09:58%0.21:21%0.85:   | 5.04 | 02%1.72:71%0.43:63%0.88%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2016 | 25.8  | 29.21 | 25.29 | (33.88)   | 1162.3670  | 19.99 | 6.86  | 01%0.94:51%0.89:28%0.00:48:13891101009:69%0.75:   | 1.73   | 7.35%0.20:57%0.17:97%0.35:25%0.25:74%0.76: | 6.39 | 96%0.20:39%0.00:69%1.39%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2017 | 21.92 | 22.05 | 19.28 | (51.08)   | 1772.3800  | 16.43 | 6.07  | 33%0.84:93%0.69:25%1.45414411891351009:23%0.91:   | 1.48   | 75%0.12:19%0.11:78%0.23:24%0.25:20%0.77:   | 3.88 | 54%0.56:77%0.00:81%0.32%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2018 | 18.33 | 22.41 | 18.73 | (72.88)   | 2538.3792  | 9.33  | 1.84  | 37%0.07:17%0.05:60%0.47910300891321009:59%0.17:   | 1.33   | 30%0.10:82%0.09:88%0.14:45%0.24:84%0.76:   | 1.16 | 18%0.19:75%0.83:73%0.14%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600026 | 600026 | 2019 | 19.57 | 21.21 | 18.01 | (60.88)   | 2232.3765  | 10.57 | 3.45  | 53%0.31:68%0.24:75%1.15911103491321009:57%0.41:   | 1.28   | 83%0.09:10%0.08:75%0.11:72%0.24:70%0.78:   | 0.84 | 85%0.00:47%0.54:00%0.30%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |
| 600500 | 600500 | 2010 | 65.38 | 25.22 | 26.08 | (1142)    | (602.256)  | 12.26 | 4.35  | 48%1.16:70%0.53:17%0.32914712391681009:17%0.11:   | 1.41   | 70%0.12:58%0.13:80%0.13:52%0.14:98%0.89:   | 5.34 | 17%1.25:58%0.00:47%1.05%:    | 5      | 0.05009 | 2.5    | →      |        |        |        |        |        |        |        |        |        |        |
| 600500 | 600500 | 2011 | 71.98 | 21.35 | 25.14 | (1.55)    | (72.2636)  | 17.09 | 4.72  | 31%1.30:03%0.60:88%0.219154115291061009:29%0.09:  | 1.49   | 79%0.14:29%0.14:40%0.16:65%0.14:48%0.91:   | 4.88 | 68%0.87:11%0.98:99%1.02%:    | 5      | 0.05009 | 1      | →      |        |        |        |        |        |        |        |        |        |        |
| 600500 | 600500 | 2012 | 56.87 | 19.55 | 23.89 | (7.58)    | (490.2824) | 18.57 | 4.22  | 84%1.07:94%0.44:42%0.21914114291311009:84%0.08:   | 1.43   | 86%0.13:96%0.14:51%0.15:91%0.12:36%0.89:   | 4.92 | 26%0.88:17%0.00:10%1.05%:    | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600500 | 600500 | 2013 | 62.26 | 19.53 | 23.54 | (9.65)    | (412.123)  | 17.84 | 3.4   | 77%0.65:19%0.45:94%0.25912903691781009:95%0.10:   | 1.29   | 76%0.14:80%0.16:71%0.09:43%0.20:11%0.89:   | 5.15 | 77%0.86:39%0.00:97%1.29%:    | 5      | 0.05009 | 3      | →      |        |        |        |        |        |        |        |        |        |        |
| 600500 | 600500 | 2014 | 22.35 | 21.28 | 20.08 | (26.74)   | 1339.3495  | 15.23 | 3.89  | 77%0.92:61%0.53:13%0.25914111091510859:17%0.14:   | 1.47   | 22%0.19:55%0.20:78%0.17:19%0.20:19%0.70:   | 4.87 | 76%0.91:88%0.57:14%1.38%:    | 5      | 0.05009 | 0      | →      |        |        |        |        |        |        |        |        |        |        |

### 4) Search sample companies' financial data from CSMAR database and integrate with 3) together. Refer to Appendix A

## 5.5.2 Data Collection: Primary Data Collection- Interview

The interview is probably the most widely used method in qualitative research. This study used interviews to collect primary data for the purpose of getting it focus and well guided, meanwhile, it also provides the flexibility to add more relevant questions during the interview. This consisted of the opinions of senior managers of Chinese chemical logistics companies to obtain the most updated information and feedback in this industry. Since the chemical logistics companies in this industry have to be managed by several authorities, such as Ministry of Transport, Ministry of Public Security, and State Administration of Work Safety, the Ministry of Environment Protection etc. Each authority can issue various regulations and standards. New regulations from different government offices could be issued as often as every month. How to interpret and catch the most updated information is a big challenge and have to listen to seniors in this industry. Without first-hand data from the seniors in the industry, a lot of useful research information could be missed. The interviewing gives us the flexibility to do it. 'There is no one set of questions administered to all interviewees and no specific sequencing of the issues raised '(Prasad, 1993).

The interviews for this research were conduct in China between Mar.-Apr. 2023. Face to face interviews is the preference of this study because it provides the chance to do the intensive study. Face to face interview is quite effective because it can avoid communication breakdown. Although as we all know, face to face interviews is relatively expensive because of its associated international travelling expenses and suchlike are included, the satisfaction gained and most importantly, the level of trust built between the interviewee and interviewer ensures in depth and thorough information on the subject matter is collected. (Maxim, 1999 p281). But due to the tight schedule and some travelling restrictions, some interviews have to be virtual. The advantage for virtual interview is cost saving and time saving and also easy to trace the record for further analysis. Right now, internet is quite effective tool to communicate and provides the similar face to face interview just except the interview are not carried out in the same place. Since the primary data need to collect from Chinese chemical logistics industry, the interviewees are all based in China and in the various broad geographic locations, the internet interviews is the effective alternative solution to this research. All the interviews are in Chinese, and all the transcription need to be translated into English.

## Interview Content

The interview content is also designed follow the research framework and the research hypothesis. The in-depth interview enabled us to gain more precise information and further deep feedback. It includes the following sections:

Section A--C is trying to gather the respondents' views on the risk management as the form of CSR to the company performance and sustainable development in Chinese chemical logistics industry.

Section D--E endeavours to get the respondents' comments for green finance in the Chinese chemical logistics industry.

Refer to **Appendix B** Interview Questions

### (b) Interview Sampling

Interview sampling is an important aspect of qualitative research as it determines who will be included in the study and what data will be collected. In qualitative research, sampling is typically not random but rather purposive, which means that participants are selected based on specific criteria related to the research question. Here are some common interview sampling techniques used in qualitative research:

**Maximum Variation Sampling:** This technique involves selecting participants who represent a wide range of experiences related to the research question. For example, if the research question is about experiences with a health condition, the researcher might select participants with a range of severity levels, ages, genders, and socio-economic backgrounds.

**Snowball Sampling:** This technique involves asking participants to refer others who might be interested in participating in the study. This can be useful when studying hard-to-reach or marginalized populations.

**Convenience Sampling:** This technique involves selecting participants who are easily accessible and willing to participate in the study. This is a common approach in exploratory research or when the sample is not critical to the research question.

**Purposeful Sampling:** This technique involves selecting participants who meet specific criteria related to the research question. For example, if the research question is about experiences of first-generation college students, the researcher might select participants who are currently enrolled in college and are the first in their family to attend.

**Theoretical Sampling:** This technique is used in grounded theory research, where data collection and analysis occur simultaneously. Participants are selected based on the emerging themes and concepts in the data, and the sample is continuously refined as the analysis progresses.

When selecting participants for interviews, researchers should consider factors such as diversity, representation, and the potential for new insights. By using purposive sampling techniques, researchers can ensure that the sample is relevant to the research question and that the data collected is rich and meaningful. However, it is important to acknowledge that interview sampling in qualitative research is not meant to be representative of the population, but rather to provide in-depth insights into the experiences and perspectives of the participants selected.

Qualitative research emphasizes in depth and detailed information, and therefore it usually involves a small number of respondents in a specific piece of research (Hakim, 1987). This research targets 12 participants as the sampling to do the in-depth interview who are all the senior management in the Chinese chemical logistics industry. They all have good understanding of CSR and company management with strong working experience and industry background. Generally, this study was considered to take the purposeful sampling and also involves the theoretical sampling technique with the interviews carrying on.

#### (c) Interview Administration

The participants were being provided the interview questions beforehand. They are all the reputable seniors in the Chemical logistics industry with over 10 years working experience in the market. Also, their various focus on OP, General Management, and Finance Management fit our research area well and could generate the thorough understanding on CSR and green logistics finance. In addition to the management in the Chemical logistics companies, with the interviews being carried on the progress,

this study also invites the participators from their customers (Chemical factories) and some related government officials in the industry. It provides more complete views from different perspectives. The interviewees are listed in below table.

Table 4.2 List of Interview Participators brief

| Interviewee    | Organization   | Position                    |
|----------------|--|-----------------------------|
| Interviewee 1  | public listed chemical factory<br>subsidiary logistics company | Deputy Manager              |
| Interviewee 2  | Third-party Logistics Company                                  | V.P                         |
| Interviewee 3  | Third-party Logistics Company                                  | General Manager             |
| Interviewee 4  | Third-party logistics company                                  | operation & HSE<br>manager  |
| Interviewee 5  | Public Listed Third-Party Logistics<br>Company                 | Finance VP                  |
| Interviewee 6  | Third-Party Logistics Company                                  | Logistics Manager           |
| Interviewee 7  | Third-Party Logistics Company                                  | VP                          |
| Interviewee 8  | Chemical Factory   | Logistics Manager           |
| Interviewee 9  | public listed Chemical Factory                                 | Logistics Safety<br>Manager |
| Interviewee 10 | chemical manufacturing giant                                   | Supply chain manager        |
| Interviewee 11 | Local transport bureau   | government staff, Phd.      |

#### (d) Issues of Reliability and Validity

Reliability and validity are important concepts in research that apply to both qualitative and quantitative methods. While reliability refers to the consistency and stability of research findings, validity relates to the accuracy and truthfulness of research results.

Reliability in qualitative research refers to the consistency of the findings, meaning that the same results can be obtained if the research is repeated under similar conditions. One way to ensure reliability is by using a clear and well-defined research protocol that outlines the steps to be taken, the methods to be used, and the criteria for selecting participants. This can help to ensure that the research is conducted consistently across different settings, and that the results are reliable.

Another way to enhance reliability in qualitative research is by using multiple coders to analyze the data. This approach, known as inter-coder reliability, involves having two or more researchers code the data independently and then compare their results. This can help to identify any discrepancies or inconsistencies in the data and improve

the reliability of the findings. In qualitative research, the reliability of the findings can be improved through several methods. One such method is through the use of a pilot study. A pilot study is a small-scale study conducted before the actual research, which can help to identify any potential issues or problems in the research design. By conducting a pilot study, researchers can identify and address any inconsistencies or errors in the data collection process, which can improve the reliability of the findings.

Another way to improve reliability is using a standardized data collection process. This can involve using standardized interview protocols, observation checklists, or coding frameworks. Standardization helps to ensure that the data collected is consistent across different settings and that the findings are reliable. Additionally, researchers can use member checking to improve the reliability of their findings. Member checking involves sharing the research findings with the participants to verify the accuracy of the data and the interpretations made by the researcher. By involving the participants in the research process, researchers can improve the reliability of their findings and ensure that the data collected accurately reflects the experiences of the participants.

Validity in qualitative research refers to the accuracy and truthfulness of the findings. It is essential to ensure that the data collected accurately reflects the research question and that the interpretations made by the researcher are justified. One way to enhance validity is by using multiple sources of data, such as interviews, observation, and documents. This can help to triangulate the data and provide a more complete picture of the phenomenon being studied. Another way to enhance validity in qualitative research is by using a reflexive approach. This involves the researcher reflecting on their own biases, assumptions, and experiences that may influence the research. By acknowledging and addressing these factors, the researcher can increase the validity of the findings and ensure that the data collected accurately reflects the experiences of the participants.

In qualitative research, validity can be improved through several methods. One such method is through the use of a purposive sampling strategy. Purposive sampling involves selecting participants based on specific criteria related to the research question. This can help to ensure that the data collected is relevant and accurate, and

that the findings are valid. Another way to improve validity is through the use of a reflexivity approach. Reflexivity involves the researcher reflecting on their own biases and assumptions that may influence the research process and the interpretation of the data. By acknowledging and addressing these biases, researchers can improve the validity of their findings and ensure that the data collected accurately reflects the experiences of the participants. Additionally, researchers can use triangulation to improve the validity of their findings. Triangulation involves using multiple sources of data and methods to verify the accuracy of the data and the interpretations made by the researcher. By using multiple sources of data, researchers can ensure that the data collected accurately reflects the experiences of the participants and that the findings are valid.

In sum, reliability and validity are crucial concepts in qualitative research. Reliability is essential to ensure consistency and stability of the findings, while validity is important to ensure accuracy and truthfulness. By using clear research protocols, multiple coders, multiple sources of data, and a reflexive approach, researchers can enhance the reliability and validity of their findings and contribute to a greater understanding of the phenomena they are studying. Researchers can improve the reliability and validity of their findings through the use of a pilot study, standardized data collection processes, member checking, purposive sampling, reflexivity, and triangulation. By using these methods, researchers can enhance the rigor and credibility of their qualitative research and contribute to a greater understanding of the phenomena being studied.

Interviews are a common method of data collection in qualitative research, and as with any research method, there are also issues of reliability and validity to consider. One of the key issues with interviews is ensuring that the findings are consistent and repeatable. Here are some strategies for addressing reliability issues in interviews:

- **Standardized Interview Protocols:** To ensure that all interviewees are asked the same questions and in the same order, researchers can develop standardized interview protocols. This helps to reduce variability in the data collection process and improve the reliability of the findings.
- **Interviewer Training:** Interviewers should be trained to ask questions in a consistent and neutral manner. This can be achieved through standardized

interviewer training sessions that teach interviewers how to ask questions in a non-biased way.

- **Multiple Coders:** When analyzing the data, using multiple coders to review and code the interview transcripts can help to improve reliability. This can help to identify inconsistencies or discrepancies in the data and ensure that the findings are consistent across different coders.

Validity issues with interviews often relate to the accuracy of the data collected. Here are some strategies for addressing validity issues in interviews:

- **Sampling Strategy:** To ensure that the interview sample is representative and provides accurate data, researchers should use a purposive sampling strategy. This involves selecting participants based on specific criteria related to the research question.
- **Reflexivity:** Researchers should be reflexive and acknowledge their own biases and assumptions that may influence the research process and the interpretation of the data. This can help to ensure that the data collected accurately reflects the experiences of the participants.
- **Member Checking:** Member checking involves sharing the research findings with the participants to verify the accuracy of the data and the interpretations made by the researcher. By involving the participants in the research process, researchers can improve the validity of their findings and ensure that the data collected accurately reflects the experiences of the participants.
- **Triangulation:** Triangulation involves using multiple sources of data and methods to verify the accuracy of the data and the interpretations made by the researcher. By using multiple sources of data, researchers can ensure that the data collected accurately reflects the experiences of the participants and that the findings are valid.

In conclusion, interviews are a valuable method of data collection in qualitative research, but they require attention to issues of reliability and validity. To improve reliability, researchers can use standardized interview protocols, interviewer training, and multiple coders. To improve validity, researchers can use a purposive sampling strategy, reflexivity, member checking, and triangulation. By addressing these issues, researchers can enhance the rigor and credibility of the qualitative research findings.

### 5.5.3 Data analysis

This section is to explore the associated research instruments to analysis the secondary data for doing the quantitative research and primary data from the interview.

#### 1) Secondary data analysis

Secondary data analysis is the process of analyzing data that has already been collected by other researchers or organizations for a different purpose. Secondary data can come from a variety of sources, including government agencies, academic research studies, and private organizations. When selecting a data analysis method for secondary data analysis, it is important to consider the type of data being analyzed and the research questions being asked. Researchers should also ensure that the data analysis method is appropriate for the research questions being asked and that it is used in a manner consistent with its intended purpose. Additionally, researchers should be transparent about their data analysis methods and acknowledge any limitations or potential biases in their analysis. There are various statistical methods that can be used to analyze secondary data in quantitative research, for example, Descriptive statistics, Inferential statistics, Structural equation modeling, Latent class analysis, Longitudinal analysis, Cluster analysis, Survival analysis, etc. The choice of statistical method normally depends on the nature of the data and the research questions being addressed.

The secondary data were statistically analyzed through the use of Stata, which provides several statistical methods to assess the results obtained, which are identified as follow:

**Descriptive statistics:** Descriptive statistics, such as mean, median, and standard deviation, are used to summarize the main characteristics of the data.

This method is generally the first step to do this secondary data analysis. The objective of this method is to summarize and describe the main features of samples, to check the variables. Descriptive statistics are often used in secondary data analysis to provide an overview of the data and to identify patterns and relationships between

variables. Descriptive statistical methods are useful for providing a snapshot of the data and for identifying patterns and trends. However, they do not test hypotheses or make inferences about the population and are generally used for exploratory purposes. Descriptive statistics are often used in conjunction with inferential statistics, which are used to make statistical inferences about the population based on the sample data.

**Inferential statistics:** Inferential statistics, such as t-tests, ANOVA, and regression analysis, are used to test hypotheses and make inferences about the population based on the sample data. Inferential statistics is a branch of statistics that is concerned with making inferences or drawing conclusions about a population based on a sample of data. Inferential statistics are often used in secondary data analysis to test hypotheses and to make predictions about the population. Here are some common inferential statistical methods:

- **Confidence intervals:** Confidence intervals are used to estimate the range of values in which a population parameter is likely to fall based on the sample data. For example, a 95% confidence interval for the population mean would indicate that there is a 95% chance that the true population mean falls within the interval.
- **Hypothesis testing:** Hypothesis testing is used to test whether there is a significant difference between two groups or whether an observed effect is statistically significant. This involves setting up null and alternative hypotheses, selecting an appropriate test statistic, and calculating a p-value to determine the likelihood of observing the results by chance.
- **Regression analysis:** Regression analysis is used to examine the relationship between one or more independent variables and a dependent variable. This can be used to test hypotheses and to make predictions about the population based on the sample data. Regression analysis is a statistical method that is used to examine the relationship between one or more independent variables and a dependent variable. It is often used in secondary data analysis to test hypotheses and to make predictions about the population based on the sample data. Regression analysis involves estimating a mathematical model that describes the relationship between the independent variables and the dependent variable. The output of a regression analysis typically includes several statistics, including the

coefficients of the independent variables, the intercept, the R-squared value, and the p-values. The coefficients represent the strength and direction of the relationship between the independent variables and the dependent variable, and the intercept represents the value of the dependent variable when all of the independent variables are equal to zero. The R-squared value indicates the proportion of variance in the dependent variable that can be explained by the independent variables, and the p-values indicate whether the coefficients are statistically significant. Regression analysis can be used for a variety of purposes, including predicting outcomes, testing hypotheses, and identifying important variables that are related to the outcome of interest.

- Analysis of variance (ANOVA): ANOVA is used to test for differences between three or more groups. It is an extension of analysis of variance that is used to analyse more than one dependent variable. This involves calculating the sum of squares and mean squares and using them to test the null hypothesis that there is no difference between the groups.
- Factor analysis: Factor analysis is used to identify underlying factors that explain the correlation between multiple variables. This can be used to reduce the complexity of the data and to identify important variables that are related to the outcome of interest. In social science it is normally applied to correlations between variables.

Inferential statistical methods are used to make statistical inferences about the population based on the sample data. These methods allow researchers to test hypotheses and to make predictions about the population with a certain degree of confidence. However, it is important to use these methods appropriately and to interpret the results carefully, as incorrect or inappropriate use of inferential statistics can lead to inaccurate conclusions.

These are just some of the statistical methods that can be used to analyze secondary data in quantitative research. The choice of method will depend on the nature of the data and the research questions being addressed. It is important for researchers to carefully select the appropriate statistical method and ensure that they are using the method correctly to avoid making incorrect conclusions.

## 2) Primary data analysis

Analyzing interview data involves several steps to make sure it is organized and structured in a systematic way to obtain the most out of the data. Although this research invites 12 interview participants, it still needs the proper tools to do the data analysis.

- **Transcription:** The first step is to transcribe the interviews into a written format. This can be done either manually or with the help of automated transcription software.
- **Coding:** The next step is to code the data, which involves identifying and labeling themes, concepts, and categories that emerge from the data. This can be done using a software program or manually by using a coding framework.
- **Data reduction:** This step involves summarizing the data by extracting key themes and concepts from the coded data.
- **Data interpretation:** The final step is to interpret the data by drawing conclusions and making recommendations based on the findings.

In general, the interviews were recorded and transcribed later. The verbatim records of each interviewee were then organized and coded. At this point, a coding analysis was employed.

### **Coding analysis:**

Coding analysis is a method used in qualitative research to identify patterns and themes in data. It involves systematically organizing and categorizing data to identify recurring themes or patterns. The process of coding analysis typically involves the following steps:

- **Data preparation:** The first step in coding analysis is to prepare the data for analysis. This may involve transcribing interviews or other sources of data into text format or importing data from other sources.
- **Initial coding:** The next step is to review the data and identify initial codes or categories. These codes may be identified through a process of open coding,

where the researcher reviews the data line-by-line and identifies themes or patterns that emerge.

- **Categorization:** Once initial codes have been identified, the researcher may group them into broader categories or themes. This may involve creating a coding framework or using a pre-existing coding framework.
- **Refining codes:** After the initial codes have been categorized, the researcher may refine and reorganize the codes and categories as necessary. This may involve collapsing similar codes or creating new codes to capture emerging themes.
- **Interpretation:** Finally, the researcher interprets the coded data to draw conclusions and make recommendations based on the findings.

There are several software programs that can be used to facilitate coding analysis, including NVivo, Atlas.ti, and MAXQDA. These programs allow researchers to organize and analyze data in a systematic and efficient manner, making it easier to identify patterns and themes. Coding analysis is a valuable tool in qualitative research as it allows researchers to identify and analyze patterns and themes in data, leading to a deeper understanding of the phenomena being studied. However, it is important for researchers to be transparent about their coding process and to clearly explain how they arrived at their findings. Additionally, coding analysis requires careful attention to detail and a commitment to rigor to ensure that the findings are valid and reliable. Bryman(2001:400) states that there are disadvantages to this analysis which could result in losing the context of what the interviewee said and also the narrative flow of the interviews may also be lost.

### **Thematic analysis:**

Thematic analysis is a method used to identify themes or patterns in qualitative data. It involves systematically reviewing and coding the data to identify recurring themes or patterns. Attride-Stirling (2001:387) indicates that thematic analysis seeks to reveal prominent themes in text at a different level. It is often used in secondary data analysis to identify common themes or patterns across multiple sources of data. However, it is important to use thematic analysis appropriately and to interpret the results carefully,

as incorrect or inappropriate use of thematic analysis can lead to inaccurate conclusions.

The process of thematic analysis typically involves the following steps:

- Familiarization with the data: The researcher reads through the data to become familiar with the content and context of the data.
- Initial coding: The researcher identifies and codes relevant segments of the data that relate to the research question or objective. This involves assigning labels or codes to the data to represent the themes or patterns identified.
- Collating codes into potential themes: The researcher identifies and groups similar codes together to form potential themes. This involves grouping codes that relate to similar concepts or ideas.
- Reviewing themes: The researcher reviews and refines the themes to ensure that they accurately represent the data and address the research question or objective.
- Defining and naming themes: The researcher defines and names the themes to clearly convey their meaning and relevance to the research question or objective.
- Producing the report: The researcher writes up the findings and presents them in a clear and concise manner, using examples from the data to support the themes identified.

Coding analysis and thematic analysis are both methods used to analyze qualitative data, but there are some key differences between them. Coding analysis involves breaking down the data into smaller units of meaning, called codes, and organizing these codes into categories or themes. The focus of coding analysis is on identifying patterns and themes within the data. The codes are often descriptive and are used to categorize and label specific aspects of the data. Coding analysis is often used to identify patterns or themes within a specific area or topic, and to identify similarities and differences between different sources of data. Thematic analysis, on the other hand, involves analyzing the data to identify and explore the themes or patterns that emerge. Thematic analysis is often used to explore the underlying meaning and interpretations of the data, and to identify the relationships between different themes or patterns. The focus of thematic analysis is on understanding the meaning of the

data and the context in which it was produced. In summary, coding analysis involves breaking down the data into smaller units of meaning, while thematic analysis involves exploring the themes or patterns that emerge from the data.

Both methods can be used to analyze qualitative data, but they have different focuses and objectives. Coding analysis and thematic analysis can be used together in qualitative research. In fact, many researchers use coding analysis as a preliminary step to identify codes and themes within the data, and then use thematic analysis to explore and interpret the underlying meanings and relationships between those themes. In this approach, the coding analysis is used to identify and categorize the data into initial codes or categories, and then the thematic analysis is used to explore the relationships and patterns between those codes or categories. This can help to provide a more nuanced and in-depth understanding of the data and the research question or objective. For doing this the primary data analysis, it combined the two methods to gain a more comprehensive understanding of the data and the research topic and can develop a richer and more nuanced interpretation of the findings.

When analyzing interview data, it's important to ensure that the data is reliable and valid. This can be done by triangulating the data with other sources, such as observation, surveys, or document analysis. It's also important to maintain the confidentiality and anonymity of the participants and to adhere to ethical guidelines for research.

## **5.6 Limitations and Difficulties**

It is understandable that every research face various limitation and difficulty, it is the same for this research as well. The main challenge faced was the data collection and analysis process which must be conducted in China. The limitation and difficulties for this research is mainly on the travelling difficulties and long-distance communication barrier. Overall, the researcher managed to get good cooperation from as many interviewees as possible.

## **5.7 Summary**

This chapter make the exploration for research framework and the methodology of the study. The research addresses the Chinese chemical industry and do the analysis for

its two large categories. Also, this chapter discuss the hypothesis development based on the literatures reviewed regarding to CSR and Green Finance. Subsequently, the data collection and analysis method and techniques are discussed in many details including step by step exploration. The research employed both secondary data and primary data collection and analysis. In Sum, the data collection and analysis process were successfully discussed in this chapter although the study faces much limitation and difficulties.

## **Chapter 6 An Evaluation of the CSR influence in China:** Quantitative evidence from the public chemical logistic companies

### **6.0 Introduction**

In the last chapter of Research Methodology, it made the research framework and research methodology exploration to discuss the operational aspect of the research. As presented in last chapter, this study combines the quantitative and qualitative research. For the Category A of the research cluster: Public listed Chinese chemical logistical enterprises, the secondary data for the public list companies is more reliable and easier to access. Therefore, the study took the quantitative method to do the secondary data analysis to test the one of the research hypotheses regarding to the relationship between CSR and company financial performance.

### **6.1 Research Hypotheses Development for Empirical Analysis**

In the Chapter 3, it did detail review for the various literature for CSR. Based on the stakeholder theory, various internal or external parties, including employees, customers, suppliers, government, and community, have interests or “stakes” in a company during its corporate operations (Freeman, 1984). Some competitive advantages of an enterprise are line in the relationships with stakeholders (Maignan, et al. 2000; Crilly, et al. 2012). Due to these externalities linked to stakeholders, firms have to eliminate negative impact on society (e.g. exerting environmental protection) and building the positive image via CSR activities (e.g. charitable donations and community involvement). Thus, stakeholder theory offers a good reason for the CSR in place and a logical framework that a firm realize its welfare from relationship management of stakeholders to the assignment of organizational resources (Brammer and Millington, 2008). Particularly, the instrumental function of the stakeholder model explains that the correspondence to stakeholders’ needs and social trustworthiness in CSR activities can help companies improve firm value (Jones, 1995). Thus, there is a potential link between CSR practices and firm’s profitability and sustainable growth.

Ample previous research empirically investigates the relation between CSR and firm performance by using stakeholder theory. Maignan et al. (2000) reports a positive

association between CSR practices and financial performance measured by return on assets (ROA), return on investment (ROI), profit growth, and sales growth. Likewise, Barnett and Salomon (2006) find a positive effect of CSR practices on the average monthly return of SRI funds by examining 61 funds from socially responsible investments (SRI) from 1972–2000. Recently, the evidence from Taiwan also proves such a positive relation by comparing the firms with better CSR performance with those without CSR initiatives (Hou, 2019). US firms are reported similar results about CSR and cumulative abnormal returns (Surroca, et al. 2010). In the context of China, Chen and Wang (2011) identify the positive effect in the current and following year. Furthermore, Zhu et al. (2016) find state-owned enterprises shows stronger performance in terms of labour practices, community involvement, supply chain, and political responsibility. From the perspective of stakeholders, CSR practices make firms reinforce their commitment to the operation (Weiss, 2008). Based on the above discussions in the last chapters, the first hypothesis was presented as follow.

*H 0: In the Chinese chemical logistics industry, Risk management in the form of CSR has no relationship with firm performance. This is the null hypothesis of the research.*

*H 1: In the Chinese chemical logistics industry, Risk management in the form of CSR has a relationship with firm performance. This is the alternative hypothesis of this research.*

For carry out the empirical analysis, I break down this first hypothesis to be:

**Hypothesis 1A (H1A). In the Chinese context, CSR performance of chemical logistics companies has positive relationship with firm performance.**

**Hypothesis 1B (H1B). In the context of China, chemical logistics firms' risk management in form of CSR practices regarding various stakeholders (shareholders, employees, customers, and suppliers, the environment and society, respectively) has positive relationship with firm performance.**

The individual aspect of stakeholder theory can separate different groups of stakeholders in order to identify respective firms' CSR activities. Freeman (1984) indicates that companies' performance and operations are directly affected by

customers, employees, and suppliers, while indirectly by government, environment, and society. As one of the primary stakeholders, shareholders are closely related to corporate strategy and operations (Pan, et al. 2014). Shareholders and potential investors can recognize a firm's financially responsible activities through its financial returns. As I introduced in the Chapter 3, for the chemical logistics industry, the professional employees are highly critical for the company risk management performance because any emergency accident could lead to serious social risks. Meanwhile, the majority labor in this industry, are vehicles drivers and warehouse operators. For these positions in the chemical logistics industry, it needs special licenses and working certificate which are not easy to obtain. The shortage for the qualified chemical vehicles drivers has already been one of the top difficulties for Chinese chemical logistics industry. It is quite common that most employers have to offer additional attractive cash bonus for the experienced drivers to keep their loyalty. Employee's loyalty is essential for a firm to maintain valuable human assets and high productivity (Turban & Greening, 1997). Because of global production and marketing activities, supply chain management and product safety maintenance have been increasingly involving CSR practices. Especially, as I introduced in the Chapter 3, the customers for the Chinese chemical logistics are chemical factories, and majority of the global top 30 chemical giant set their factories in China. These global chemical companies are normally the lead in the CSR promotions. For example, BASF launched 1+3 programs ten years ago to introduce CSR to the companies in their supply chain. Additionally, chemical logistics companies would place the environment protection on the priority of their CSR strategy because the negative impacts during transportation on the local environment, such as chemical leakages and discharges, may be fined by governments, resulting in substantial short-term costs (Hart & Ahuja, 1996). The enterprise innovation in China can be stimulated by the pro-environment CSR efforts facilitated by public visibility and firm transparency (Wu et al. 2018). To carrying forward the social citizenship, chemical logistics firms can contribute to the local community from various aspects including education, healthcare and wellbeing in exchange of favorable policy from the local government (Pan, et al. 2014; Waddock & Graves, 1997).

## **6.2 Research Variables**

### **6.2.1 CSR Variables- Independent Variables**

Independent Variables are the factors that the hypothesize have an impact on the researched dependent variable. According to the hypotheses developed in the last chapter and above, CSR is one of the variables for this study. It was developed based on the implementation from CSR definitions and CSR theory especially in the light of the stakeholder theory. From the perspective of stakeholders, the company has the CSR in practice can enhance their commitment to the firm's operations and lower the potential risks (Weiss, 2008). Maignan et al (2000) indicated that CSR practices measured by a 5-point scale scoring by external experts have a positive association with financial performance measured by return on assets (ROA), return on investment (ROI), profit growth, and sales growth.

For testing the first hypotheses regarding to the relationship between CSR and firm performance, CSR is measured on the Hexun criteria. As introduced and explored very detail in last chapter, Hexun is a top-ranking rating agency which provides professional CSR and financial information of listed companies in China. The evaluation and measurement of corporate social responsibility has always been a hot topic in theoretical and practical circles. How to evaluate and measure corporate social responsibility behavior is very important. XiaoWen Song did empirical research for the 6 popular CSR measurement methods in 2021. He Based on the collation of 288 empirical literatures in CSSCI source journals from 2016 to 2019, summarized six methods of CSR measurement in China and compared their advantage and disadvantages. The research found that Hexun score has the highest consistency evaluation among the six commonly used CSR measurement methods in China. Based on the framework of stakeholder theory, Hexun does the CSR evaluation from five CSR dimensions of stakeholders for Chinese public listed companies. More specifically, the overall CSR score is calculated based on the weighted sum of all tier's indicators from five dimensions. As illustrated in the below chart, there are shareholders, employees, suppliers and customers, the environment, and society. The professional evaluation index table of Hexun Social responsibility Report describes the assignment of each index in detail. Meanwhile, it is divided into two categories according to the nature of the index, one is numerical index and the other is logical index. Numerical index based on Hexun data center calculation model to obtain

accurate scores; The logical indicator is scored according to whether the social responsibility report discloses the indicator and whether the disclosure is detailed. As different industries have different emphasis on shareholder responsibility, employee responsibility, supplier and customer, environmental responsibility and social responsibility, there will be corresponding adjustment in the weight of the assigned value. Hexun's data sources are also all from publicly disclosed annual reports and corporate social responsibility reports of listed companies. Under these five dimensions, Hexun listed 13 second tier indicators and 38 third tier indicators and scoring range between 0 and 100.

The shareholders of a listed company are investors of a listed company, hold shares of the company, have the right to participate in the shareholders' meeting and have the right to vote. Shareholders' rights mainly include the two parts of shareholders' property rights and shareholders' right to participate in shareholder management, and the property rights of shareholders are the root and core of their rights and interests, reflecting their demands and objectives for capital contribution. Therefore, the performance of social responsibilities requires enterprises to reasonably use the tangible and intangible assets invested by shareholders to continuously satisfy their rights and interests in investment profits through effective operation and sustainable development of enterprises. Hexun used 5 groups of 18 indicators from 5 aspects: A1-A3 corporate financial operation (profit analysis, cash flow, return on investment), A4-A5 financial management, compliance, innovation and R&D to evaluate CSR Shareholder dimension and calculate according to the relevant proportions (see the below for details).

A1: ROE (2%), ROA (2%), Return of sales (2%), Cost margin (1%), EPS (2%), Retained earnings per share (1%)

A2: Quick ratio (0.5%), Liquidity ratio (0.5%), Cash ratio (0.5%), Equity ratio (0.5%), Asset-liability ration (1%)

A3: Dividend capital ratio (2%), Dividend yield (3%), Bonus share allocation ratio of profit (3%)

A4: Number of penalties by stock exchange (5%), R & D expenditure (1%)

A5: Concept of technological innovation (1%), The number of items of technological innovation (2%)

From the CSR employee perspective, enterprise employees are the intangible assets of the company's healthy development. The wages and benefits paid by the company to employees measure the value of employees' work, and at the same time reflect the company's care and affirmation of employees, and competitive remuneration in the industry is an important prerequisite for employees' continuous and innovative work. The value created through the work of employee creativity is an important guarantee for enterprises to improve their competitiveness. Due to the high-risk nature of the chemical logistics industry, the employment of qualified employees (such as the driver of dangerous goods vehicles), the compliance operation and regular training of employees, as well as benefits, and employee loyalty to the company are all key compared to other logistics industries, Hexun adopts a total of 7 three-level indicators from employee return on investment B1, employee safety training B2, employee care B3, to evaluate CSR employees dimension and calculate according to the relevant proportion.

B1: Per capita incomes of workers (4%), Training of staff (1%)

B2: Periodic security check (2%), Safety training (3%)

B3: Policy of caring (1%), Number of caring (2%), Caring payments (2%)

CSR on Suppliers & Customers dimension: The suppliers of logistics enterprises play an important supporting role in the business activities of logistics enterprises, and the products or services they effectively provide are an important prerequisite for the business activities of logistics enterprises. A long-term sustainable strategic partnership of risk sharing. For the customers side, only when customers get satisfactory services in all aspects of the consumption process will they establish the loyalty of the enterprise, develop continuous purchasing behavior, and thus promote the continuous growth of enterprise sales. For China's chemical logistics industry, its customers are mainly chemical manufacturing plants and distributors, and its suppliers are mainly diesel suppliers and equipment accessories suppliers that account for a large proportion of its cost. Hexun adopts five three-level indicators from the C1-C3 three aspects of quality management system evaluation C1, customer satisfaction evaluation C2 and fair competition C3 to evaluate CSR employees' dimension and calculate them according to the relevant proportions.

C1: Policy of quality management (3%), Quality management system certificate (4%)

C2: Customer satisfaction survey (3%)

C3: Vendor fair completion (3%), Anti-bribery training (2%)

CSR on environment dimension: The environment contents of CSR for logistics enterprises is to fulfil the responsibility of environmental protection include abiding by environmental protection laws and regulations and fulfilling environmental protection the duty of care, this is the bottom line of responsibility. However, chemical logistics industry is more sensitive for the CSR environment dimension due to its special industry characters. In the whole supply chain, their customers (chemical products manufacturers) are facing the changeling from the society and restrictions from the various government bureaus. Since chemical logistics companies do the delivery service for these chemical manufacturers, such pressure and attention for environment protection are also being put on their head especially under current 'Double Carbon' target set by the Chinese government. Hexun sets five three-level indicators on CSR environment section.

D: Policy of environmental protection (2%), Environmental management system certificate (3%), Environmental investment amount (5%), Number of types of sewage (5%), Number of types of green energy (5%)

CSR on society dimension: For this section, it focuses on logistics enterprise performance to the community, mainly refers to the company's beneficial to charitable purposes, not directly related to the company's economic activities. Corporate benevolence and public donations help to build the good image of the enterprise in the public and also enhances the company's products Brand value. which is an important intangible asset of an enterprise. Hexun selected the Tax paid by the logistics companies and their Donation as the two three-level indicators on CSR social section.

E: Tax (10%), Donation amount (10%)

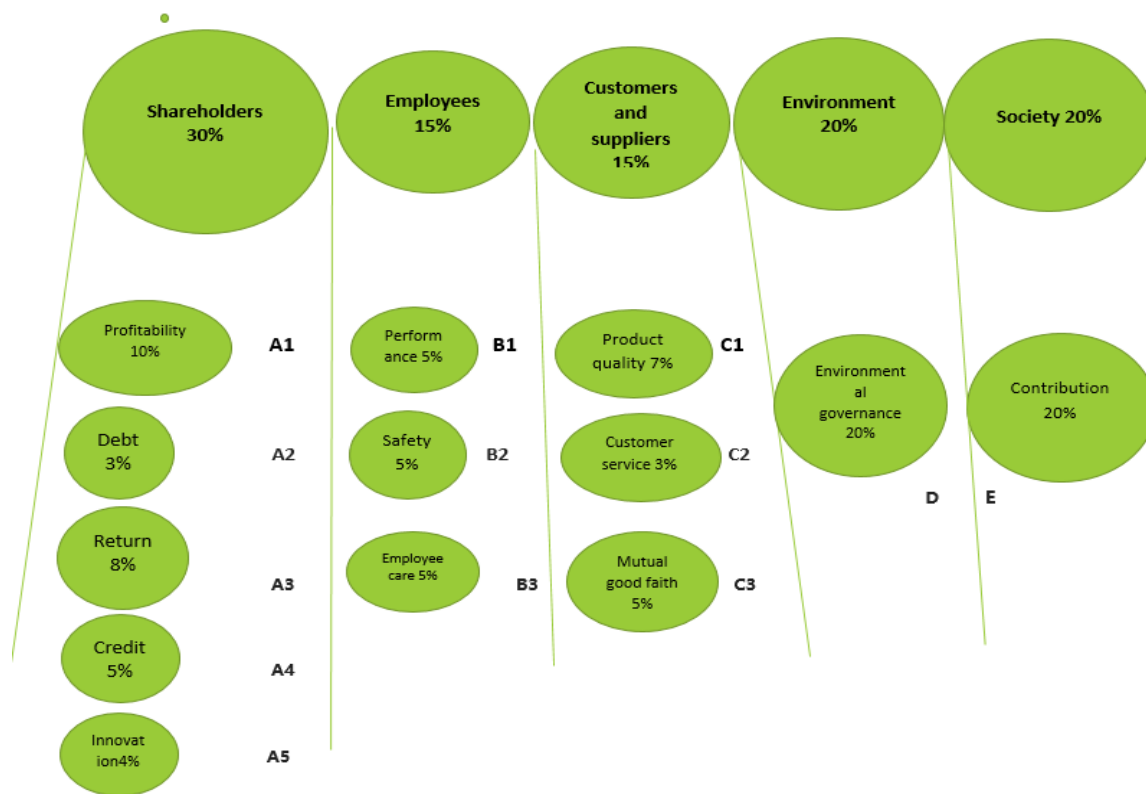


FIGURE 5.1 ChartA: Hexun CSR evaluation framework for public listed company

A1: ROE (2%), ROA (2%), Return of sales (2%), Cost margin (1%), EPS (2%), Retained earnings per share (1%)

A2: Quick ratio (0.5%), Liquidity ratio (0.5%), Cash ratio (0.5%), Equity ratio (0.5%), Asset-liability ratio (1%)

A3: Dividend capital ratio (2%), Dividend yield (3%), Bonus share allocation ratio of profit (3%)

A4: Number of penalties by stock exchange (5%), R & D expenditure (1%)

A5: Concept of technological innovation (1%), The number of items of technological innovation (2%)

B1: Per capita incomes of workers (4%), Training of staff (1%)

B2: Periodic security check (2%), Safety training (3%)

B3: Policy of caring (1%), Number of caring (2%), Caring payments (2%)

C1: Policy of quality management (3%), Quality management system certificate (4%)

C2: Customer satisfaction survey (3%)

C3: Vendor fair completion (3%), Anti-bribery training (2%)

D: Policy of environmental protection (2%), Environmental management system certificate (3%), Environmental investment amount (5%), Number of types of sewage (5%), Number of types of green energy (5%)

E: Tax (10%), Donation amount (10%)

*Source: HeXun website (hexun.com)*

Relying on the experience of Hexun rating staff, their knowledge on mathematical computations and qualitative judgment involves in identifying 38 third tier indicators. Hexun's own data models provides the score of numerical indicators with guide, for example, quick ratio in shareholder dimension and environmental investment amount in the environment dimension. Hexun's rating staff exert their discretion depending on disclosure of relevant information and inclusion of sufficient details in the CSR reports for the score of those qualitative indicators, including the policy of quality management in customer and supplier dimension. The score of 0 denotes that the reports disclose no relevant item. Therefore, in order to compute second tier indicators, Hexun normalizes the score of third tier ones with multiplying by the corresponding weight. Subsequently, it generates the overall CSR score by adding up all weighted first tier indicators.

Previous literature argues that the Hexun CSR rating serves best in examining the CSR performance of Chinese listed companies (Xiong, et al., 2016). RKS CSR rating provides another source which is frequently employed in China, but Zhong et al. (2019) prove the better robustness of Hexun standards in assessing CSR performance than RKS whose quality of CSR reporting is questioned. Additionally, Hexun CSR rating shows more objectivity resulting from the numerical computation of specific indicators rather than content analysis used by RKS CSR rating in evaluation. Thus, the research in the Chinese context prefers the Hexun rating system in evaluating the performance of corporate CSR activities [Tang, et al., 2018; Zheng, et al., 2018].

According to the Hexun system, the overall CSR score for chemical logistic firm can be computed by the following equation:

$$\text{CSR score} = 30\% \text{CSR\_shareholder} + 30\% \text{CSR\_employee} + 15\% \text{CSR\_client} + 15\% \text{CSR\_environment} + 10\% \text{CSR\_society}, (1)$$

where CSR\_shareholder, CSR\_employee, CSR\_client, CSR\_environment and CSR\_society are corporate fulfilment towards the CSR dimensions of shareholders, employees, customers and suppliers, the environment, and society respectively. The

Hexun CSR rating directly provides the score of each dimension, as well as the overall CSR score.

### **6.2.2. Firm Performance and Control Variables—Dependent Variable**

Dependent Variable is generally defined as the main factor which trying to understand or predict. According to Orlitzky et al. (2003), the firm performance can be measured from the three aspects which are market-based, accounting-based, and perpetual-based. The bias may result from only relying on a single aspect (McGuire et al. 1988). For instance, the market factors often make market-based measures sensitive to macroeconomic fluctuations (Ullmann,1985), while the past financial information limits accounting-based measures to the historical perspective of a firm. Both market-based and accounting-based measures are utilized in this research in order to overcome the individual bias. In doing so, Tobin's Q is used as a proxy of market-based measure, and return on assets (ROA), return on equity (ROE), and earnings per share (EPS) are used as proxies of accounting-based measures.

- Tobin's Q or The Q Ratio was first used by Nicholas Kaldor in his article published 1966 and later popularized by the Nobel Laureate, James Tobin, who the ratio was named after. The Q Ratio is the total price of the market divided by the replacement cost of all its companies. Tobin's Q is a fairly simple concept and popular method of estimating the fair value of the stock market. It relies on the concepts of market value and replacement value, and measures whether a firm or an aggregate market is relatively over- or undervalued.
- Return on assets (ROA) refers to a financial ratio that indicates how profitable a company is in relation to its total assets. ROA can determine how efficiently a company uses its assets to generate a profit. The metric is commonly expressed as a percentage by using a company's net income and its average assets. A higher ROA means a company is more efficient and productive at managing its balance sheet to generate profits while a lower ROA indicates there is room for improvement.
- Return On Equity (ROE) is a ratio to measure net income after tax with equity (Kasim, 2016). This ratio shows the efficiency of the use of own capital. ROE compares the net income to the equity of the firm. This important financial metric

is used to use to determine how efficient management is at utilizing equity financing provided by shareholders. The higher the ROE, the better. That means that the position of the owner of the company is getting stronger. On the other hand, if ROE is low, it will get worse. That means that the position of the owner of the company is getting weaker. ROE is a gauge of a corporation's profitability and how efficiently it generates those profits. The higher return on equity (ROE) shows the company's performance is getting better and has an impact on the company's stock price. ROE is not a true measure of shareholder return because it does not take into account dividends and capital gains for shareholders.

- EPS shows the profit that is entitled to each shareholder of one share of common stock. EPS is calculated as a company's profit divided by the outstanding shares of its common stock. The resulting number can be used as an indicator of a company's profitability. Earnings per share (EPS) shows the company's ability to earn profits and distribute the profits earned by the company to shareholders. Tandellin (2001) defines Earning Per Share (EPS) as a comparison between the amount of profit with the number of shares outstanding. EPS is a ratio that shows how much profit (return) is obtained by investors or stockholders per share. The higher the EPS value, of course, makes stakeholders feel good because the greater the profit provided to stockholders (Darmadji and Fakhrudin, 2001). According to Kurnianto (2013), EPS describes the company's profitability which is reflected in each share. The higher the Earning Per Share (EPS) value, the greater the profit and the possibility of increasing the number of dividends received by shareholders

The natural logarithm of total assets serves as a variable to control the size of firms. Considering the different size of the 18 sample companies, this study takes the natural log of total assets to control the size of firms. Firm size (SIZE), measured by the natural logarithm of total assets, controls for effects of scale economies and market power associated with a firm's size (Hitt et al., 1997; Lang and Stulz, 1994; Nachum, 2004; Tallman and Li, 1996).

The details of variables measurements are shown in below table.

Table 5.1: Constructs of the variables(b)

| Variables | Measurement  |
|-----------|--|
| Tobin's Q | Total market value of firm/total assets value of firm  |
| ROA       | Return on assets (net income/total average assets)   |
| ROE       | Return on equity (= net income/total average equity)   |
| EPS       | Earnings per share<br>= (net income – preferred dividends)/weighted average shares outstanding |
| LNTA      | Natural logarithm of total assets  |

### 6.3 Model for multiple regression analysis of firm performance

Within the realm of statistical analysis, regression stands out as a prominent technique employed to establish relationships between a dependent variable and one or more independent variables. This modeling approach aims to discern whether alterations observed in the dependent variable correlate with changes in the identified explanatory variables. Characterized as a predictive modeling technique, regression is instrumental in unveiling the intricate relationships between independent variables and a designated dependent variable. Its application extends across diverse domains, with a particular emphasis on time series modeling, forecasting, and elucidating causal connections between variables. The foundation of regression analysis necessitates the explicit definition of a dependent variable, positing that this variable is influenced by one or more independent variables. This foundational step is integral to the subsequent execution of a comprehensive regression analysis, facilitating the exploration of the hypothesized relationships and contributing to the robustness of statistical modeling within various research contexts. In this study, the regression model is set to analysis the relationship between CSR variables and company performance variables to test the research hypothesis. CSR variables are the independent variables, and each company performance variable is the dependent variable. The regression model used here are Multiple linear models because the research will do the analysis not only the relationship between CSR and firm performance, but also the impact of each CSR dimension related to firm performance.

To examine the relationship between CSR and firm performance, this chapter regresses firm performance on the overall score of CSR and other control variables using the following model:

$$performance_{it} = \beta_0 + \beta_1 CSR_{it} + \beta_2 size_{it} + \beta_3 gearing_{it} + \varepsilon_{it} \quad (2)$$

where,  $performance_{it}$  is the performance of firm  $i$  in year  $t$ , which is measured by market-based proxy such as Tobin's  $Q$  and accounting-based proxies of ROA, ROE, and EPS.  $CSR_{it}$  is the CSR score of firm  $i$  in year  $t$ . As discussed in previous section, the CSR score is obtained from the Hexun CSR database.  $size_{it}$  is the nature logarithm of total assets of firm  $i$  in year  $t$ , and  $gearing_{it}$  is the gearing ratio of firm  $i$  in year  $t$ .  $\varepsilon_{it}$  is the disturbance term. Based on Hypothesis 1A, the chapter expects the coefficient  $\beta_1$  to be positive and statistically significant with firm performance.

To further examine the relations between specific CSR dimension of stakeholders and firm performance, the chapter also regresses firm performance with shareholders dimension, employees' dimension, customers and suppliers' dimension, the environment dimension and society's dimension, respectively. The model specification is listed as follow:

$$performance_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 size_{it} + \alpha_3 gearing_{it} + \mu_{it} \quad (3)$$

where, similarly, the dependent variable is proxied by Tobin's  $Q$ , ROA, ROE, and EPS.  $X_{it}$  is performance of stakeholders' practices of firm  $i$  in year  $t$ , which are represented as  $csr\_shareholder$ ,  $csr\_employee$ ,  $csr\_client$ ,  $csr\_environment$ , and  $csr\_society$ , respectively. As proposed in Hypothesis 1B, this chapter expects the relationship between each dimension of stakeholders and firm performance to be positive and statistically significant.

## 6.4 Analysis of summary of descriptive statistics

Descriptive statistics serve as concise informational indicators that succinctly encapsulate a provided dataset, which may either represent the entire population or a

subset of it. These statistics function to describe, illustrate, and summarize fundamental characteristics of a dataset derived from a specific study, presenting a condensed overview of the data sample and its corresponding measurements. Offering invaluable insights, descriptive statistics enhance analysts' comprehension of the underlying data, providing a snapshot without venturing into theoretical constructs, inferences, probabilities, or definitive conclusions.

The foundational components of descriptive statistics are delineated into measures of central tendency and measures of variability (spread). Measures of central tendency, such as the mean, median, and mode, encapsulate the essence of the dataset by highlighting its central values. Conversely, measures of variability, including standard deviation, variance, minimum and maximum variables, kurtosis, and skewness, shed light on the extent of dispersion within the dataset.

Descriptive statistics fulfill the role of summarizing or delineating the characteristics inherent in a given dataset. The tripartite structure of descriptive statistics encompasses measures of central tendency, measures of variability (spread), and frequency distribution. Measures of central tendency elucidate the central tendencies within the dataset, exemplified by the mean, median, and mode. Measures of variability expound upon the spread or dispersion of the dataset, incorporating metrics such as variance and standard deviation. Measures of frequency distribution detail the occurrence and distribution of data points within the dataset, providing insights into the frequency of specific values.

For this study, the Stata is the statistical software for doing the data research. Stata is a complete, integrated software package that provides data science needs—data manipulation, visualization, statistics, and automated reporting. It can work fast and accurate data and easy to use. The below table figures worked out by Stata shows the descriptive statistics of all variables of this study: (Sum ∪)

| Variable        | Obs | Mean   | Std. Dev. | Min      | Max    | Median | Skewness |
|-----------------|-----|--------|-----------|----------|--------|--------|----------|
| Tobin_Q         | 120 | 2.508  | 6.638     | 0.205    | 45.534 | 1.251  | 5.670    |
| ROA             | 164 | 6.619  | 13.161    | -66.900  | 63.880 | 6.160  | -0.999   |
| ROE             | 159 | 8.588  | 20.015    | -156.030 | 54.200 | 8.810  | -4.642   |
| EPS             | 158 | 0.432  | 0.596     | -2.190   | 3.440  | 0.410  | 0.861    |
| CSR             | 152 | 24.547 | 16.372    | -3.510   | 85.550 | 20.335 | 1.565    |
| CSR_shareholder | 152 | 13.692 | 5.118     | -3.440   | 24.290 | 14.050 | -1.229   |
| CSR_employee    | 152 | 3.145  | 3.761     | 0.000    | 14.910 | 1.900  | 1.768    |
| CSR_client      | 152 | 1.539  | 4.031     | 0.000    | 15.000 | 0.000  | 2.406    |
| CSR_environment | 152 | 2.569  | 6.602     | 0.000    | 30.000 | 0.000  | 2.340    |
| CSR_society     | 152 | 3.601  | 1.839     | -4.390   | 7.420  | 3.955  | -1.242   |
| Inta            | 164 | 22.016 | 1.671     | 17.329   | 24.948 | 21.792 | -0.208   |

Table 5.2: Descriptive Statistics

The overall CSR score reports the mean value of 24.547 and the median value of 20.335 with a range from 1 to 100 respectively, which shows a relatively low CSR rating score for Chinese chemical logistics company in the sample. Overall CSR score has a standard deviation of 16.372 which describes a relatively wide distribution of CSR performance across sample firms.

In terms of dimensions of stakeholders, CSR score on shareholder shows the mean value of 13.692 and the median value of 14.05 respectively which are much higher than the CSR scores of other dimensions. This suggests the sample firms pay large attention on shareholders' interest, rather than other dimensions, which is in line with the company's main objective. More specifically, its negative skewness of distribution on shareholder's CSR score demonstrates that most of the Chinese chemical logistics firms are present on the left side to the mean value. This suggests that a relatively large amount of Chinese chemical logistics firms in the sample exert a lower CSR score than average one on shareholders' responsibility.

In contrast, society's dimension (CSR-society) and employees' dimension (CSR-employee) reports the mean value of 3.601 and 3.145, and the median of 3.955 and 1.9, respectively. They are much lower than those value on shareholders' dimension of CSR score, so the sample firms put less emphasis on society and employees, although average scores are still higher than those on aspects of environment, customers and suppliers. The negative skewness statistics of society's CSR score also confirm this implication by showing lots of sample firms have lower CSR scores than average.

The environmental dimension (CSR-environment) and the customers' and suppliers' dimension (CSR-client) reports the mean value of 2.569 and 1.539 respectively. It suggests that chemical logistics firms have the lowest CSR score on customer and supplier compared with other dimensions. Particularly, both CSR-environment and CSR-client report zero median value which implies that the sample firms seldom look after environmental protection, their customers' satisfaction and supplier chain's health on average.

In the table 5.2, Tobin's Q reports the mean value of 2.508 and the median value of 1.251. Both values are greater than 1, suggesting that market value of the sample firms is higher than their book value on average. If Chinese chemical logistics enterprises would like only to expand their production capacity, they prefer to establish new plants or factories rather than purchase the incumbent ones on the market because new-built capacity would be cheaper than buying existing capacity. However, from another point of view, it also means the market value of the sample firms may have good value from the intangible assets such as brand image and premium customer reputation. ROA and ROE report the mean value of 6.619 and 8.588, and the median value of 8.588 and 8.810, respectively. This is consistent with the logic that ROE normally is greater than ROA given the same profit generated within the same firm. ROA and ROE have standard deviation of 13.161 and 20.015 which describes a relatively wide distribution of financial performance across sample firms. The negative value of skewness statistics for both ROA and ROE show that many sample firms' returns are distributed on the left side of to the mean value. This implies that a large amount of chemical logistics enterprises in China is underperformed compared with their industrial average level. EPS reports the mean value of 0.432 and the median value of 0.410. The standard deviation of 0.596 shows value of sample firms' EPS is relatively concentrated. The skewness value of 0.861 means these firms earned better than the industrial benchmark. The natural logarithm of total assets reports the mean value of 22.016 and the median value of 21.792. Although its skewness value is -0.208, it reports a standard deviation of 1.671. This demonstrates that total assets of most sample firms after logarithm transformation becomes left to the mean value, but their distribution is relatively narrow across chemical logistics

enterprises in China. Most Chinese chemical logistics firms are relatively smaller than average level in size.

In general, Chinese chemical logistics companies have realised to transfer their attentions to the responsibility towards stakeholders and the environment, but the strength of transformation is far more less than the satisfactory level of CSR requirement. Furthermore, based on the aforementioned finding, shareholders are placed on the most important position by chemical logistics companies in China. When considering the market based financial performance, the market value of Chinese chemical logistics companies is generally greater than the value of their asset replacement. In terms of the accounting based financial performance, these firms could generate decent return on average although their scales are not much big compared with other listed firms.

## **6.5 Pairwise Analysis of the relationship between variables**

The pairwise correlation relationship for the dependent and independent variables is presented in Table D of Pairwise Correlation Result. The positive coefficients between overall CSR score, shareholder CSR score and society CSR score and ROA, ROE, and EPS show that good CSR performance are positively related to better accounting-based financial performance. They are found to be significant at 0.01 level. However, the negative coefficients show that Tobin's Q have a negative relationship with overall CSR score and all dimensions' CSR scores, particularly for shareholder's and society's scores with significance at 0.01 level. It implies good CSR performance is negatively associated with market-based performance.

Table 5.3: Pairwise Correlation Result (PWCORR ∪ SIG)

|                 | Tobin_Q | ROA    | ROE    | EPS    | CSR   | csr_sh~r | csr_em~e | csr_cl~t | csr_en~t | csr_so~y | Inta  |
|-----------------|---------|--------|--------|--------|-------|----------|----------|----------|----------|----------|-------|
| Tobin_Q         | 1.000   |        |        |        |       |          |          |          |          |          |       |
| ROA             | -0.161  | 1.000  |        |        |       |          |          |          |          |          |       |
|                 | *       |        |        |        |       |          |          |          |          |          |       |
| ROE             | -0.123  | 0.782  | 1.000  |        |       |          |          |          |          |          |       |
|                 |         | ***    |        |        |       |          |          |          |          |          |       |
| EPS             | -0.137  | 0.568  | 0.715  | 1.000  |       |          |          |          |          |          |       |
|                 |         | ***    | ***    |        |       |          |          |          |          |          |       |
| CSR             | -0.234  | 0.223  | 0.269  | 0.237  | 1.000 |          |          |          |          |          |       |
|                 | ***     | ***    | ***    | ***    |       |          |          |          |          |          |       |
|                 | -0.338  | 0.543  | 0.657  | 0.624  | 0.511 | 1.000    |          |          |          |          |       |
|                 | ***     | ***    | ***    | ***    | ***   |          |          |          |          |          |       |
| CSR_employee    | -0.107  | 0.007  | 0.041  | -0.006 | 0.905 | 0.200    | 1.000    |          |          |          |       |
|                 |         |        |        |        | ***   | **       |          |          |          |          |       |
| CSR_client      | -0.103  | 0.034  | 0.034  | 0.007  | 0.899 | 0.156    | 0.903    | 1.000    |          |          |       |
|                 |         |        |        |        | ***   | *        | ***      |          |          |          |       |
| CSR_environment | -0.108  | 0.050  | 0.047  | 0.028  | 0.911 | 0.157    | 0.921    | 0.941    | 1.000    |          |       |
|                 |         |        |        |        | ***   | *        | ***      | ***      |          |          |       |
| CSR_society     | -0.358  | 0.205  | 0.335  | 0.271  | 0.387 | 0.454    | 0.167    | 0.158    | 0.138    | 1.000    |       |
|                 | ***     | **     | ***    | ***    | ***   | ***      | **       | *        | *        |          |       |
| Inta            | -0.598  | -0.078 | -0.021 | 0.015  | 0.437 | 0.254    | 0.446    | 0.323    | 0.350    | 0.302    | 1.000 |
|                 | ***     |        |        |        | ***   | ***      | ***      | ***      | ***      | ***      |       |

Notes: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

| Model    | (1)     | (2)  | (3)  | (4)  |
|----------|---------|------|------|------|
| Variable | Tobin_Q | ROA  | ROE  | EPS  |
| size     | 1.57    | 1.41 | 1.33 | 1.4  |
| gearing  | 1.29    | 1.24 | 1.19 | 1.23 |
| CSR      | 1.26    | 1.17 | 1.14 | 1.16 |
| Mean     |         |      |      |      |
| VIF      | 1.37    | 1.27 | 1.22 | 1.27 |

A variance inflation factor (VIF) provides a measure of multicollinearity among the independent variables in a multiple regression model. Based on the analysis of VIF for these 4 models, the above result shows the VIF values of variables are relatively low. It suggests there is no multicollinearity issue among the specifications.

## 6.6 Finding from multiple regression analysis

The structure of collected data suggests a panel-based regression model to control the unobserved heterogeneity in the proposed model. The Likelihood test is applied at first to examine whether fixed effects exist or not. Subsequently, Hausman test is used to choose between fixed effects and random effects. The outcome suggests that fixed effects is the appropriate specification in examining the relationship between CSR with Tobin's Q. The random effects model is employed in examining the relationship

between CSR with ROE, and CSR with ROA and EPS based on the outcome of the Likelihood test.

Table 5.4 The relationship between the firm's performance and its CSR in Chinese logistical industry

|              | (1)<br>tobin_q       | (2)<br>roa           | (3)<br>roe          | (4)<br>eps              |
|--------------|----------------------|----------------------|---------------------|-------------------------|
| CSR          | 0.0179<br>(0.0303)   | 0.241***<br>(0.0724) | 0.396***<br>(0.110) | 0.0104***<br>(0.00323)  |
| Size         | -2.651***<br>(0.372) | -1.262<br>(0.766)    | -1.161<br>(1.267)   | -0.0135<br>(0.0344)     |
| gearing      | 0.0254<br>(0.0250)   | -0.00981<br>(0.0497) | -0.0648<br>(0.0757) | -0.00473**<br>(0.00222) |
| Constant     | 60.79***<br>(7.809)  | 28.51*<br>(15.99)    | 25.22<br>(26.84)    | 0.559<br>(0.720)        |
| Adjusted R2  | 0.3481               | 0.0522               | 0.0679              | 0.0747                  |
| F-statistics | 22.18***             | 3.77***              | 4.55***             | 5.01***                 |
| N            | 120                  | 152                  | 147                 | 150                     |

Notes: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Regression results are shown in Table 5.4. CSR has a significant and positive coefficient with ( $p < 0.05$ ) ROA, ROE, and EPS. These results indicate that as CSR score rises several aspects of accounting performance of a firm increase. However, the model (1) hasn't found the significant evidence on relationship between CSR and Tobin's Q. This implies that in China's context, CSR practices hardly influence logistical firms in terms of market performance. Generally, the results of model (2), (3) and (4) are consistent with the first hypothesis which claims that CSR activities facilitate the improvement in firm performance. These findings echo the previous research about CSR and firm performance in China (Sial, et. al. 2018).

In model (1), firm size shows a negative and significant value ( $p < 0.05$ ) with Tobin's Q. This shows that the larger a firm is, the smaller its market performance is. It suggests the market value of the firm is relatively smaller than its replacement cost when a firm has a large value of fixed assets. The heavy fixed assets are quite common in the large and medium sized Chinese chemical logistics companies because these companies more prefer to own their equipment. Model (4) reports a negative and significant value ( $p < 0.05$ ) of gearing ratio with EPS. This indicates that

as the gearing ratio of a firm increases, its earning goes down. It implies a firm cannot benefit from the high leverage level. It is also understandable in this industry; the shortage of qualified labour is now the most challenging issues for most chemical logistics companies in China. It means it is hard for a company to expand their revenues automatically just adding more equipment. It is worth to do further exploration in the following interviews with the experts in this industry.

The further specification builds firm performance proxies with each individual dimension of CSR in a panel-based regression model. The results of the Hausman test imply that the dimensions of shareholders (csr\_shareholder), employees (csr\_employee), customers and suppliers (csr\_client), the environment (csr\_environment), and society (csr\_society) are appropriate in a fixed effects model when investigating the impact on Tobin's Q. However, the random effects model is appropriate to explain the impact on ROA, ROE and EPS.

Table 5.5: The impact of stakeholder's dimensions on the firm's performance in Chinese logistical industry

|                 | (1)<br>Tobin_Q       | (2)<br>ROA          | (3)<br>ROE          | (4)<br>EPS               |
|-----------------|----------------------|---------------------|---------------------|--------------------------|
| Csr_shareholder | -0.135<br>(0.101)    | 1.589**<br>(0.202)  | 2.752**<br>(0.292)  | 0.0797**<br>(0.00822)    |
| Csr_employee    | 0.969**<br>(0.372)   | -1.178*<br>(0.699)  | -1.272<br>(1.010)   | -0.0471<br>(0.0285)      |
| Csr_client      | -0.270<br>(0.339)    | -0.209<br>(0.719)   | -0.649<br>(1.001)   | -0.0364<br>(0.0292)      |
| csr_environment | -0.207<br>(0.223)    | 0.752<br>(0.469)    | 0.897<br>(0.654)    | 0.0418**<br>(0.0191)     |
| csr_society     | -0.474<br>(0.296)    | -0.0915<br>(0.571)  | 1.320<br>(0.806)    | 0.00870<br>(0.0232)      |
| Size            | -2.504***<br>(0.369) | -1.095<br>(0.682)   | -0.0593<br>(1.048)  | -0.0145<br>(0.0278)      |
| gearing         | 0.00775<br>(0.0254)  | -0.0162<br>(0.0435) | -0.0861<br>(0.0603) | -0.00548***<br>(0.00177) |
| Constant        | 59.36***<br>(7.577)  | 11.52<br>(14.06)    | -29.61<br>(22.36)   | -0.169<br>(0.574)        |
| r2              | 0.435                | 0.344               | 0.466               | 0.472                    |
| N               | 120                  | 152                 | 147                 | 150                      |

Notes: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

Table 5.5 shows the results of the panel-based models investigating different CSR dimensions of stakeholders. Across the models, the shareholders dimension reports a positive and significant ( $p < 0.05$ ) coefficient with ROA, ROE, and EPS. These results demonstrate that the high shareholders' welfare solicitude will result in various high accounting-based performance for Chinese logistical sector. In fact, CSR practices facilitate firms to win shareholder's trust and bring more new investors who are caring about companies' CSR performance, which improves firm financial performance. These findings are in line with the previous research (Barnett & Salomon, 2006; Branco & Rodrigues, 2006). However, in model (1), Tobin's Q reports an insignificant coefficient. This shows no strong evidence was found between CSR practices and the market-based firm performance.

In model (1) of Table 5.5, it is reported a positive and significant ( $p < 0.05$ ) relationship exists between the employee's dimension of CSR and the firm's market performance measures. The implementation of Labor Contract Law has improved the protection of considerable employees' rights in China. Such practices on labour protection motivates employee's morale and reduces the turnover rates of workers. Thus, these promote firm's productivity and market value in Chinese logistical sector (Turban & Greening, 1997). However, model (2) shows a negative and significant ( $p < 0.05$ ) coefficient of the employee's dimension of CSR with firm's ROA. This, from another aspect, indicates firm's accounting performance, especially profit, will decrease when it largely considers employee's various welfare, because this will increase the operational costs and expenses. As I explained that the difficulty in recruiting qualified professional labours in the Chinese chemical logistics industry, and the employers have to offer additional cash bonus to the labours to save the income taxations of those employees. Such portion cannot be reflected as labour cost in their financial reports, instead, it normally be put into the section of diesel or others. It is very common practice in the logistics industry, just give one example, the employers normally set a level for fuel consumption for hundred kilometres. Normally such level is at least 10% higher than the actual consumption, the drivers will present the fuel ticket or other invoices for such portion of difference. Therefore, such cost will be booked as diesel cost or other costs varying from each company. I could do the interview with the people

in the industry to understand the actual portion of such difference. But due to this reason, the labour cost in the financial report may not really reflect the true pictures and impact our research data analysis.

In model (4) of table 5.5, the environment aspect of CSR shows significantly ( $p < 0.05$ ) and positively link with EPS, which relates to the enormous attention from the public and local authorities. Firm's compliance with regulations on environmental preservation and protection facilitates to build a good relationship with relevant governmental department. It also reduces the operating costs and occurrence of fines concerning environmental risk (Hart and Ahuja, 1996). The environment-related CSR activities help firm promote its public image and the attention of environment-sensitive investors are drawn by these responsible behaviours. For the Chinese chemical logistics industry, the environment aspect could be quite sensitive issue to lead to serious social risk. Meanwhile, most local government put chemical logistics companies in their attention list to avoid the complaint from the neighbourhood for the possible leakage and waste disposals.

Furthermore, the government also link the company environment performance with their credit record, for example, the companies with bad environment record cannot get the permit for bank loan until they got the environment issue covered or improved.

Across the models, there is no significant coefficient between the customers and suppliers' dimension of CSR and market-based and accounting based firm performance. This suggests that there is no direct relation between firm's effort on high-quality services and their customer loyalty. Similarly, good relationship with suppliers doesn't ensure better procurement process. Furthermore, it hasn't been found the significant relationship between the social dimension of CSR and various firm performance. This asserts that firm's financial performance cannot benefit from its proactive social activities, such as community development and charitable donations, although this can improve firm's positive image and corporate citizenship (Laan, et. al. 2008). However, these may not directly bring financial benefit for the company. I could try to explore further by way of interview with the experts in the industry.

In model (1), similar to the overall CSR rating, firm size reports a negative and significant value ( $p < 0.05$ ) with Tobin's Q. This indicates that the larger a firm is, the smaller its market performance is. It echoes the common issue of big firm on "too big to fall" and provides a robust finding for the influence of firm size. It could be understandable in the Chinese chemical logistics industry, especially the large size companies, they more prefer to own their own equipment and vehicles because of their company size to hold their own maintenance team. It makes them more like 'Asset Heavy' company. Model (4) reports a negative and significant value ( $p < 0.05$ ) of gearing ratio with EPS. This reinforces the negative impact of high leverage level, which identifies that the high level of gearing ratio will undermine a firm's ability to creating profit. Same reason, the big amount of purchasing cost as well as associated financial costs for equipment and vehicles will be listed in the financial report as liability as well.

Overall, the above models show various CSR dimensions are positively related to firm performance. The evidence confirms the contribution of specific aspect of CSR to firm development. These findings suggest that firm's stakeholders' demands can be addressed by its CSR activities, which supports the instrumental aspect of stakeholder theory.

## **6.7 Discussion of results**

Based on the instrumental aspect of stakeholder theory, the positive association between CSR and firm performance can be explored by the impact of the demands of stakeholders and social trustworthiness on the benefit of CSR activities. Companies can build good relationships with key stakeholders through considerable CSR related behaviours, which can generate, promote, and remain link to strategic resources (Wood and Jones, 1995). The competitive advantage of a firm can be established when the resources are critical and hard to obtained to the firm. The good CSR practices with stakeholders enable firm to access to these resources so as to improve the firm performance.

For specific aspects of CSR practices, positive impact on society rises through effective stakeholder management. For example, employees' retention rate and labour productivity will be improved (Turban and Greening, 1997). Sometimes, the goodwill

generated through positive social image facilitates firms to attract more customers and provides them with more access to some valuable commercial opportunities. Thus, the competitive advantages of the firms can be built up through good interactive with various groups of stakeholders, so that it brings out superior economic returns.

## **6.8 Research limitation**

There are some limitations for this research. First, the study does not fact in the impact of the economic fluctuation on the hypothesis's relationship between CSR indicators and firm performance. Second, the study doesn't consider the time effect of implementation in CSR practices on the change of a firm's performance in later years. Future research can utilise time lag to extend such relationship.

## **6.9 Conclusion**

This research aims to build the link between CSR practices and firm performance enhancement in the context of chemical logistics industry in China. The on the stakeholder theory and the CSR stakeholder framework outlined by the Hexun CSR database leads me to measure various aspects of CSR performance from five CSR dimensions and their incorporated overall CSR score. By investigating the CSR performance of 18 Chinese chemical logistics firms from 2010 to 2019, it is found that in general, firm's financial performance benefits from CSR practices. More specifically, good shareholder dimension of CSR is identified to improve a firm's performance for every indicator. However, the results indicate that the employee dimension of CSR is negatively related to a firm's performance. This outcome is attributed to the specific characteristics of Chinese chemical logistics industry. There are quite a portion of labour costs was not correctly reflected in the official financial reports. It could be the reason, but I also did further research to collect more primary data through the next step interviews. Whereas the scores on other dimensions of CSR do not show significant impact.

In the real world, many Chinese firms are reluctant to engage with CSR activities because they couldn't see the immediate benefit from these practices even not

boosting the profit and their share prices. Nevertheless, the empirical evidence implies that CSR practices help to make firms more sustainable. For example, the impression of some key stakeholders weighs more on CSR activities. Thus, such good relationship between firms and stakeholders is a competitive advantage when firms want to build a strong brand image and customer loyalty. This will expand their revenue and market share so as to promote financial performance in the long term.

The CSR practices of developed countries are extensively discussed but the literature on CSR framework in emerging countries is underdeveloped especially for the chemical logistics industry in China. Due to its unique feature of this industry, this study chose the chemical logistics industry as the research object. It extends the literature on CSR in a particular industry and empirically assesses the impact of CSR practices on firm performance from each individual dimension. More angles of view were cast upon the CSR endeavours.

This research provides with some practical implications. First, given the strong effect of CSR practices regarding the shareholder dimension on firm performance, Chinese chemical logistics firms should pay more attention on their shareholder-related socially responsible activities. Second, firms should enhance their CSR endeavours in the process of management and operation to improve sustainable financial gains given the positive effect of CSR on firm performance. Third, the government can introduce more incentives to help firms effectively implement CSR practices from the aspects of policy and regulation, such as levying fines to restrict cases of CSR violations and allowing tax reduction to subsidising outstanding CSR performance.

# **Chapter 7 An Empirical Study of the CSR and the Development of Green Finance in the Chinese chemical logistics industry**

## **7.0 Introduction**

In the last chapter, the analysis was done on the secondary data about CSR and firm performance of the public listed chemical logistics companies. This chapter attempts to explore and present the finding from the interview analysis focus on the CSR & Green Finance development of the private companies in the Chinese chemical logistic industry.

Per to the research methodology chapter, the aim of this interview analysis is to explore more in-depth information on the current practice of Chinese chemical logistic companies towards CSR and Green Finance and trying to obtain the clear picture of CSR and GF development process. This chapter and the analysis from this chapter is to provide the complements for the quantitative analysis of the last chapter.

The interviews in this research included seven questions designed based on research questions. The 12 interviewees were invited to the research and includes the logistics managers, HSE managers, Finance V.P, Operation manager of the Chinese chemical logistics companies, mainly from the private companies; and invite the participators from the customers section of the Chemical logistics companies, which are those chemical manufacturers. It could help to explore the CSR & GF development in the Chinese chemical logistics industry from different perspectives. During the interviews the interviewees all shared information and their experience according to our pre-provided questions list regarding the CSR & GF. These individuals were carefully selected to share their understanding and experience of CSR & GF for Chinese chemical logistics companies because they are all with 5 or more than 20 years working experience in this industry. The outcome of this analysis provides valuable insights into the practice of CSR & GF in the Chinese chemical logistics industry. The interviews with the chemical manufacturers employees also helped to reveal the development gap in the different industry. It may help to understand the future potential

development trends for the CSR & GF development of the Chemical logistics industry in China.

All the interviews are in Chinese and has to translate into English and transcribed later.

The main points extracted from the verbatim scripts were systematically organized into specific themes using a coding method, and the findings from this analysis are presented in this chapter.

## **7.1 Risk management in Chinese Chemical Logistics Industry**

This section presents the general knowledge of Risk Management in the Chinese Chemical Logistics industry from the experienced management. Below are the thematic findings from the interviews about this section:

The first interview questions is trying to find the attitude on Risk management in the Chinese Chemical Logistics Industry from the participants with different background,

1) Data Analysis for Interview Question 1:

**Interview Question 1:**

**1a. Would you mind doing some introduction for yourself?**

**1b: Would like to tell me something about the risk management of Chinese chemical logistics industry/company?**

**Focused Coding: Subtheme/Remarks**

- **Personal Background Introduction**
- **Company overview**
- **Importance of Risk Management**
- **Challenges**

These subthemes provide insights into the personal backgrounds of the interviewees, company overviews, the importance of risk management in the Chinese chemical

logistics industry, and the challenges faced in maintaining effective risk management practices.

## Personal Background Introduction

Based on the interview record, the following personal background introduction was sort out as follows:

Table 6.1 Shows the background of the interview participants that took place in 2023:

| Interviewee    | Organization  | Position                 | Year In role    |
|----------------|---|--------------------------|-----------------|
| Interviewee 1  | public listed chemical factory subsidiary logistics company | Deputy Manager           | 20+ years       |
| Interviewee 2  | Third-party Logistics Company                               | V.P                      | 20+ years       |
| Interviewee 3  | Third-party Logistics Company                               | General Manager          | 20+ years       |
| Interviewee 4  | Third-party logistics company                               | operation & HSE manager  | Nearly 30 years |
| Interviewee 5  | Public Listed Third-Party Logistics Company                 | Finance VP               | 10+ years       |
| Interviewee 6  | Third-Party Logistics Company                               | Logistics Manager        | 3+ years        |
| Interviewee 7  | Third-Party Logistics Company                               | VP                       | 20+ years       |
| Interviewee 8  | Chemical Factory  | Logistics Manager        | 10+ years       |
| Interviewee 9  | public listed Chemical Factory                              | Logistics Safety Manager | 5+ years        |
| Interviewee 10 | chemical manufacturing giant                                | Supply chain manager     | 5+ years        |
| Interviewee 11 | Local transport bureau                                      | government staff, Phd.   | 8+ years        |

## Company overview

- Interviewee 1: subsidiary of public listed chemical factory, responsible for managing chemical transportation and storage services, complete business scope and qualifications, selects third-party logistics companies for transportation operations. Own limited small amount of fleet.
- Interviewee 2: mother company established in 1949, a key state-owned backbone road transport enterprise, third party logistics company focuses on chemical and auto parts logistics. Own over 300 vehicles fleet.
- Interviewee 3: Third-party logistics company established in 2007, modern logistics enterprise focusing on transportation development, with a fleet size of more than 300 heavy trucks, serving large and medium-sized petrochemical enterprises.
- Interviewee 4: a wholly foreign-owned third-party logistics company, integrated into big public listed logistic group, with about 40 own vehicles and additional outsourcing and leasing equipment.
- Interviewee 5: a public listed third-party logistics company, with over 20 years of experience in the chemical industry and hazardous chemicals management. Engaged in chemical supply chain business with large fleet over 1000 and warehouse around China and aims to become a chemical Amazon.
- Interviewee 6: F Company, established in 2011, a Taiwan-funded enterprise specializing in chemical logistics services for its parent company's chemical factory in China. Owns a fleet of over 20 vehicles and also serves other Taiwan-funded chemical enterprises.
- Interviewee 7: Chemical Dangerous Goods Transport Co., Ltd., a wholly owned subsidiary of Logistics Group, a leading integrated logistics enterprise in China. Specializes in road transportation of hazardous chemicals with over 300 vehicles fleet and holds various certifications.
- Interviewee 8: a Taiwan-funded enterprise with a large ABS resin supplier as the head office. Operates a chemical factory in East China and requires daily transportation of highly toxic and dangerous chemicals.
- Interviewee 9: Well-known listed chemical company in China, Leading enterprise in the chemical industry, Ranked in the world's top 50 chemical companies.
- Interviewee 10: World-renowned chemical group, leader in sustainable development in the industry.
- Interviewee 11: Local government office to support & manage transport and

logistics companies.

It can be brief listed as below:

| <b>Subtheme</b> | <b>Personal Background Introduction</b>                         |
|-----------------|---|
| Interviewee(s)  | Remarks   |
| 1,2,3,4,7,8,9   | Operation / HSE/ section  |
| 3               | General Management  |
| 5               | Financial Management background                                 |
| 1,2,3,4,7       | Working experience in Chemical Logistics area over 20 years     |
| 5,6,8,9,10      | Working experience in Chemical Logistics area over 5 years      |
| <b>Subtheme</b> | <b>Company Overview</b>   |
| Interviewee(s)  | Remarks   |
| 2,3,4,7         | Chinese Private Third- Party Logistics Company                  |
| 5               | Chinese public listed Third-Party Logistics Company             |
| 1,6             | Chemical Enterprise Subsidiary logistics company                |
| 5               | Logistics company size capability: big (fleet size:500+)        |
| 2,3,4,7         | Logistics company size capability: medium (fleet size:100+)     |
| 1,6             | Logistics company size capability: small (fleet size:10-99)     |
| 8,9,10          | Chemical Factory based in China with chemical logistics demand  |
| 11              | Government staff in charge of transportation section management |

The interviewees selected for this research are well-positioned to provide insightful and valuable information on the relationship between Corporate Social Responsibility (CSR), Green Finance, and business performance in the Chinese Chemical Logistics Industry. Their diverse backgrounds, roles, and extensive experience in the industry make them highly suitable for the study. Below is a breakdown of why each interviewee is appropriate for this research.

- Interviewees with Extensive Industry Experience:

Interviewees 1, 2, 3, 4, 7 have over 20 years of experience in chemical logistics. Their long-standing careers in this sector imply that they have witnessed the evolution of industry practices, including risk management, CSR, and sustainability efforts. They

are likely to have deep insights into how these areas impact business performance and can speak to the challenges and opportunities within the industry.

Interviewees 5, 6, 8, 9, 10 have more than 5 years of experience in the chemical logistics industry. This experience, while not as extensive as others, still equips them with a solid understanding of industry trends, particularly around newer initiatives like Green Finance and CSR, which are relatively recent developments.

- Representation of Diverse Company Types:

Interviewees 2, 3, 4, 7 represent Chinese private third-party logistics companies. These companies are typically agile and might have unique approaches to CSR and Green Finance, driven by the competitive and regulatory environment in China.

Interviewee 5 represents a public-listed third-party logistics company. This perspective is crucial as public companies are often under more significant scrutiny regarding their CSR and sustainability practices. They are also more likely to be involved in Green Finance initiatives due to their size and public accountability.

Interviewees 1 and 6 come from chemical enterprise subsidiary logistics companies. These companies often have direct mandates from their parent companies, which might have global CSR and sustainability goals. Their insights can provide a view of how these global mandates are implemented in the Chinese context.

Interviewees 8, 9, 10 are from chemical factories based in China with a demand for chemical logistics. Their perspective is vital as they are end-users of the logistics services and are directly affected by the logistics companies' CSR and sustainability practices.

- Specialized Knowledge and Operational Insights:

Interviewee 3 has a general management background, offering a broad view of how CSR and Green Finance integrate with overall business strategy and operations within a modern logistics enterprise.

Interviewee 5 comes from a financial management background. This is particularly relevant for discussing Green Finance, as they can provide detailed insights into how financial mechanisms are used to support sustainability initiatives in the industry.

- Regulatory and Safety Insights:

Interviewee 11 is from a local government office responsible for transport and logistics management. This interviewee can provide a regulatory perspective, crucial for understanding the external pressures on chemical logistics companies to adopt CSR and Green Finance practices.

Given their extensive experience, diverse roles, and the types of companies they represent, these interviewees are well-suited to discuss the key themes of the research: CSR, Green Finance, and their impact on business performance in the Chinese Chemical Logistics Industry. Their combined insights will offer a comprehensive view of the current state and future potential of these practices in contributing to sustainable business development.

### **Importance of Risk Management**

- Interviewee 1: Risk management is a key focus due to the hazardous nature of chemical transportation, emphasizing the risks of explosion, fire, poisoning, and radiation. Selecting third-party logistics companies with excellent safety management is crucial.

*“Risk management in the chemical transportation market, which is a key focus of our work because the transportation of hazardous chemicals has the characteristics of flammable, explosive, toxic and corrosive, if the transportation process is heated, encountered with open flame, collision, vibration, friction, etc., there is a risk of explosion, fire, poisoning, radiation and other major accidents. Therefore, the vehicle transporting dangerous goods is like a “mobile time bomb”, a little careless, may cause catastrophic consequences. So, although we are a fully qualified transportation company, but we believe to use professionals and professional equipment to do professional things, our work is mainly from the market to select the ‘right company’, that is, safety management is perfect, high safety factor of hazardous chemicals transportation third-party companies to do operations.” (Interviewee 1)*

- Interviewee 2: Risk management is crucial for the survival, competition, and development of chemical logistics enterprises. Compliance with safety regulations and customer requirements, including safety reviews, is essential.

*“A safety accident may lead to several tons or even tens of tons of dangerous goods into the natural environment, seriously damage and pollute the ecological environment, will cause serious harm to the society, for our direct managers, the consequence is that they may bear legal and criminal responsibility and go to jail.”*  
(Interviewee 2)

- Interviewee 3: Safety risk management is essential for chemical logistics companies to serve customers and pass safety reviews. Large chemical enterprises have strict safety management requirements for their logistics providers.

*“For chemical logistics, safety management is the key to the survival, competition, and development of enterprises, because customers cannot choose logistics service providers with safety management problems to serve themselves! A chemical logistics enterprise that does not do a good job in safety risk management is impossible to continue to grow in market competition. At present, there is a lot of demand for safe chemical logistics service providers in China, especially foreign chemical giants, and their first step is to conduct a safety review for the logistics provider, and only after the safety review is passed will they be eligible to enter the bidding process.”* (Interviewee 3)

- Interviewee 4: Risk management is a top priority due to the high-risk nature of chemical logistics. Safety management is necessary to prevent accidents, protect the environment, and meet customer requirements.

*“Now these are the basic safety management requirements of large chemical enterprises for their logistics providers, Taking ISO9001&14001/OHSAS18001 integrated management system as the management standard, we practice HSE*

*quality, environment and occupational health and safety management and continuous management” (Interviewee 4)*

- Interviewee 5: Risk management is a top priority due to safety risks in the chemical supply chain industry. Regular safety training, monthly safety meetings, and annual investment in security risks are mandatory. Small companies often struggle with standardized risk management due to high costs.

*“But as far as I know, this is impossible for a large number of small companies in the market, because the cost of standardized risk management is too high, and small companies with insufficient business volume simply cannot afford it, so they cannot develop for a long time, so in the future, this industry will become more and more large-scale, intensive” (Interviewee 5)*

- Interviewee 6: Safety risk management is crucial for chemical logistics providers. Strict safety management is required by their Taiwan head office, and they must establish their own logistics company to meet safety management specifications and ensure long-term services.

*“Our group company for safety risk management requirements are very strict, at that time we were not willing to get involved in the chemical logistics industry, because our company's main business is chemical manufacturing, but we really could not find a third-party logistics company that meets our safety management specifications and can give us long-term services. Therefore, we have established our own logistics company, which is managed according to the group's unified safety management system and takes into account the characteristics of the logistics industry.” (Interviewee 6)*

- Interviewee 7: Risk management is a priority for Chemical Dangerous Goods Transport. Safety management is essential to mitigate risks, comply with regulations, and avoid severe penalties for accidents. Small and medium-sized logistics companies often lack the resources for comprehensive risk management.

*“For us, the safety of vehicles is a big concern for us. Risk management in the chemical logistics industry is a top priority. Therefore, at present, China's chemical logistics industry attaches great importance to risk management, because the state's penalties for serious accidents are becoming more and more severe, managers are to bear criminal responsibility, and competent authorities at all levels also regularly conduct safety inspections and risk management training. However, many small fleets in the market, the company itself is still struggling at the profit and loss passing line, where will there be additional investment to implement risk management, how to ensure advanced technology without capital investment, how to hire experienced safety management personnel?”*  
(Interviewee 7)

- Interviewee 8: Risk management in the Chinese chemical logistics industry has improved over time. Strict safety risk management is required by their Taiwan head office, and the acceptance and level of risk management in the market are increasing.

*“The overall acceptance and level of risk management in this market is increasing, and the level of risk management of large and medium-sized enterprises in this market is close to or approaching the level of Asian counterparts.”* (Interview 8)

- Interviewee 9: Risk management is crucial in the Chinese chemical logistics industry.

Medium and large companies prioritize compliance and standardized risk management. Large chemical manufacturers cannot choose small and non-standard logistics companies due to inadequate risk management. Safety risk management is the primary assessment factor when selecting suppliers. Auditing of safety risks, safety records, risk systems, and safety management implementation is conducted for new logistics providers.

*“Large chemical manufacturers like us, it is impossible to choose small and non-standard chemical logistics companies, the most important reason is that their risk management is not standardized, or the implementation is not in place. This is the*

*primary assessment factor for us to choose suppliers, suppliers who do not meet our safety risk management requirements” (Interviewee 9)*

- Interviewee 10, as the logistics supply chain procurement manager, highlights the comprehensive evaluation of logistics provider partners. They have witnessed the development and progress of hazardous chemical logistics providers and recognize the importance of risk management, particularly compliance management.

*“With the development of the chemical logistics industry in recent years, there have been many private third-party logistics, the use of advanced management concepts, perfect risk system, but also the introduction of some professionals, we are very pleased with this development, with the development of these third-party logistics companies, although the industry still has two levels of differentiation” (Interview 10)*

- Interviewee 11, from the traffic management department, believes that risk management is the top priority of their work. They perform regular supervision functions, conduct safety system inspections, and emphasize the main responsibility of safety work.

*“For the risk management of the transportation and logistics industry, we have always believed that this is the top priority of all work, with the strengthening of the country's punishment for safety accident risk in recent years, we as a government department, also have management responsibility” (Interviewee 11)*

## **Challenges**

- Interviewee 1: Difficulty in finding logistics companies with excellent safety management in the market, limited resources for independent operations, and the need to select third-party companies for transportation operations.
- Interviewee 2: Increase in transport accidents involving hazardous chemicals, weak safety awareness in the industry, and challenges in meeting safety management requirements.

- Interviewee 3: Difficulty for small fleets to establish proper safety risk management systems due to lack of resources, survival in the market based on personal experience, and challenges in meeting safety requirements for serving certain customers.
- Interviewee 4: High-risk nature of chemical logistics, challenges posed by high temperatures in Guangdong, strict safety requirements imposed by large chemical enterprises, and the need for continuous management and investment in safety risk management.
- Interviewee 5: Difficulty for small companies to afford standardized risk management due to high costs, hindering their long-term development. Foresees the industry becoming more large-scale and intensive.
- Interviewee 6: Initial challenge of finding a logistics provider meeting their safety management requirements. Small and non-standard logistics companies often lack standardized risk management.
- Interviewee 7: Challenges in ensuring capital investment for effective risk management. Small fleets struggle with additional investment, advanced technology, and hiring experienced safety management personnel.
- Interviewee 8: Difficulty in finding logistics providers that meet safety risk management requirements. Many small and non-standard companies cannot provide the necessary level of safety management.
- Interviewee 9: Limited compliance with risk management specifications in the industry
- Non-standard or inadequate risk management implementation among many groups in the industry. Difficulties in finding logistics providers that meet safety risk management requirements. Suppliers' risk management performance is a key consideration over low freight rate.
- Interviewee 10: mentions challenges related to competition and efficiency improvement. With the development of the chemical logistics industry, they note the differentiation between logistics providers and the need for large state-owned groups to improve efficiency and adopt innovative means to compete.
- Interviewee 11: discusses challenges related to supervision responsibility. They mention the strengthening of punishment for safety accident risks and the need to check if supervision responsibilities are in place.

| Subtheme             | Importance of Risk Management   |
|----------------------|---|
| Interviewee(s)       | Remarks   |
| 1,2,3,4,5,6,7,8,9    | High importance of risk management with the description of "top priority" " <b>crucial</b> "  |
| 1, 2,3,4,6,7,8,9     | Improvement and <b>increasing acceptance</b> of risk management   |
| 1,8,9,10             | Safety risk management is crucial for choosing chemical logistics providers   |
| 1,2,3,4,5,6,7,8,9,10 | <b>Compliance with regulations</b> is essential.  |
| 5,7,9                | Small and medium-sized logistics companies often lack the resources for comprehensive risk management   |
| 4,5                  | Safety Risk management is necessary to prevent accidents, protect the environment, and meet customer requirements   |
| Subtheme             | Challenges  |
| Interviewee(s)       | Remarks   |
| 1,2,4,6,8            | <b>High-risk nature</b> of chemical logistics   |
| 2, 3,4               | Strict safety requirements imposed by large chemical enterprises, and the need for continuous management and investment in safety risk management.              |
| 4,5,7                | Challenges in ensuring <b>capital investment</b> for effective risk management  |
| 3,5,7,8              | Not only for the capital investment, but also the challenges for lack of advanced <b>technology</b> , and hiring experienced safety management <b>personnel</b> |
| 2,3,6,7,8            | The competition from Small and limited-compliance logistics companies without adequate risk management  |

### Concluding Theme: Risk Management in Chinese Chemical Logistics Industry

The interviews with various professionals from the Chinese chemical logistics industry shed light on the importance of risk management in this sector. The Chinese chemical logistics industry faces unique challenges due to the nature of the products being transported, such as flammability, toxicity, and explosiveness. The consequences of accidents in this industry can be catastrophic, posing significant risks to both human lives and the environment.

Interviewees emphasized the criticality of safety in chemical logistics operations. They stressed the need for strict safety regulations, professional equipment, and well-trained personnel to mitigate risks effectively. Safety risk management was identified as a key focus for chemical logistics companies to ensure the safe transportation and storage of hazardous chemicals.

It was evident that risk management practices varied among different companies in the industry. Larger companies, particularly those serving major chemical enterprises, displayed a strong commitment to safety risk management. They invested in robust safety management systems, obtained necessary certifications, and implemented regular safety training programs. These companies recognized that meeting safety requirements was essential to win contracts and maintain long-term relationships with customers.

However, smaller logistics companies faced challenges in establishing comprehensive risk management systems. Limited resources, including capital and professional managers, hindered their ability to meet the safety standards set by major chemical enterprises. As a result, they relied heavily on personal experience and basic safety measures, potentially exposing themselves to higher risks.

The interviews highlighted the increasing demand for safe chemical logistics service providers, especially from foreign chemical giants. These companies placed a strong emphasis on safety when selecting logistics partners, requiring thorough safety assessments and adherence to safety management protocols. This trend is driving the need for chemical logistics companies to invest in safety risk management systems to remain competitive in the market.

In conclusion, risk management is of utmost importance in the Chinese chemical logistics industry. Ensuring the safe transportation and storage of hazardous chemicals is crucial for protecting lives, the environment, and maintaining the reputation and viability of logistics companies. While larger companies with sufficient resources prioritize safety risk management, smaller players face challenges in meeting stringent safety requirements. As the industry continues to evolve, the adoption of standardized risk management practices is likely to become increasingly vital for the long-term growth and sustainability of chemical logistics companies.

## 2) Data Analysis for Interview Question 2:

**Question 2: What is your attitude or suggestion for making good risk management in Chinese chemical logistics industry?**

### **Focused Coding: Subtheme/Remarks**

- **Professionalism**
- **Standardization**
- **Safety Prioritization**
- **Government Supervision**
- **Collaboration**
- **Technological Advancement**

I have categorized the coding for each interviewee based on the subthemes above:

- Interviewee 1:  
Professionalism  
Find a professional company to do professional things.  
Continuously learn new knowledge, including foreign hazardous chemical management experience and innovative technologies
- Interviewee 2:  
Compliance & Standardization  
Call for the development of standardized and compliant operations in the industry.  
Highlight the need for effective safety training, allocation of safety management personnel, and government and industry supervision.  
Safety Prioritization  
Emphasize safety risk management as the top priority in chemical logistics.  
Recognize the importance of market concentration and the need for improved safety management.
- Interviewee 3:  
Compliance & Standardization  
Advocate for the standardization of the industry's development and the elimination of non-compliant small enterprises  
Highlight the risks of disorderly competition and emphasize the importance of safety risk management systems.
- Interviewee 4:

## Government Supervision

Mention the increasing stringency of state and industry regulations, leading to the reduced survival space for small fleets.

Highlight the importance of government supervision for the development of the industry.

### ➤ Interviewee 5:

#### Safety Prioritization

Emphasize the significance of safety risk management and its impact on operating qualifications and business opportunities.

Highlight the need for compliance with regulations and industry norms to avoid unfair competition and ensure long-term development.

### ➤ Interviewee 6:

#### Safety Prioritization

Stress the importance of safety management as a top priority for chemical logistics companies.

Highlight the challenges of retaining personnel due to competitive salaries and the implications for safety management.

#### Collaboration

Advocate for guidance and support from the government and the market for security risk management

Highlight the need for industry recognition and acceptance of security risk management implementation.

### ➤ Interviewee 7:

#### Collaboration

Emphasize the importance of strict implementation of safety management by all chemical logistics companies.

Highlight the need for fair competition based on the implementation of security risk management.

### ➤ Interviewee 8:

#### Collaboration

Stress the responsibility of regulated chemical logistics companies to implement sound risk management.

Highlight the impact of logistics providers' risk management on the overall supply chain and emphasize the importance of qualification reviews and assessments.

➤ Interviewee 9:

Safety Prioritization

Emphasize the controllability of accident risks through proper risk prevention and daily management.

Highlight the need to assess logistics providers' operational behavior and reward those with good risk management.

Technological Advancement

Mention the use of technology such as drones for inspections and the incorporation of technology into risk management practices.

➤ Interviewee 10:

Professionalism: Emphasizes the need for professional risk management in hazardous chemical logistics companies.

Standardization: Calls for operating in compliance and meeting qualification requirements for hazardous chemical operations.

Safety Prioritization: Highlights the importance of allocating sufficient resources for risk management, including employee training, safety assessment, and safety inspection.

Collaboration: Expresses willingness to assist logistics providers in risk management through third-party training and sharing European security risk management experience.

➤ Interviewee 11:

Professionalism: Stresses the importance of all transportation and logistics enterprises, especially chemical logistics, doing a good job in risk management.

Standardization: Mentions that small logistics enterprises can learn from the risk management practices of large and medium-sized logistics enterprises.

Safety Prioritization: Emphasizes the need for enterprise leaders to prioritize risk management and improve risk management awareness.

Government Supervision: Highlights the role of external experts conducting risk management training and organizing visits and communication among logistics enterprises in the jurisdiction.

Collaboration: Encourages learning from good examples of risk management and improving together as an industry.

It's important to note that some interviewees touch this question in the question1, so I take it into consideration and list as below:

| Subtheme          | Attitude or Suggestion for risk management |
|-------------------|--|
| Interviewee(s)    | Remarks                                    |
| 1,6,10,11         | Professionalism                            |
| 1,2,3,4,5,8,10,11 | Compliance & Standardization               |
| 1,2,5,6,9,10,11   | Safety Prioritization                      |
| 4,11              | Government supervision                     |
| 6,7,8,9,10,11     | Collaboration                              |
| 9                 | Technological Advancement                  |

After analyzing the interviews for question2, it is evident that the interviewees share a common understanding of the importance of risk management in the Chinese chemical logistics industry. Their attitudes and suggestions can be summarized into the following key themes:

- **Emphasizing Professionalism and Standardization:** Several interviewees highlighted the need for professional and standardized practices in the industry. They suggested that chemical logistics companies should seek out professional expertise, implement regular supervision and assessment, and continuously update their knowledge. The development of the industry should move towards compliance, standardized operations, and the adoption of innovative technologies.
- **Recognizing Safety as the Top Priority:** All interviewees agreed that safety risk management is the foremost concern in chemical logistics. They emphasized the need for strict safety measures, allocation of safety management personnel, and effective safety training. The implementation of safety risk management systems and adherence to regulations were seen as crucial for the long-term development of the industry.
- **Government and Industry Supervision:** Interviewees acknowledged the role of government and industry supervision in ensuring proper risk management. They suggested that stricter regulations and supervision should be in place to

standardize the industry and prevent non-compliant practices. The importance of government support and guidance in promoting security risk management was highlighted.

- **Recognizing the Impact on Supply Chain:** Some interviewees, particularly those from logistics factories, emphasized the impact of risk management in their choice of logistics providers. They stressed the need to review qualifications, safety records, and implementation of risk management by logistics providers. Long-term contracts and periodic assessments were suggested to ensure continuous compliance with risk management standards.
- **Collaboration and Support:** Interviewees expressed willingness to support and collaborate with logistics providers in implementing risk management. They suggested rewards for companies with good risk management practices and expressed a desire for the industry's recognition and acceptance of security risk management implementation.
- **Continuous Monitoring and Technological Solutions:** Interviewees recognized the importance of ongoing monitoring and inspections to identify potential risks. Some mentioned the use of technology such as drones to conduct inspections and detect violations. They highlighted the need for proactive risk prevention through daily management practices and the incorporation of technological solutions.

In conclusion, the interviews underscored the significance of risk management in the Chinese chemical logistics industry. The suggested themes emphasize the need for professionalism, safety prioritization, compliance and standardization, government supervision, collaboration, and technological advancements. Implementing these recommendations can contribute to the development of a safer and more regulated industry that aligns with sustainability goals and meets the needs of economic and social progress.

## **7.2 CSR practice in the Chinese chemical logistics industry**

This section is trying to explore what is CSR real practice in the Chinese Chemical logistics industry from the active players in the industry. The thematic findings from the interviews about this section as below:

1) Data Analysis for Interview Question 3:

**Question 3: Based on your general knowledge, how would you describe CSR development in Chinese Chemical Logistics Industry?**

Based on the provided interviews, here is a summary of the CSR development in the Chinese Chemical Logistics Industry from each interviewee:

- Interviewee 1: The interviewee mentions that their transportation company places great importance on corporate social responsibility (CSR), particularly in terms of safety. They emphasize regular safety training, supervision, and investment in safety to prioritize sustainable development and fulfill social responsibility.
- Interviewee 2: The interviewee notes that CSR has gained attention in the chemical logistics industry, especially after major accidents and strengthened safety supervision. However, they also mention that smaller companies may not prioritize CSR as much as larger or state-owned enterprises.
- Interviewee 3: The interviewee highlights their exposure to CSR through their partnership with BASF, who advocates for CSR in their supply chain. BASF provides training and assessment on CSR, and they expect their logistics providers to fulfill CSR requirements. However, the interviewee acknowledges that most fleets in the industry, particularly smaller ones, may struggle with implementing CSR due to limited resources and long-term development vision.
- Interviewee 4: The interviewee explains that their company, as part of State-owned transportation Group, emphasizes CSR and releases annual CSR reports. They specifically mention their participation in road emergency assistance as a unique CSR initiative in the chemical logistics industry. They also believe that larger and more standardized operations are more likely to understand and implement CSR.
- Interviewee 5: The interviewee states that CSR is understood and implemented by listed companies, but many small and medium-sized fleets in the chemical logistics industry are not aware of CSR or unable to implement it. They mention that their company focuses on low carbon, sustainable development, and aims to lead industry standards and fulfill social responsibilities.
- Interviewee 6: The interviewee highlights their group company's emphasis on CSR, which includes fair treatment of employees and safety training. They

mention that while many logistics fleets provide high wages to drivers, they often reduce benefits such as social security, affecting retirement salaries. Their company adheres to CSR principles and ensures that drivers receive the benefits they deserve, creating a virtuous circle.

- Interviewee 7: The interviewee describes their CSR efforts, including fuel-saving training for drivers and the installation of safety systems in vehicles. They mention that only large and medium-sized companies that have the capital to invest can fully implement CSR. They also note that CSR is often brought in by foreign companies.
- Interviewee 8: The interviewee notes that regulated medium and large chemical logistics providers understand and fulfill CSR. They mention safety risk management as part of CSR responsibility and highlight their group's efforts in CSR, including charity projects and sustainable procurement. They believe that Chinese logistics providers still have a gap in fulfilling CSR compared to their group.
- Interviewee 9: The interviewee states that their company focuses on CSR and cooperates with logistics providers to fulfill CSR requirements. They highlight their driver service center and technological systems for safety and risk management. They believe that CSR is beneficial for their company's security risk management and sustainable development.
- Interviewee 10: CSR development in the Chinese Chemical Logistics Industry involves incorporating sustainable development and driving corporate social responsibility in the supply chain. The concept of "golden bee" emphasizes a win-win situation between man and nature, where enterprises contribute to society and guide sustainable development while making profits. The "1+3" CSR program aims to educate and promote CSR among suppliers, customers, and logistics service providers. Logistics providers in the industry have a weak understanding of CSR, leading to initiatives such as professional training, on-site audits, and communication with employees to promote CSR implementation. These CSR efforts also contribute to risk management in the industry.
- Interviewee 11: The CSR development in the Chinese Chemical Logistics Industry shows that while small enterprises are still in the early stages of understanding CSR, medium and large enterprises are increasingly prioritizing CSR

management. Some companies are actively implementing CSR practices in environmental and social aspects, especially under the guidance of their customers. However, there is a growing polarization between enterprises in terms of their CSR engagement.

Overall, the interviews indicate that CSR development in the Chinese Chemical Logistics Industry varies among companies. Two extremes in the industry: active fulfillment of social responsibility and chaotic competition. Larger and more standardized operations tend to understand and implement CSR more comprehensively, often influenced by foreign companies. Due to the limited sources of capital and professionals, smaller fleets and companies with limited resources may face challenges in fulfilling CSR requirements. However, there is a general trend of increasing attention to safety, sustainability, and social responsibility in the industry. Meanwhile, Chemical manufacturers have better CSR implementation and would like to support their logistics suppliers for this work because it may lead to the sustainability of the whole supply chain. Also, it is good to see that the understanding for CSR is not limited on traditional charity and welfare activities. The technological advancement for CSR implementation was introduced as well for improving the employee loyalty.

| Subtheme           | <b>CSR development in Chinese chemical logistics industry</b>                                 |
|--------------------|---|
| Interviewee(s)     | Remarks   |
| 1,2,4,5,6,7,8,9,10 | Implementation of risk management as part of CSR  |
| 3,6,8              | Gap in CSR fulfillment for Chinese logistics providers compared to international counterparts |
| 1,2,3,5,7          | Capital investment required for effective CSR implementation                                  |
| 2,3,4,6,8,11       | Different levels of CSR understanding, and action based on company size                       |
| 1,5,9,10           | CSR Leading the industry towards a sustainable future   |
| 9                  | Technological Advancement   |

After analyzing the interviews with various individuals from the Chinese chemical logistics industry, several key themes emerge regarding the development of corporate social responsibility (CSR) in the industry. While there is a growing recognition of CSR

among large and medium-sized logistics providers, the implementation and understanding of CSR vary across different companies. The size and scale of the company, as well as its exposure to international markets and foreign customers, appear to influence the extent to which CSR is prioritized and fulfilled.

- **Increasing Awareness and Importance of CSR:** The interviews indicate that there has been a notable increase in awareness and importance attached to CSR within the Chinese chemical logistics industry. Larger companies, often with state-owned enterprise backgrounds or connections to foreign customers, tend to place greater emphasis on CSR due to the associated benefits such as sustainable long-term development, compliance, and improved market reputation.
- **Risk management as an Integral Part of CSR:** Safety management and risk control play a significant role in fulfilling CSR within the chemical logistics industry. Given the hazardous nature of chemical transportation, companies are increasingly prioritizing safety training, supervision, and investment. They recognize that ensuring safety not only fulfills their social responsibility but also contributes to their own long-term development and risk management.
- **Varied Adoption of CSR Practices:** While some logistics providers actively embrace CSR and incorporate it into their operational philosophy, others, particularly smaller and self-employed companies, may not fully understand or prioritize CSR due to limited resources, investment capacity, and long-term vision. This disparity in CSR adoption leads to a wide range of practices, with larger companies generally exhibiting a more comprehensive understanding and implementation of CSR initiatives.
- **Influence of Foreign Customers:** The presence of foreign customers, particularly multinational corporations, has played a significant role in introducing and driving CSR practices within the Chinese chemical logistics industry. Many companies have adopted CSR principles because of their partnerships with foreign clients who impose CSR requirements on their suppliers. The influence of foreign customers has contributed to the development and implementation of CSR initiatives in the industry.
- **Employee Welfare and Engagement:** Several interviewees highlight the importance of employee welfare, including fair compensation, benefits, and safety measures, as part of CSR. Companies that prioritize CSR recognize that treating

employees well fosters loyalty, improves safety performance, and contributes to a positive corporate culture. Employee-focused CSR initiatives, such as safety training, additional benefits, and skill development, are seen as crucial for attracting and retaining qualified drivers in the industry.

- **Technological Advancements and Sustainability:** Some companies are integrating technological advancements and sustainability practices into their CSR strategies. This includes implementing innovative risk management systems, reducing carbon emissions, and actively participating in clean energy supply chains. These initiatives reflect a commitment to aligning business operations with national and global sustainability goals, while also enhancing safety, efficiency, and environmental performance.

In conclusion, CSR development in the Chinese chemical logistics industry is gaining traction, driven by the recognition of its benefits and the influence of foreign customers. While larger and more regulated companies tend to have a better understanding and implementation of CSR initiatives, smaller and self-employed logistics providers face challenges in adopting CSR practices due to resource constraints. Nonetheless, safety management, employee welfare, and sustainability are increasingly becoming integral parts of CSR efforts within the industry. As the industry continues to evolve, it is expected that CSR will become more prevalent and standardized across the Chinese chemical logistics sector.

### **7.3 CSR influence for the company development**

Data Analysis for Interview Question 4:

**Question 4: In current practice, per to your view, Does CSR contribute to company performance? Should Chinese Chemical logistics companies promote CSR practice as part of their risk management?**

Based on the interviews, the subtheme that emerges is the relationship between CSR (Corporate Social Responsibility) and company performance in the context of Chinese Chemical logistics companies. The focused coding for each interviewee's response is as follows:

➤ Interviewee 1:

Attaching importance to CSR is an indicator of a company's long-term development potential.

CSR contributes to customer service, employee training, and safety management.

Logically speaking, CSR should be promoted as part of risk management.

➤ Interviewee 2:

Fulfilling CSR is beneficial for the development of the company.

Compliance and responsible operation differentiate the company from informal small companies.

Importance should be given to CSR and risk management for long-term development.

➤ Interviewee 3:

CSR is conducive to the long-term development of the company.

Risk management and fulfilling CSR are necessary for the development of chemical logistics companies.

➤ Interviewee 4:

CSR is essential for chemical logistics companies to gain acceptance from customers and authorities.

Safety inspections and risk management are mandatory for regulatory compliance.

➤ Interviewee 5:

CSR contributes to company performance based on financial data and analysis.

CSR should be part of enterprise risk management for Chinese Chemical logistics companies.

➤ Interviewee 6:

Fulfilling CSR leads to long-term healthy development.

Positive impact on driver satisfaction, customer satisfaction, market growth, and employee income.

➤ Interviewee 7:

CSR supports the long-term development of the company.

Stability in drivers and reduced safety risks lead to progress and success.

Fulfilling CSR and effective safety risk management are essential, not just lip service.

➤ Interviewee 8:

CSR implementation is beneficial for the company's development.

Risk management and CSR are necessary for large-scale chemical logistics companies to obtain orders from major customers.

➤ Interviewee 9:

CSR implementation is beneficial for the company's development.

CSR helps attract drivers and ensures safety records.

Risk management and CSR are crucial for chemical logistics companies' continued development.

➤ Interviewee 10:

CSR contributes to long-term sustainable development.

The "1+3" CSR program improves CSR practices in the supply chain.

CSR helps reduce supply chain risks and establishes strategic relationships.

➤ Interviewee 11:

CSR implementation contributes to the economic efficiency of logistics enterprises.

Sustainable development provides favorable conditions for expanding production.

CSR helps gain recognition and new customers, leading to increased income and profits.

Based on the focused coding, the key themes that emerge are:

| Subtheme       | <b>The relationship between CSR and company performance</b>     |
|----------------|---|
| Interviewee(s) | Remarks   |
| 1,2,3,4,8,11   | CSR as a factor in attracting customers and gaining recognition |

|                      |   |
|----------------------|---|
| 1,2,3,4,7,9          | The positive impact of CSR on driver satisfaction, employee income, and market growth |
| 1,2,3,4,5,6,7,8      | Should incorporate CSR practices into risk management strategies.                     |
| 1,2,3,4,5,6,7,8,9,10 | Importance of CSR for long-term development and company performance                   |

These themes suggest that promoting CSR practices and integrating them into risk management strategies can benefit Chinese Chemical logistics companies in terms of performance, sustainability, and reputation.

- Importance of CSR for company performance: Many interviewees emphasized that corporate social responsibility (CSR) is essential for the long-term development and performance of companies. They mentioned that fulfilling CSR helps in building a positive reputation, gaining customer trust, attracting new customers, and establishing long-term partnerships.
- Link between CSR and risk management: The interviewees highlighted the connection between CSR and risk management. They believed that promoting CSR practices, such as employee training, safety management, and compliance with regulations, is crucial for mitigating risks and ensuring the sustainable growth of chemical logistics companies. They mentioned that regulatory authorities conduct regular inspections and evaluations, making CSR implementation necessary for gaining approval and avoiding penalties.
- Benefits of CSR for stakeholders: The interviewees pointed out various benefits of CSR for different stakeholders. They mentioned that fulfilling CSR contributes to customer satisfaction, employee morale, and overall market expansion. CSR practices were seen as improving driver recruitment and retention, reducing safety risks, enhancing efficiency, and increasing income and profits.
- CSR as part of a virtuous circle: Interviewees described a virtuous circle created by CSR practices. They explained that fulfilling CSR leads to customer satisfaction, which in turn results in market growth, increased efficiency, and stable employee income. This positive cycle highlights the interconnectedness of CSR, customer relations, and company performance.
- CSR as a requirement: Some interviewees mentioned that CSR is not optional but a necessity for Chinese chemical logistics companies. They highlighted that large

customers and regulatory authorities expect companies to fulfill CSR obligations, such as safety management and environmental protection. Non-compliance with CSR standards could lead to the loss of major customer orders and reputational damage.

Overall, the analysis suggests that CSR is considered crucial for company performance and risk management in the context of Chinese chemical logistics companies. Fulfilling CSR obligations helps build trust, attract customers, mitigate risks, and contribute to long-term sustainable development. In last Chapter, Empirical analysis was done based on the secondary data for public-listed Chinese chemical logistics companies. The findings from the thematical analysis of the interviews here also verified one of the research hypotheses: In the Chinese context, CSR performance of chemical logistics companies has positive relationship with firm performance.

## 7.4 Understanding for Green Finance practice in the industry

This was to investigate financial sources for green projects in the Chinese chemical industry.

### Question 5: Would you mind introduce how have been the Chinese Chemical logistics companies financed?

This question is relatively simple, and the response is quite straightforward. Based on these responses, the following can be identified:

| Subtheme       | The major finance methods by Chinese chemical logistics companies                  |
|----------------|--|
| Interviewee(s) | Remarks  |
| ALL            | Bank Loans   |
| 2,3            | Private (including shareholder or Employee) lending                                |
| 5              | Share market   |
| 4,6            | Finance from mother company  |
| 2,3,5,7        | Project (New Tech. or Sustainable related) subsidy finance support from government |
| 4              | Financial leasing (equipment)  |

The above sheet just records the responses from the interviewees of logistics companies, it reflects the way how their company get financed. The responses from the chemical manufacturing and government staff covers all the above-mentioned methods. It means that they are familiar with the various logistics players in the market. These represent the different methods used by Chinese chemical logistics companies for financing their operations. Based on the responses provided by the interviewees, I can conclude the following regarding the financing method of Chinese chemical logistics companies:

- **Traditional Financing Methods: Shareholder contribution/Bank loans/Private Lending**

Many logistics companies rely on contributions from shareholders to finance their operations. Almost all the Companies often secure loans from banks by providing collateral such as equipment or fixed assets. Some companies seek financing through private lenders or individuals. Also, the subsidiary logistics companies normally seek finance support from their group mother company.

- **Listed Companies:**

Few chemical logistics companies are listed on stock markets. Listed companies have more diverse financing methods and channels available to them, including stock issuance, bonds, and potential listing on international stock exchanges.

- **Financial Leasing:**

Some logistics companies explore financial leasing options to raise funds for their operations. However, the popularity and penetration rate of financial leasing in the chemical logistics industry are not high due to specific equipment qualification requirements.

- **Government Project Subsidies/Green Finance project:**

Logistics companies, especially those involved in green finance or energy conservation and emission reduction projects, can apply for government project subsidies. These subsidies aim to promote compliance, safety risk management, and green development and new technologies application. While there is limited participation in green finance projects within the chemical logistics industry, some companies have been involved in energy conservation and emission reduction

projects. These projects often require approval, detailed project reports, and on-site audits by relevant government departments. Successful projects may receive special project incentive funds.

It is important to note that these conclusions are based on the responses of the interviewed individuals and may not represent the entire Chinese chemical logistics industry. Additionally, the views and experiences shared by the interviewees may vary, highlighting the diverse financing landscape within the industry.

**Question 6: Have you ever worked/involved in the Green Finance project? If yes, please kindly share some your views, if not yet, would you mind share some examples/information you know from the industry.**

| Subtheme          | <b>Green Finance development in the Chinese Chemical logistics Industry</b> |
|-------------------|---|
| Interviewee(s)    | Remarks   |
| 1,2,3,4,6,7       | Limited awareness and participation   |
| 2,3,7             | Government incentives   |
| 2,3,4,5,7         | Compliance requirements   |
| 2,3,4,5,6,7,10,11 | Increasing focusing on green and low carbon development                     |
| 5,10,11           | Emphasis on sustainability  |
| 10                | Promote Green Project similar as what do for CSR (similar trends)           |

From the analysis from the interviews, Companies in the industry are increasingly focusing on green and low-carbon development, participating in green finance projects, and fulfilling corporate social responsibility. Green finance initiatives involve activities such as establishing intelligent supply chain platforms, adopting LNG trucks to reduce emissions, and utilizing renewable energy sources like solar panels.

Green Finance development in the Chinese chemical logistic industry:

- **Limited involvement:** Most interviewees had limited involvement in green finance projects. They either had no experience or were not directly responsible for such

projects.

- Government incentives: Logistics companies have participated in government initiatives for green and low-carbon projects. These initiatives include subsidies and incentives for energy conservation, emission reduction, and the adoption of green technologies.
- Green bond issuance experience from upstream industry: The companies in the Chemical manufacturing industry have experience of issued green bonds. Chemical logistics industry is looking forward for it.

Based on the interviewees' feedback, it is easy to identify the Challenges and Opportunities for Green Finance development in the Chinese chemical logistics industry:

- Limited awareness and participation: Many interviewees mentioned that green finance projects are not widespread in the chemical logistics industry, and smaller companies have limited access to such initiatives.
- Compliance requirements: Qualifications and compliance management, such as safety records and meeting ISO standards, are often prerequisites for accessing green finance projects.
- Need for more support: Several interviewees expressed the hope that the government, financial institutions, and commercial companies would provide more support and design additional green finance projects for the industry.
- Emphasis on sustainability: Companies recognize the importance of green and low-carbon development, corporate social responsibility, and environmental sustainability. They are investing in technologies and initiatives to reduce carbon emissions and improve efficiency.

Overall, the financing methods of Chinese chemical logistics companies primarily involve shareholder contributions, bank loans, and, to a lesser extent, listed financing, and government subsidies. Green finance projects have been limited, but companies are increasingly focusing on sustainability and participating in government initiatives for energy conservation, emission reduction, and green technology adoption. There is a call for more support and opportunities for green finance in the industry.

## **7.5 Attitude for Green Finance for the company development**

**Question 7: In your opinion should Chinese chemical logistics companies to promote Green Finance? And tell me more about your thinking for it.**

**Focused Coding: Subtheme/Remarks**

- Need for Green Finance
- Benefits of Green Finance
- Challenges
- Support
- Collaboration and Awareness

The responses were categorized from the coding as representing below:

| Subtheme       | <b>Attitude for Green Finance for the company development</b> |
|----------------|---|
| Interviewee(s) | Remarks   |
| ALL            | Recognition of the need for Green Finance                     |
| 2,5,8,10       | Benefits of Green Finance                                     |
| 3,4,6          | Challenges and Limited Access to Financing                    |
| 8,9,11         | Call for Government and Financial Institutions' Support       |
| 8,9,10         | Collaboration and Awareness                                   |

- First, All the interviewees here indicated the need for Green Finance for Chinese chemical logistics industry. Chinese chemical logistics companies, including both private and public third-party enterprises, require green finance to support their operations. These companies need financing support through multi-channel approaches to ensure their sustainable development. Green finance is essential not only for achieving the dual carbon goal but also for promoting the overall growth and advancement of the chemical logistics industry. Private logistics companies, in particular, face the challenge of limited financing options and higher costs compared to larger companies. Green finance can provide additional financing channels specifically tailored to the needs of private enterprises, reducing their reliance on traditional financing means, and facilitating their long-term development. Overall, green finance is crucial for the growth, sustainability,

and achievement of environmental objectives in the Chinese chemical logistics industry.

- **Benefits of the Green Finance:** Green finance plays a pivotal role in improving the operational efficiency of Chinese chemical logistics companies. It enables these companies to effectively face competition and achieve sustainable development in a highly competitive market. By providing financial support and resources, green finance helps reduce financing costs for logistics enterprises, particularly private companies that often struggle with limited financing options. This reduction in costs not only facilitates their day-to-day operations but also promotes their long-term growth and stability. Moreover, green finance aligns with the implementation of dual carbon goals, as it supports the adoption of environmentally friendly practices and technologies in the logistics industry. It enables companies to reduce their reliance on labor-intensive and costly traditional financing methods, thereby streamlining their operations and promoting a more sustainable approach to logistics. Ultimately, green finance is a key enabler for Chinese chemical logistics companies in their journey towards achieving the dual carbon goals and driving positive environmental change.
- **Challenges and Limited Access to Financing:** Private logistics companies in China face significant challenges due to limited financing channels and higher financing costs compared to large companies. They often rely on bank loans or private fundraising to secure the necessary funds. Unfortunately, the chemical logistics industry lacks sufficient training and publicity regarding green finance, which further exacerbates the situation. There is a lack of policy publicity and guidance for green finance projects, hindering their development in the industry. As a result, the availability of green finance projects in the chemical logistics sector remains limited. Additionally, there is a notable absence of resource tilt towards green finance initiatives in the industry, which hampers the progress and adoption of sustainable financial practices. These limitations underscore the need for greater support, awareness, and tailored policies to facilitate the integration of green finance in the chemical logistics industry and unlock its potential for sustainable development.

- **Call for Government and Financial Institutions' Support:** The current level of government support and incentives for green finance is limited, posing a challenge to its widespread adoption. To address this, governments and financial institutions need to take proactive steps. They should design and provide a broader range of green financial products that cater to the specific needs of various industries, including the logistics sector. Additionally, governments should offer more support and publicity for green finance projects to create awareness and encourage participation. Financial institutions, on their part, should play an active role by developing innovative green financial products that align with sustainability goals. Their participation and support are crucial to driving the growth and effectiveness of green finance initiatives. Therefore, a collaborative effort between governments and financial institutions is necessary to promote the development of green finance and foster its integration across industries.
- **Collaboration and Awareness:** Collaboration between chemical logistics companies and their customers is essential in the pursuit of sustainable development and the achievement of the dual carbon goal. To promote a greener and more environmentally friendly industry, chemical logistics companies should actively engage in green finance initiatives. By promoting and adopting innovative finance solutions, these companies can support their own sustainable growth while also contributing to the broader environmental objectives. It is crucial for chemical logistics companies to work together, sharing knowledge and best practices, to effectively implement green finance strategies that align with their unique requirements. Through this collective effort, the industry can drive positive change, reduce environmental impact, and create a more sustainable future. One of the interviewees (Interviewee 10) indicated that as the chemical manufacturer, they are happy to promote green finance to the chemical logistics industry and it will develop like CSR. "Although green finance seems to be a new thing for China's chemical logistics industry, it is the same as the original CSR, from understanding to acceptance to development, there is a development process."

From the interviews for this question, the following concluding theme emerges. The need for Chinese chemical logistics companies to promote green finance is widely acknowledged among the interviewees. Green finance is seen as crucial in achieving the dual carbon goal and ensuring sustainable development in the industry. Private logistics companies, especially third-party chemical logistics companies, face challenges due to limited financing channels and higher costs compared to larger companies. The lack of training, publicity, and policy guidance in the chemical logistics industry for green finance is identified as a barrier that needs to be addressed. Interviewees emphasize the importance of government support, incentives, and the design of more green financial products by financial institutions. Collaboration between chemical logistics companies and customers, as well as the industry as a whole, is viewed as essential for driving the adoption of green finance and innovative finance solutions. The development of green finance projects in the chemical logistics industry is recognized as relatively limited, and there is a call for increased support, publicity, and resources from governments and financial institutions. Overall, there is a consensus among the interviewees that promoting green finance in Chinese chemical logistics companies is necessary for achieving sustainable development, enhancing competitiveness, and contributing to the dual carbon goal.

## **7.6 Discussion and Summary**

This section will analyse the qualitative findings from the interviews with respect to the two key hypotheses of this study. By focusing on the themes that emerged from the qualitative data, I can evaluate the validity of the hypotheses regarding CSR and Green Finance in the Chinese chemical logistics industry.

### **7.6.1 Hypothesis 1: CSR as a Form of Risk Management and Its Relationship with Firm Performance**

The first hypothesis posited:

H0: Risk management in the form of CSR has no relationship with firm performance.

H1: Risk management in the form of CSR has a relationship with firm performance.

The qualitative findings provide substantial support for H1, affirming that risk management through CSR plays a pivotal role in enhancing firm performance in the Chinese chemical logistics sector. Interviewees consistently linked CSR practices to improved safety standards, regulatory compliance, and long-term business success.

### **Risk Management as Core to CSR**

Many interviewees, particularly from large companies, emphasized the role of CSR in managing risks associated with the transportation and storage of hazardous chemicals. Interviewee 1 and Interviewee 4 both described how their organizations view CSR not merely as a tool for public relations but as an integral part of their risk management strategy. For instance, these companies invest in rigorous safety training, continuous supervision, and risk assessment to protect their workforce and prevent accidents. This aligns directly with the hypothesis that CSR as a form of risk management is crucial for company performance. By avoiding costly accidents and maintaining safety compliance, these firms enhance their operational efficiency, protect their reputations, and sustain profitability.

### **CSR's Positive Impact on Firm Performance**

Multiple respondents, including Interviewee 7, linked effective CSR practices with improved firm performance, confirming the relationship proposed in H1. Interviewee 7 noted that investments in safety systems and fuel-saving initiatives as part of their CSR policy not only reduced operational costs but also increased employee satisfaction, particularly among drivers. This direct impact on cost efficiency and workforce morale suggests that CSR practices can translate into measurable financial benefits, as companies that prioritize social responsibility also tend to perform better in the long term.

Moreover, CSR initiatives that address customer concerns regarding environmental sustainability and safety help companies retain major contracts and build stronger relationships with both local and international partners. Interviewee 9 mentioned how

CSR compliance with international standards helped their company secure partnerships with multinational corporations, leading to greater business opportunities and enhanced profitability. This clearly supports the idea that CSR is positively correlated with firm performance.

### **Disparities in CSR Adoption**

However, the findings also highlighted a disparity in CSR implementation between larger and smaller companies, which adds nuance to the hypothesis. Larger, well-established firms appear more capable of fully integrating CSR into their business strategies, while smaller firms often struggle due to limited resources. Interviewee 5 acknowledged that while CSR leads to improved firm performance, many small and medium-sized logistics providers are reluctant to invest in CSR practices because of the short-term costs involved, even though they recognize the long-term benefits. This suggests that while CSR positively influences performance, the extent of its impact may vary depending on company size and resource availability.

#### **7.6.2 Hypothesis 2: Green Finance and Its Impact on Business Development and Sustainability**

The second hypothesis stated:

H0: Green Finance has no impact on chemical logistics business development and sustainability.

H1: Green Finance has an impact on chemical logistics business development and sustainability.

The qualitative data provided mixed support for H1. While many interviewees agreed that Green Finance could play a significant role in the development and sustainability of chemical logistics businesses, the concept is still in its early stages in the Chinese market.

### **Limited Awareness and Participation in Green Finance**

Several interviewees, including Interviewees 6 and 7, mentioned that Green Finance

initiatives are not yet widely adopted across the industry, particularly among smaller logistics providers. These interviewees noted that many companies have not yet taken full advantage of Green Finance opportunities due to limited awareness and the perceived complexity of the application process. Smaller firms often lack the financial expertise or the capacity to engage in large-scale sustainable projects that would qualify for Green Finance support. This suggests that while H1 may hold true for companies with the resources to engage in Green Finance, many smaller players in the industry are still excluded from its potential benefits, limiting its overall impact on business development at this stage.

### **Green Finance's Role in Driving Sustainability**

However, among the larger companies that have begun to explore Green Finance, there is evidence that it positively contributes to business sustainability. Interviewee 9 described how their company was investing in energy-efficient vehicles and low-carbon technologies, partly funded through government subsidies and Green Finance programs. This supports H1 by demonstrating that Green Finance can encourage businesses to adopt sustainable practices that contribute to long-term operational efficiency and environmental compliance. These initiatives help firms meet the dual carbon goal and align with global sustainability standards, which in turn can improve their market positioning and competitiveness.

### **Government Support and Green Finance Accessibility**

Interviewees also emphasized the importance of government incentives in making Green Finance more accessible to businesses across the industry. Interviewee 11 suggested that with more targeted support from both the government and financial institutions, more chemical logistics companies could engage in Green Finance projects. This aligns with the growing consensus that Green Finance has the potential to boost business sustainability but requires better policy guidance and broader access to financing options to benefit the entire industry.

The qualitative findings suggest that while Green Finance is not yet widely impactful across all companies, its potential for supporting sustainability and business growth is

significant, particularly for firms that can access these financial resources. This indicates partial support for H1, with the caveat that the industry needs more awareness and facilitation to fully leverage Green Finance.

### **7.6.3 Conclusion on Hypotheses**

The qualitative findings largely support the alternative hypotheses for both CSR and Green Finance, though the extent of this support varies depending on company size, resources, and the level of engagement with CSR and Green Finance initiatives.

For Hypothesis 1, the qualitative data strongly supports the relationship between CSR (specifically through risk management) and improved firm performance. CSR practices that focus on safety, environmental responsibility, and employee welfare clearly contribute to both operational efficiency and profitability, confirming H1. However, the disparity in CSR adoption across company sizes suggests that smaller firms may not realize the full benefits of CSR unless they are given more support to implement such strategies effectively.

For Hypothesis 2, the qualitative findings provide partial support for H1, indicating that Green Finance can positively impact business sustainability and development, especially among larger firms that have already begun adopting sustainable practices. However, the limited participation in Green Finance among smaller firms points to barriers that need to be addressed, such as better access to funding and more government-led incentives.

By aligning these findings with the two hypotheses, this study contributes to a more comprehensive understanding of how CSR and Green Finance influence business performance and sustainability in the Chinese chemical logistics industry.

### **Summary**

Through the intensive interviews with the experienced industry players, this chapter has analyzed and explored the CSR & Green Finance development in the Chinese chemical logistics industry. It is worked under the research aim to seek CSR management and green finance for business development to support business sustainability under the global call for carbon peak and carbon neutrality. The qualitative analysis using the interview survey involving eleven interviewees, who are

mainly from the Chemical logistics company, and the ones from their customers and local governments.

Based on the interviews with the various individuals, it can be observed that risk management and corporate social responsibility (CSR) are considered crucial aspects for the sustainable development of the industry. The interviewees highlight the importance of standardized operations, compliance with regulations, and the need for a strong risk management system to ensure safety and minimize accidents. In terms of risk management, the interviewees emphasize the significance of finding professional companies to handle hazardous chemical logistics, continuous learning, and adopting innovative technologies. They also stress the importance of safety training, supervision, and investment in safety measures. It is acknowledged that companies that neglect risk management and do not prioritize CSR are likely to face challenges in terms of long-term development potential.

Regarding CSR development, the interviewees express varying levels of awareness and implementation. Larger companies, especially those with a state-owned enterprise background, show a greater emphasis on CSR and have integrated it into their business philosophy. They recognize the positive impact of fulfilling social responsibilities on company performance, employee morale, and customer satisfaction. However, it is noted that many small and medium-sized companies, due to limited resources and short-term visions, may not prioritize CSR as significantly. Nevertheless, there is a general trend in the industry towards intensification and increased focus on safety management and social responsibility, driven by stricter national supervision and the acceptance of CSR by customers and the market. The development of a strong risk management system and the promotion of CSR practices are seen as essential for the long-term success and growth of Chinese chemical logistics companies.

During the interview, there are the opinion that the development of green finance will follow the trends of CSR development. The interviewees expressed positive views on the promotion of green finance in the Chinese chemical logistics industry. They recognized the need for financing support, especially for private companies, to meet the high requirements of safety risk management and professionals, and compliance management related to CSR. Green finance was seen as a valuable additional

financing channel that could help support the long-term development and sustainability of private chemical logistics companies.

The interviews highlight the importance of risk management and CSR in the Chinese chemical logistics industry. Establishing standardized operations, investing in safety measures, and fulfilling social responsibilities are crucial for the sustainable development of companies in this sector. With the industry evolving towards stricter regulations and greater emphasis on safety, companies that proactively manage risks and integrate CSR into their operations are more likely to thrive in the long run. Regarding the associated financing challenges faced by Chinese chemical logistics companies, with a particular focus on private companies, the concept of green finance was relatively new to the interviewees, and while they had limited direct involvement, they recognized the potential benefits and supported its promotion in the industry. Access to green finance would provide additional resources and support for companies to invest in green technologies, improve energy efficiency, and contribute to environmental sustainability.

## **Chapter 8 Conclusion**

### **8.0 Introduction**

This chapter intends to concisely summarize the results of this study and provides recommendations for future study. First, based on the proposed research plan, the recapitulation of the study is reviewed including the research questions and research strategies. The contributions, limitations and suggestions for further study are also addressed.

### **8.1 Recapitulation of the Study**

The exploration undertaken in this research commenced with an in-depth examination of Corporate Social Responsibility (CSR) and Green Finance (GF), originating from Western ideologies. CSR, often deemed a disruptive doctrine, challenges conventional economic thinking. Green Finance, emerging as a multifaceted interaction between finance and the environment, gained prominence in recent years, fueled by the global imperative for carbon peak and neutrality. This study addresses a critical gap in the literature by focusing on the application of CSR and GF within the Chinese Chemical Logistics Industry. Despite being a niche within the logistics domain, the chemical logistics sector demands rigorous risk management due to its potential societal and public health impacts. Leveraging extensive working experience and knowledge in this industry, the research endeavors to implement CSR strategies and green financial models tailored for sustainable business practices. The alignment of these strategies with global carbon mitigation and neutrality goals aims to fortify business sustainability within the chemical logistics domain. The objectives outlined in Chapter 1 were systematically pursued to achieve a comprehensive understanding of CSR and GF in the Chinese Chemical Logistics Industry: Exploration of Chinese chemical logistics industry development: A detailed review of industry particularities emphasized the crucial need for effective risk management.

Advanced knowledge of CSR in risk management: The literature review in Chapter 3 delved into theoretical foundations, advocating for the adoption of CSR as a risk management tool within the Chinese Chemical Logistics Industry.

Critical review of green finance development: The chapter 4 provided a comprehensive examination of GF development at national and international levels, laying the groundwork for understanding its potential impact on sustainability. Seeking solutions for implementation and practice: Empirical analyses in Chapters 6 and 7 explored practical aspects of CSR and GF implementation, providing insights into challenges and opportunities.

The first research question explored theories for Corporate Social Responsibility. The literature review uncovered a rich tapestry of theories, ranging from stakeholder theory to legitimacy theory, offering a robust foundation for understanding CSR. Additionally, the exploration of Green Finance theories provided diverse approaches to integrating environmental considerations into financial practices. The second and third research questions focused on the development of CSR and GF in China and the international market. A comprehensive review revealed the evolution of CSR and GF in the Chinese context, particularly gaining momentum with the "Dual Carbon" goals. Internationally, the discourse on CSR and GF highlighted a global shift towards sustainable business practices. The fourth research question delved into challenges confronting the chemical logistics industry in China related to CSR and GF. Findings from both quantitative and qualitative analyses identified significant gaps in systematic approaches to risk management within the sector.

The fifth research question sought to ascertain the potential contribution of CSR and GF to the sustainable development of Chinese chemical logistics companies. Through a combination of quantitative and qualitative analyses, the study revealed acknowledgment and sporadic practice of CSR and GF within the industry. Hypotheses testing provided valuable insights into the relationship between CSR and financial performance, as well as the impact of Green Finance on business development and sustainability. The findings underscored the potential significance of CSR in enhancing profitability and the positive impact of Green Finance on business development and sustainability. In integrating quantitative and qualitative insights, the empirical analyses harmonized findings from both dimensions, providing a comprehensive understanding of Corporate Social Responsibility (CSR) and Green Finance (GF) within the Chinese Chemical Logistics Industry. The quantitative analysis, leveraging secondary data from publicly listed companies, yielded statistical

evidence indicating a potential correlation between CSR practices and financial performance. Simultaneously, qualitative analysis, derived from interviews with industry professionals, enriched the study with nuanced insights into the tangible challenges and opportunities surrounding CSR and GF in the chemical logistics sector. Thematic analysis of qualitative data identified key themes, including those related to risk management, government support, and societal recognition, further enhancing the holistic perspective on sustainable business practices in this industry.

## **8.2 Findings of this study**

The study found that while there is acknowledgment and sporadic implementation of CSR and GF practices within the Chinese chemical logistics industry, a systematic and comprehensive approach is lacking. Specific industry risks demand collaborative efforts from the government, society, and enterprises to foster long-term sustainability.

### **Summary from the Discussion and Explanation of Hypotheses**

In the research titled an empirical study of the CSR and the development of Green Finance in the Chinese Chemical Logistics Industry, two key hypotheses are presented for investigation. These hypotheses focus on the roles of Corporate Social Responsibility (CSR) as a form of risk management and the development of Green Finance in relation to business sustainability and profitability. This section provided a detailed discussion and explanation findings from the research through these hypotheses, integrating insights from both the quantitative and qualitative approaches used in the study.

**Hypothesis 1:** Risk Management in the Form of CSR Increases Profitability of Corporations

#### **Statement of Hypothesis**

H0: Risk management in the form of CSR has no relationship with firm performance.

H1: Risk management in the form of CSR has a relationship with firm performance.

This hypothesis is grounded in the belief that CSR, as a form of risk management, is not only a regulatory or ethical requirement but also a strategic tool that enhances long-term profitability. The hypothesis is tested by examining the relationship between the CSR practices of publicly listed chemical logistics companies in China and their financial performance. The assumption is that companies with robust CSR initiatives, which focus on compliance management across various stakeholders—such as shareholders, employees, customers, suppliers, the environment, and society—will ultimately experience sustained profitability and business growth.

### **Theoretical Framework**

CSR as a risk management tool emphasizes ethical and sustainable business practices. By complying with environmental regulations, prioritizing employee welfare, enhancing supply chain transparency, and investing in community well-being, chemical logistics companies can mitigate risks, reduce operational disruptions, and build a reputation for reliability and safety. The positive public perception that results from adhering to CSR practices can also attract more investors and customers who value sustainability.

From a theoretical perspective, CSR is often linked to stakeholder theory, which posits that companies that balance the interests of all stakeholders are more likely to experience long-term success. Risk management theory also supports this, as effective CSR initiatives reduce the risks associated with non-compliance, legal penalties, and environmental damage, which can otherwise lead to costly lawsuits, fines, and damage to corporate reputation.

### **Methodology**

The first hypothesis was tested using secondary data from publicly listed Chinese chemical logistics companies. The research covered a 10-year period from 2010 to 2019, encompassing 152 firm-year observations. The CSR data used in the study was sourced from Hexun, a major provider of CSR ratings in China, and was integrated with financial performance data from CSMAR (China Stock Market & Accounting Research) to explore the relationship between CSR performance and firm profitability.

The data was analyzed using Stata, a statistical software package, with a panel-based regression model employed to control for unobserved heterogeneity. The use of panel data allows for more accurate estimates of causal relationships over time, as it can account for variables that are specific to each firm but not directly observable.

The quantitative approach was deemed suitable because the availability of reliable CSR and financial performance data for public companies made it possible to conduct a robust statistical analysis. Moreover, this method allows for an objective assessment of the correlation between CSR and profitability, free from potential biases that may arise in qualitative analyses.

## **Results and Discussion**

The analysis of the quantitative data revealed a positive relationship between CSR and firm performance, supporting the alternative hypothesis (H1). Chemical logistics companies that implemented more comprehensive CSR practices experienced better financial performance, as indicated by metrics such as return on assets (ROA), return on equity (ROE), and profit margins.

### Key findings include:

**Improved Risk Management:** Companies that prioritized CSR in areas like environmental protection, employee safety, and community engagement saw reduced operational risks, fewer accidents, and less legal trouble. This resulted in cost savings and increased investor confidence.

**Enhanced Reputation:** Firms that actively communicated their CSR achievements were better positioned to build brand loyalty and attract customers who prioritized sustainability, leading to increased market share and profitability.

**Long-Term Sustainability:** CSR practices, particularly those related to environmental sustainability and employee welfare, contributed to a stable and motivated workforce, leading to greater productivity and long-term profitability.

The findings align with the growing body of literature that suggests CSR is not merely a cost but a strategic investment that yields long-term financial benefits. For Chinese chemical logistics companies, where the transport of hazardous materials poses

significant risks, the implementation of CSR practices appears to be especially critical in mitigating risks and ensuring sustainable growth.

#### Implications:

The results of this hypothesis have important implications for the Chinese chemical logistics industry:

**Regulatory Compliance:** Compliance with CSR-related regulations not only avoids legal penalties but also enhances corporate image and operational efficiency.

**Stakeholder Engagement:** Proactively addressing stakeholder concerns through CSR improves relationships with employees, customers, suppliers, and local communities, leading to a more resilient business model.

**Strategic Investment:** Companies should view CSR as a strategic investment rather than a regulatory burden. It is critical for long-term success and the avoidance of reputational risks.

### **Hypothesis 2: Green Finance Boosts Low-Carbon Economy Development and Business Sustainability**

#### **Statement of Hypothesis**

H0: Green Finance has no impact on chemical logistics business development and sustainability.

H1: Green Finance has an impact on chemical logistics business development and sustainability.

This hypothesis posits that Green Finance, as a mechanism to fund environmentally sustainable projects, contributes to both business development and long-term sustainability in the chemical logistics industry. The hypothesis suggests that companies that invest in green technologies, renewable energy, and low-carbon initiatives through the support of Green Finance will benefit from increased operational efficiency, reduced environmental impact, and greater resilience in a rapidly evolving regulatory environment.

## **Theoretical Framework**

Green Finance refers to financial support for projects that contribute to environmental sustainability, such as investments in renewable energy, carbon reduction, and resource efficiency. Green Finance plays a crucial role in enabling businesses to transition from traditional, carbon-intensive practices to more sustainable operations. By offering incentives, such as lower interest rates or tax breaks for eco-friendly projects, Green Finance allows companies to reduce their carbon footprint while remaining competitive.

## **Methodology**

To test this hypothesis, the study employed a qualitative approach, gathering primary data through interviews with industry experts, including logistics managers, HSE managers, and finance VPs from private logistics companies and chemical company subsidiaries. A total of 12 interviews were conducted, designed to explore the impact of Green Finance on business sustainability.

The qualitative method allowed for a more in-depth understanding of how Green Finance initiatives were being implemented in the chemical logistics industry. Thematic analysis and coding analysis were used to identify key themes from the interviews, providing a rich interpretation of how industry players perceive Green Finance's role in promoting sustainable business practices.

## **Results and Discussion**

The results of the interviews suggest that Green Finance is becoming an increasingly important tool for promoting sustainability within the chemical logistics industry. The qualitative data supported the alternative hypothesis (H1), showing that companies that actively pursued Green Finance experienced tangible benefits in terms of sustainability and business development.

### **Key findings include:**

**Increased Investment in Green Technologies:** Companies that leveraged Green Finance were able to invest in low-carbon technologies, such as electric trucks, renewable energy for warehouses, and more efficient logistics management systems.

These investments helped reduce operational costs while also meeting stricter environmental regulations.

**Compliance with Environmental Regulations:** As China moves toward achieving its dual carbon goals (carbon peaking by 2030 and carbon neutrality by 2060), companies in the chemical logistics sector are under increasing pressure to reduce their carbon emissions. Green Finance provided the necessary funding to help firms comply with these regulations, thereby avoiding fines and reputational damage.

**Enhanced Long-Term Sustainability:** Green Finance not only facilitated compliance but also promoted long-term sustainability. By reducing their reliance on fossil fuels and investing in renewable energy, companies became more resilient to energy price fluctuations and future regulatory changes.

**Public and Private Sector Collaboration:** Several interviewees noted that government subsidies and public-private partnerships played a crucial role in supporting Green Finance projects. The government's support in incentivizing green investments helped reduce the financial burden on companies and promoted the adoption of sustainable practices.

## **Implications**

The findings have several important implications for both the chemical logistics industry and the broader push toward a low-carbon economy:

**Policy Support:** Governments and financial institutions should continue to provide support for Green Finance initiatives, ensuring that companies have access to the capital needed to invest in green technologies.

**Sustainable Business Practices:** For companies, adopting Green Finance as a core part of their business strategy is essential to maintaining competitiveness in a future where environmental sustainability is a key determinant of success.

**Industry Transformation:** The chemical logistics industry must undergo a transformation toward greener practices, and Green Finance is the most effective tool for achieving this transition.

## **Conclusion**

In conclusion, the empirical investigation into the role of CSR as a form of risk management and the impact of Green Finance on business sustainability has yielded valuable insights into the Chinese chemical logistics industry. The study finds support for both hypotheses, demonstrating that companies that invest in CSR and Green Finance are more likely to experience long-term profitability, sustainability, and resilience in an increasingly regulated and environmentally conscious market.

These findings highlight the importance of adopting strategic CSR initiatives and leveraging Green Finance to ensure compliance with environmental regulations, improve operational efficiency, and enhance corporate reputation. For companies in the chemical logistics sector

### **8.2.1 Role of CSR and GF in Risk Reduction and sustainable development**

CSR and GF were identified as instrumental in mitigating risks within the chemical logistics sector.

However, the study emphasized that social recognition and government support are equally crucial for sustainable development in high-risk industries. The role of Corporate Social Responsibility (CSR) and Green Finance (GF) in the Chinese chemical logistics industry emerges as pivotal for risk reduction and sustainable development. Through comprehensive interviews, it is evident that companies prioritizing CSR practices, including standardized operations, compliance with regulations, and robust risk management systems, are better equipped to navigate the unique challenges of transporting hazardous chemicals. The findings underscore the interconnectedness of CSR and risk management, emphasizing safety, compliance, and the positive impact on company performance. Additionally, the nascent but recognized role of Green Finance introduces a valuable tool to address financing challenges, especially for private companies. Green finance aligns with the industry's trajectory towards sustainability, promoting the adoption of environmentally friendly practices and technologies. Collaboration, awareness, and sustained support from government and financial institutions are deemed essential for the successful

integration of green finance practices, contributing to the long-term viability and growth of the Chinese chemical logistics industry in alignment with global calls for carbon neutrality.

The intersection of CSR, green finance, and sustainability represents a holistic approach to achieving sustainable development. When integrated effectively, these concepts can create synergies that enhance corporate resilience and contribute to broader societal goals. For instance, CSR initiatives can drive sustainable business practices by encouraging companies to adopt environmentally friendly technologies, reduce waste, and promote social equity. Green finance can provide the necessary capital for implementing these initiatives, enabling businesses to invest in renewable energy projects, energy-efficient infrastructure, and sustainable supply chains.

Moreover, the integration of CSR, green finance, and sustainability can foster innovation and the development of new business models. By aligning their operations with sustainability principles, companies can identify new market opportunities, develop sustainable products and services, and enhance their competitive advantage. For example, the growing demand for renewable energy and sustainable products has created new business opportunities for companies that prioritize sustainability.

### **8.2.2 Conclusion and implications**

#### Comprehensive Understanding of CSR and GF in Chinese Chemical Logistics

In conclusion, this research contributes to a comprehensive understanding of CSR and GF within the Chinese Chemical Logistics Industry. By integrating quantitative and qualitative analyses, the study unveils the potential of CSR and GF in fostering sustainable development. The findings underscore the need for a strategic, systematic, and collaborative approach to risk management, incorporating CSR and GF principles. The comprehensive analysis of the Chinese chemical logistics industry, integrating both primary and secondary data, highlights the multifaceted impact of corporate social responsibility (CSR) on firm performance. The primary data, derived from interviews with industry professionals, emphasizes the critical role of risk management in the sector, particularly given the unique challenges posed by the transportation of

hazardous chemicals. Larger companies, as revealed by the secondary data empirical analysis, demonstrate a strong commitment to safety risk management, aligning with the findings that CSR practices, especially in the realm of environmental responsibility, significantly correlate with earnings per share and contribute to sustainable development. Furthermore, the secondary data analysis underscores the positive association between shareholders' welfare solicitude and heightened accounting-based performance, reinforcing the instrumental aspect of stakeholder theory. This aligns with the primary data, which emphasizes the importance of safety and risk management for both human lives and the environment in the Chinese chemical logistics industry. The interviews reveal that larger companies, serving major chemical enterprises, prioritize safety measures, recognizing the instrumental role of CSR in mitigating risks and fostering sustainable growth. While the primary data highlights the challenges faced by smaller logistics companies in establishing comprehensive risk management systems, the secondary data analysis identifies a negative relationship between firm size and market performance. This reinforces the significance of CSR-driven risk management, emphasizing that larger firms, often more capable of investing in safety management systems and certifications, exhibit better market performance. The detrimental impact of high gearing ratios on earnings per share, as indicated in the secondary data, further underscores the importance of adopting sustainable practices for the overall viability and growth of the Chinese chemical logistics industry.

- The research findings from the secondary data analysis for the public listed companies in the Chinese logistical sector underscore the positive influence of specific corporate social responsibility (CSR) dimensions on firm performance, revealing an intricate interplay between CSR practices and various performance metrics. The study highlights the instrumental role of CSR in risk management and sustainable development. Notably, a robust association is observed between shareholders' welfare solicitude and heightened accounting-based performance, reinforcing the instrumental aspect of stakeholder theory. CSR practices emerge as pivotal in fostering shareholder trust, attracting new investors, and contributing to sustainable financial performance. The employee's dimension demonstrates a

nuanced impact, positively influencing market performance measures, while considerations of various employee welfare aspects may impact accounting performance due to heightened operational costs. Environmental CSR activities are shown to significantly correlate with earnings per share, emphasizing the dual benefits of compliance with environmental regulations and fostering positive relationships with authorities for long-term sustainable development. However, the study identifies no direct link between CSR efforts related to customers, suppliers, and social activities and firm performance, warranting further exploration. Moreover, the negative relationship between firm size and market performance, coupled with the detrimental impact of high gearing ratios on earnings per share, underscores the importance of CSR-driven risk management and sustainable practices for the Chinese chemical logistics industry's overall viability and growth. Overall, the research suggests that targeted CSR initiatives not only address stakeholders' demands but also play a pivotal role in enhancing risk resilience and fostering sustainable development in the sector.

- The primary data analysis, consisting of interviews with professionals from the Chinese chemical logistics industry, highlights the paramount importance of risk management in this sector. The industry, characterized by the transportation of hazardous chemicals, faces unique challenges due to the potential catastrophic consequences of accidents. Safety in chemical logistics operations is emphasized, with strict safety regulations, professional equipment, and well-trained personnel deemed crucial for effective risk mitigation. Larger companies, serving major chemical enterprises, exhibit a strong commitment to safety, investing in robust safety management systems and training programs. However, smaller logistics companies face challenges in establishing comprehensive risk management systems due to limited resources. The interviews also underscore the increasing demand for safe chemical logistics service providers, particularly from foreign chemical giants, driving the need for investment in safety risk management systems to remain competitive. In conclusion, risk management is vital for protecting lives, the environment, and maintaining the reputation and viability of logistics companies in the Chinese chemical logistics industry. The analysis of interviews regarding the development of corporate social responsibility (CSR) in the Chinese chemical logistics industry reveals varying levels of awareness and

implementation across companies. Larger companies, often with ties to foreign customers, prioritize CSR due to associated benefits like sustainable development and improved market reputation. Risk management is identified as an integral part of CSR, considering the hazardous nature of chemical transportation. The influence of foreign customers is evident in the adoption of CSR principles, emphasizing the role of partnerships with multinational corporations. While larger companies demonstrate a better understanding and implementation of CSR, smaller and self-employed logistics providers face challenges due to resource constraints. Nonetheless, CSR is gaining traction, with safety management, employee welfare, and sustainability becoming integral parts of CSR efforts within the industry. The findings suggest that promoting CSR practices and integrating them into risk management strategies can benefit Chinese chemical logistics companies in terms of performance, sustainability, and reputation.

During the interview, there are the opinion that the development of green finance will follow the trends of CSR development. The interviewees expressed positive views on the promotion of green finance in the Chinese chemical logistics industry. They recognized the need for financing support, especially for private companies, to meet the high requirements of safety risk management and professionals, and compliance management related to CSR. While green finance projects are relatively limited, interviewees express positive views, recognizing their potential benefits, especially for private companies facing financing challenges. Access to green finance is seen as crucial for investing in environmentally friendly practices and technologies. The consensus is that companies proactively managing risks, integrating CSR, and embracing green finance are better positioned for long-term success, emphasizing the need for continued collaboration, awareness, and support from government and financial institutions for the industry's sustainable growth.

In conclusion, the findings suggest that risk management, CSR, and green finance play pivotal roles in the sustainable development of the Chinese chemical logistics industry. As the industry evolves, companies that prioritize these aspects are better positioned for long-term success. Green finance, although relatively new, is recognized as a valuable tool to address financing challenges and promote sustainability in the industry. Collaboration, awareness, and continued support from

government and financial institutions are essential for the successful integration of green finance practices. The development of a strong risk management system and the promotion of CSR practices remain integral to the industry's growth and long-term viability.

### **8.3 Contributions of this study**

The realm of Corporate Social Responsibility (CSR) has become a focal point in finance literature, attracting increasing attention from scholars, governmental bodies, and policymakers. This research presents significant contributions to both theory and practice in the fields of Corporate Social Responsibility (CSR), Green Finance (GF), and sustainability, particularly within the context of the Chinese chemical logistics industry. By exploring CSR, GF, and sustainability as both independent and interrelated concepts, the study not only deepens the understanding of how these elements function within high-risk industries but also addresses critical gaps in the literature. Through both quantitative and qualitative approaches, the research provides comprehensive insights, offering actionable frameworks for industry practitioners and informing strategies that align business operations with global sustainability goals.

By investigating the roles of CSR and GF both independently and in conjunction with each other, the study not only enriches the theoretical understanding of these concepts but also provides a comprehensive empirical analysis that offers actionable insights for industry practitioners and policymakers. This section discusses these contributions in three key areas: theoretical development, empirical contributions, and managerial/practical contributions.

#### **a) Theoretical Contribution**

The first area in which this study contributes significantly is in theoretical development. The integration of CSR, GF, and sustainability into a unified framework, as explored in Chapters 1.3, 3.5, and 4.4, provides new theoretical insights into how these elements interact within the chemical logistics sector, a high-risk industry that has received limited academic attention. Additionally, this section considers the generalizability of these findings to other industries and regions.

- **Advancing the CSR-Financial Performance Discourse:** One of the most critical theoretical contributions of this research is its advancement of the discourse on the relationship between CSR and financial performance. While existing literature has explored the general connection between CSR initiatives and financial outcomes, particularly in developed economies, this study brings a unique focus to the Chinese chemical logistics sector—a high-risk, heavily regulated industry where the financial stakes of CSR initiatives are particularly pronounced. The research demonstrates that CSR activities, when effectively integrated into core business strategies, can provide a measurable financial benefit, even in industries where short-term financial gains are often prioritized over long-term sustainability. This finding is particularly important in industries like chemical logistics, where the risks are substantial, and the costs of environmental or safety failures can be severe.

This study provides empirical evidence that CSR initiatives can not only mitigate risks but also enhance financial performance by improving a company's reputation, customer loyalty, and employee satisfaction—all of which contribute to long-term profitability. This theoretical expansion moves beyond traditional understandings of CSR as a purely reputational tool and positions it as a strategic lever for financial success, especially in high-risk industries. This challenges the traditional notion that CSR initiatives are costly and burdensome, instead framing them as essential to long-term competitiveness. Though this study is centered on the Chinese chemical logistics industry, the theoretical insights derived from it are highly relevant to other high-risk industries across the globe, including sectors like oil and gas, mining, pharmaceuticals, and heavy manufacturing. The study's findings, particularly regarding the positive relationship between CSR practices and firm performance, can be generalized to industries where environmental, safety, and regulatory risks are significant. The framework used to explore the impacts of CSR in the Chinese chemical logistics sector can be adapted to analyze similar high-stakes environments elsewhere, especially in emerging economies where sustainability pressures are rising.

- **Integration of CSR, GF, and Sustainability:** Another major theoretical contribution of this study lies in its detailed exploration of the intersection between CSR, GF,

and sustainability. While each of these concepts has been explored individually in previous literature, this research examines how their integration can drive sustainable development, particularly in industries where the stakes for environmental and social responsibility are high. The study argues that CSR and GF are not isolated initiatives but must be considered as interconnected strategies that collectively enhance a company's ability to meet both financial and sustainability goals.

This theoretical integration is particularly important in the context of high-risk sectors like chemical logistics, where sustainability challenges are intertwined with operational risks. Chapter 4.4, for instance, emphasizes how the alignment of CSR and GF can drive industry-wide improvements in environmental performance, helping companies to navigate complex regulatory landscapes and minimize their exposure to financial penalties. The study's findings contribute to a broader theoretical understanding of how sustainability-focused financial instruments—such as green bonds and ESG investments—can support and amplify CSR efforts, leading to more comprehensive and impactful sustainability strategies. While the primary context for this research is the Chinese chemical logistics industry, the theoretical framework developed here has broad applicability. The intersection of CSR and GF, as a driver of sustainable development, can be generalized to any industry where environmental impact and sustainability are pressing concerns. Industries with significant carbon footprints, such as energy, utilities, transportation, and agriculture, can leverage the insights from this study to align their CSR strategies with green financing mechanisms. Additionally, the framework can be applied across both developed and developing countries, adapting to various regulatory and market environments where CSR and GF are increasingly seen as critical for competitive advantage and risk mitigation.

- **Application of Stakeholder Theory in High-Risk Industries:** The study also advances stakeholder theory by demonstrating its applicability in high-risk industries, where the demands of different stakeholders—such as regulators, customers, employees, and investors—are often in tension. By focusing on how CSR and GF practices can be used to align the often-conflicting interests of these stakeholder groups, the research contributes to the theoretical understanding of

how companies can achieve stakeholder legitimacy while simultaneously driving financial and environmental performance.

In the case of the Chinese chemical logistics industry, where stakeholder scrutiny is particularly intense due to the high environmental risks, the application of stakeholder theory offers a valuable framework for understanding how firms can balance their financial goals with the need to meet regulatory and social expectations. This theoretical contribution is critical for industries where failing to meet stakeholder demands can result in not only reputational damage but also financial and operational consequences.

The stakeholder theory framework applied in this study is highly adaptable and can be generalized across different industries, especially those where stakeholder expectations around sustainability and risk management are growing. The insights gained from this study are applicable to sectors like pharmaceuticals, construction, and heavy manufacturing, where stakeholders—including governments, communities, and investors—have a vested interest in how companies manage environmental and social risks. The study's findings can also be extended to companies in both developed and emerging markets that are looking to strengthen their stakeholder engagement through CSR and GF initiatives.

- **Expansion of CSR Theory in High-Risk Sectors:** Traditional CSR theory often emphasizes short-term corporate benefits, such as reputational gains or the mitigation of public relations risks. However, this study expands the theoretical framework to emphasize the long-term benefits of CSR, particularly in high-risk industries like chemical logistics, where the cost of failure can be catastrophic. The research shows that CSR initiatives, when strategically implemented, can drive not only short-term financial gains but also long-term competitive advantages by reducing operational risks and improving relationships with key stakeholders.

In Chapters 3.5 and 3.6, the study explores how CSR-driven risk management strategies can enhance both financial and operational resilience in industries that are prone to accidents and regulatory scrutiny. By providing theoretical evidence that CSR can serve as a strategic tool for managing long-term risks, the study

addresses a significant gap in the existing literature and offers a new perspective on the role of CSR in high-risk sectors.

Also, The extension of CSR theory to high-risk industries in this research has broad implications. The proactive role of CSR in risk management and long-term value creation is relevant to any industry where environmental, health, and safety risks are a concern. This includes industries like aerospace, defense, food production, and healthcare, where operational risks and stakeholder scrutiny are high. Furthermore, the findings can be generalized to companies operating in both global and regional markets, especially those in jurisdictions where environmental regulations are tightening, and sustainability is becoming a strategic priority.

- **Methodological Contribution to Theory:** The study's methodological approach also contributes to theoretical development by integrating both quantitative and qualitative research methods. By using a combination of financial data analysis and in-depth interviews with industry experts, the research offers a more comprehensive understanding of how CSR and GF practices interact to impact organizational performance. This mixed-method approach not only enhances the robustness of the findings but also provides a more nuanced theoretical understanding of the dynamics between CSR, GF, and sustainability in high-risk industries. The mixed-methodological framework developed in this study is highly generalizable to other industries and geographic contexts. The combination of quantitative and qualitative approaches can be used to explore the impact of CSR and GF in different high-risk sectors, such as mining, oil and gas, or manufacturing, where both financial performance and sustainability are critical concerns. Additionally, this methodology can be applied across different cultural and regulatory environments, making it a versatile tool for examining how CSR and GF interact in various global markets.

In summary, while this research is deeply rooted in the Chinese chemical logistics industry, its theoretical contributions—particularly regarding the intersection of CSR and GF, stakeholder theory, and CSR's role in risk management—are highly generalizable. The study offers a robust framework that can be applied to various high-

risk industries and geographic regions, making its theoretical insights relevant to a wide range of contexts. These contributions not only deepen our understanding of CSR and GF in high-stakes environments but also provide a foundation for future research in industries and regions where sustainability is becoming an increasingly strategic concern.

## b) Empirical Contribution

The second major area of contribution is in the empirical findings of the study. By combining quantitative data analysis with qualitative insights, the research offers a detailed examination of the relationship between CSR, GF, and financial performance in the Chinese chemical logistics sector.

- **Quantitative Examination of CSR and Financial Performance:** A key empirical contribution of this study is its comprehensive quantitative analysis of the relationship between CSR initiatives and financial performance in publicly listed Chinese chemical logistics companies. The study utilizes data from 152 firm-year observations spanning the period from 2010 to 2019, integrating CSR data from the Hexun database with financial data from the CSMAR database. This extensive dataset allows the research to provide robust empirical evidence on how CSR activities influence financial performance in the chemical logistics sector, offering valuable insights that are directly applicable to similar high-risk industries.

By analyzing different dimensions of CSR—such as the roles of shareholders, employees, customers, suppliers, and environmental responsibilities—the study provides a granular understanding of how specific CSR practices contribute to firm performance. The use of advanced panel data analysis methods and regression models ensures that the findings are statistically significant and reliable, adding empirical weight to the study's theoretical contributions.

- **Exploration of Green Finance's Role in Risk Mitigation:** The study also provides empirical evidence on the role of Green Finance in supporting business sustainability. Through the analysis of green bonds, green credit, and ESG investments, the research demonstrates how GF can serve as both a financial tool

and a risk mitigation strategy, particularly for companies operating in high-risk sectors. The findings show that companies that adopt GF practices are better positioned to manage environmental risks, reduce their exposure to regulatory penalties, and improve their overall financial performance.

This empirical contribution is particularly valuable for policymakers and industry leaders who are seeking to promote sustainability in high-risk sectors like chemical logistics. By providing concrete evidence of the financial benefits of GF, the study offers a compelling argument for why companies should invest in sustainability-focused financial instruments as part of their broader CSR strategies.

- **Qualitative Insights from Industry Experts:** In addition to its quantitative analysis, the study includes in-depth interviews with key industry stakeholders, including logistics managers, HSE managers, and financial and operational leaders from Chinese chemical logistics companies. These interviews provide rich qualitative data on how CSR and GF practices are perceived and implemented within the industry, offering valuable insights that complement the study's quantitative findings.

Through thematic analysis of the interview data, the research identifies key development gaps within the industry, as well as potential opportunities for improvement in CSR and GF practices. This qualitative inquiry provides a more holistic understanding of the challenges and opportunities associated with implementing CSR and GF in high-risk sectors, offering practical insights that are directly applicable to industry practitioners.

- **Identification of Development Gaps in the Industry:** One of the most important empirical contributions of this research is the identification of development gaps within the Chinese chemical logistics industry. The study reveals that while many companies have begun to adopt CSR and GF practices, there are still significant challenges in terms of implementation and alignment with global sustainability goals. These findings provide valuable guidance for both industry leaders and policymakers, offering a roadmap for how CSR and GF initiatives can be improved to better meet the demands of stakeholders and drive long-term business sustainability.

- **Longitudinal Examination of CSR Development Levels:** By analyzing CSR data over a nine-year period, the study offers a longitudinal perspective on how CSR practices have evolved within the Chinese chemical logistics sector. This temporal analysis allows the research to track changes in CSR development levels and assess their impact on organizational performance over time. The findings confirm that companies that have consistently invested in CSR initiatives are more likely to experience positive financial outcomes, providing empirical evidence that supports the study's theoretical claims about the long-term benefits of CSR.

#### c) Managerial/Practical Contribution

The research also makes significant managerial and practical contributions by providing actionable recommendations for industry practitioners and policymakers.

- **Frameworks for Enhancing CSR and GF Initiatives:** The study offers practical frameworks that companies can use to enhance their CSR and GF initiatives. By outlining how CSR and GF can be integrated into core business strategies, the research provides industry practitioners with concrete steps to foster more responsible and sustainable business practices. These frameworks are particularly relevant for high-risk industries like chemical logistics, where sustainability is critical to long-term success.
- **Guidance for Policymakers and Regulatory Bodies:** The findings also provide valuable guidance for policymakers and regulatory authorities. By emphasizing the need for robust green finance mechanisms and government support, the research highlights how regulatory incentives can play a crucial role in promoting sustainable business practices. These insights are particularly timely for governments and regulatory bodies seeking to align corporate practices with global sustainability goals, such as carbon neutrality and the UN Sustainable Development Goals (SDGs).
- **Informing Strategic Decisions for Sustainability:** The research offers detailed analyses and practical recommendations that can help businesses navigate the evolving landscape of CSR and Green Finance. By identifying key development gaps and providing strategies to address them, the study informs managerial decisions aimed at improving business sustainability in the Chinese chemical

logistics sector. These insights are also relevant to other high-risk industries facing similar environmental and regulatory challenges.

- **Revealing Industry Development Trends:** Through qualitative interviews, the study uncovers future trends and potential development paths for CSR and GF practices within the Chinese chemical logistics industry. This forward-looking perspective helps industry leaders anticipate future challenges and opportunities, allowing them to proactively adapt their strategies to align with emerging sustainability trends. As the research navigates the multifaceted landscape of CSR and GF within the chemical logistics sector, it aspires to offer more than a mere academic contribution. Instead, it endeavors to provide actionable frameworks and comprehensive insights that can foster responsible and environmentally conscious business practices within the industry. By doing so, the research ultimately aims to make a substantive contribution to broader sustainability objectives. This involves presenting detailed analyses and recommendations that industry stakeholders can leverage to navigate the evolving landscape of CSR and GF in alignment with contemporary global sustainability imperatives.

The comprehensive nature of this research allows for an exploration of various dimensions within CSR and their dynamic interactions with financial performance. The study delves into areas such as environmental responsibility, community engagement, and ethical practices, providing a nuanced understanding of the multifaceted nature of CSR initiatives within the chemical logistics sector. By doing so, the research not only adds depth to existing literature but also opens avenues for future research inquiries.

In conclusion, the academic contributions of this research extend beyond the realms of traditional CSR studies by providing a nuanced understanding of the industry-specific dynamics at play within the chemical logistics sector. The incorporation of both quantitative and qualitative methodologies enhances the depth and breadth of insights, offering a comprehensive exploration of the intricate relationship between CSR and financial performance. This research, thus, stands as a valuable addition to the academic literature, bridging gaps and providing a foundation for future inquiries into sustainable business practices, particularly in high-risk industries. The integration of industry-specific insights with broader theoretical frameworks contributes to the

ongoing dialogue on CSR and GF, enriching academic discourse and informing practical strategies for businesses operating in the chemical logistics sector.

## **8.4 Limitations of this study**

This research faces constraints in data availability, particularly within certain private logistics companies and subsidiaries of chemical firms, limiting the depth of analysis in these segments. Due to the vast number of companies within the Chinese chemical logistics sector, there is a significant variation in company size, governance standards, and operational practices. Many micro and small-sized companies in this industry often lack proper governance and compliance with regulatory standards. Over time, as regulatory scrutiny has increased, these poorly governed companies are gradually being phased out of the industry. Given this context, my research deliberately excludes these micro and small-sized companies that do not meet the necessary governance standards. Instead, the focus is on companies that are compliant with government regulations and international standards. This decision ensures that the companies included in the study are representative of industry best practices and are likely to have more established and systematic approaches to Corporate Social Responsibility (CSR) and Green Finance. However, this choice introduces certain limitations to the study:

- **Exclusion of Micro and Small-Sized Companies:**

By excluding micro and small-sized companies, the research does not capture the experiences and challenges faced by this significant segment of the industry. These smaller companies might have different perspectives on CSR and Green Finance, possibly focusing more on immediate survival rather than long-term sustainability. As a result, the findings may not fully represent the entire spectrum of the chemical logistics industry in China.

- **Focus on Listed and Medium-to-Large Companies:**

The study predominantly includes listed companies and medium-sized enterprises. These companies generally have more resources, better governance structures, and greater access to Green Finance. This focus may lead to findings that are more

optimistic or advanced in terms of CSR and sustainability practices, which might not reflect the reality for smaller or less established companies in the industry.

- **Potential Bias Towards Compliance and Best Practices:**

Since the sample companies are those that meet both government and international governance requirements, the research may inherently bias towards companies that are already performing well in terms of CSR and sustainability. This could limit the study's ability to identify and analyse the barriers that less compliant companies face in adopting these practices.

In conclusion, while the selected sample provides valuable insights into the practices of well-governed and larger companies within the Chinese chemical logistics industry, the exclusion of micro and small-sized companies may limit the generalizability of the findings. The study's results may primarily reflect the experiences of companies that are already on a more advanced path towards CSR and Green Finance, potentially overlooking the challenges faced by smaller players in the industry.

On the other hand, while the findings of the study are valuable within the Chinese Chemical Logistics Industry context, their generalizability to other industries or regions may be limited. Suggested directions for future research include conducting in-depth studies on industry-specific risks in the chemical logistics sector to provide targeted insights for risk management strategies. Additionally, longitudinal analyses tracking the evolution of Corporate Social Responsibility (CSR) and Green Finance (GF) practices within individual organizations could offer valuable insights into the dynamic nature of these initiatives, revealing trends, challenges, and best practices over time. Furthermore, comparative studies across regions and industries are recommended to contribute to a more nuanced understanding of cultural and contextual influences on CSR and GF implementation, ultimately informing tailored approaches for diverse business environments.

In conducting research on the Chinese chemical logistics industry, the selection of sample companies has been carefully considered to ensure relevance and reliability. However, there are inherent limitations in this approach that must be acknowledged.

## **8.5 Practical Implications and suggestions**

For practitioners in the chemical logistics industry, the study emphasizes the strategic integration of CSR and GF for long-term sustainability. This involves not only internal practices but also active engagement with stakeholders, fostering societal recognition and seeking government support. From the review for the global industry and data analysis of financial data and interview with the industry players, practically this study provides the forecast and recommendations for the Chinese Chemical logistics industry development as below:

The developed countries took approximately 50 to 70 years to transition from carbon peaking to carbon neutrality, whereas China has only 30 years, making this task considerably challenging. Therefore, the future development of chemical logistics in China needs to address four aspects: adjusting production capacity structure, applying decarbonization technologies and technological applications such as AI, optimizing transportation modes, and fostering green finance.

Firstly, the continuous improvement of the policy system provides new support for the high-quality development of chemical logistics. As a crucial category within the logistics industry, chemical logistics has always been guided by policies. The recent release of China's "14th Five-Year Plan for Modern Logistics Development" emphasizes the development of hazardous material container multimodal transportation, the enhancement of safety service levels, and the transformation towards "customized specialization, high-quality services, and full-chain supply chain services." It promotes full-process monitoring, online supervision, real-time querying of hazardous material logistics, and improves capabilities for abnormal warning and emergency response. It is believed that the continuous improvement of the policy system will accelerate the high-quality development of chemical logistics.

Secondly, the resource aggregation effect of leading enterprises provides new space for the development of chemical logistics. With the continuous deepening and promotion of policies such as the unified large market and the integration of domestic and foreign trade, the country encourages enterprises to grow stronger, integrate resources, and reduce costs and increase efficiency. Key enterprises in the industry have more financing channels, conforming to national policies to further integrate chemical logistics resources. Although the overall market demand and the number of participating operating enterprises are relatively dispersed, prominent enterprises

have stood out in recent years, and their scale advantages have gradually emerged. Under their influence, this study believes that the ability of many future enterprises to integrate and cooperate will be enhanced.

Thirdly, high-standard quality and safety control provide new guidance for the development of chemical logistics. The government's efforts to control the safety of chemical logistics will continue to increase, and enterprises will pay more attention to quality and safety risk control during operations. Guided by the principle of "a safer society and a more efficient supply chain," they will intensify efforts to improve management systems, catch up with or lead industry development in terms of quality, safety, health, environmental protection, especially for large enterprises actively practicing social responsibility.

Fourthly, innovative applications of digitization and intelligence provide new consensus for the development of chemical logistics. The logistics chain of the petrochemical industry in China is long, involving multiple entities, and the logistics business is complex. There is a significant gap in the construction of information systems among various participating entities, and there is room to improve the timeliness and accuracy of information transmission. Therefore, standardized construction of information systems is needed to closely connect upstream production enterprises, midstream logistics service providers, and downstream customers. This will enhance information sharing among participating entities and improve the collaborative capabilities of logistics.

Fifthly, the pattern of green, low-carbon, and sustainable development provides new goals for the development of chemical logistics. The "14th Five-Year Plan" of China emphasizes the requirements for the construction of sustainable green logistics. The use of alternative energy transport tools and efficiency improvement require joint efforts between chemical logistics enterprises and upstream parties to create overall cost-optimal and carbon-optimal solutions. Especially in the context of rising oil prices, optimizing logistics solutions and finding better alternatives, such as the application of new energy sources and changes in transportation modes, can help enterprises improve the stability and sustainable development of the entire supply chain.

Furthermore, in recent years, the transformation and upgrading of various industries, including the logistics industry, cannot be separated from the evolution of digital intelligence, from informatization, internetization to digitization. Digitization is not only a way to improve communication and decision-making efficiency and information accuracy but also reflects the capability of enterprise logistics or supply chain services, presenting a new market expectation for the industry.

Unlike the development path of intelligence in consumer fields such as e-commerce, the chemical logistics industry is still a typical representative of traditional logistics. Its delivery cycle, transport distance, and changes in categories are relatively less complicated, while possessing certain professional characteristics. Therefore, overall, the development of chemical logistics itself in recent years has an urgent demand for technological upgrades, and there is a certain foundation for the industry's digital development, although the overall transformation is not significant. The digital development and application of the chemical logistics industry mainly focus on ensuring the safety of logistics services: chemical logistics enterprises have adopted intelligent, proactive safety equipment relatively early, spanning nearly 10 years. In terms of the internal and external customer information system platform, including sales systems, intelligent settlement systems, on-route monitoring systems for vehicles, personnel management systems, and related online inspection and quarantine systems for in-transit vehicles in the warehousing link, the development has been relatively fast and advanced.

In terms of the role of digitization itself, firstly, it is undoubtedly positive. Whether it is industrial digitization, or the digitization of enterprise management models or equipment facilities, digitization is a positive force for enterprise operations and management and for industry services. The dimensions of demand for digitization itself are different. Some require improving logistics efficiency, but for the chemical industry, the first dimension is safety, the second dimension is to improve operational efficiency under safe conditions, the third is to enhance service capabilities on the basis of operational efficiency, and the fourth demand is to replace some manual operations. Therefore, the requirements of chemical logistics for digitization are different from other fields. The chemical logistics industry has its specificity, where safety is the first choice and the first standard. Any transformation and optimization must be based on

further ensuring the safety of logistics operations and the safety of related industries. Therefore, the direction and goals of the future digital transformation of the chemical logistics industry mainly focus on three aspects: firstly, ensuring safety as the top priority. Secondly, on this basis, the chemical logistics industry should play its specialized characteristics, use digital transformation to enhance the professional service guarantee capabilities of enterprises, such as investing in optimizing transportation routes, energy-saving and emission reduction, and the integration of supply chain services for cargo-owning enterprises. In addition, the current logistics industry faces new challenges such as a shortage of frontline employees. Therefore, the third dimension of digital transformation is how to improve the reliability of operation and maintenance services in high-risk environments through the use of automated and intelligent technologies and products, ensuring the reliability of operation and maintenance services in hazardous environments with a shortage of personnel.

In conclusion, the future development of chemical logistics in China needs to focus on four aspects: adjusting production capacity structure, applying decarbonization technologies and technological applications such as AI, optimizing transportation modes, and fostering green finance. Policy improvements, resource aggregation effects of leading enterprises, high-quality safety control, and innovation in digital and intelligent applications are identified as key drivers for the industry's sustainable development. The integration of green finance is highlighted as a valuable tool to address financing challenges and promote sustainability. The industry acknowledges the need for government support, incentives, and collaboration to successfully integrate green finance practices and achieve the long-term viability and growth of the Chinese chemical logistics sector in alignment with global carbon reduction goals.

## **8.6 Final Reflection**

It is evident that CSR and GF are not merely theoretical constructs but practical tools with the potential to transform industries. The chemical logistics sector, despite its complexities and risks, presents an opportunity for innovative, sustainable practices.

By aligning with global calls for carbon neutrality, organizations can not only mitigate risks but also contribute to a resilient, environmentally conscious future.

This research, while contributing to the existing body of knowledge, is but a steppingstone in the continual journey towards sustainable business practices. The path forward involves collaborative efforts, ongoing research, and a commitment to balancing economic objectives with societal and environmental responsibilities. Through this holistic approach, industries can navigate the complexities of the 21st century, embodying the principles of CSR and GF for a more sustainable and resilient future.

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## APPENDIX A: Raw DATA

### APPENDIX A:

| 证券代码       | stkcd  | year | 评级得分  | 股东责任      | 员工责任     | 客户和消费者权益   | 环境责任       | 社会责任        |
|------------|--------|------|-------|-----------|----------|------------|------------|-------------|
| stock_code | stkcd  | year | CSR   | R_shareho | R_employ | CSR_client | R_environm | CSR_society |
| 600160     | 600160 | 2010 | 62.9  | 17.46     | 10.32    | 9          | 24.5       | 1.62        |
| 600160     | 600160 | 2011 | 85.55 | 24.1      | 13.85    | 14         | 30         | 3.6         |
| 600160     | 600160 | 2012 | 68.58 | 20.73     | 12.09    | 15         | 17         | 3.76        |
| 600160     | 600160 | 2013 | 64.05 | 19.83     | 10.48    | 12         | 17         | 4.74        |
| 600160     | 600160 | 2014 | 19.01 | 13.59     | 1.06     | 0          | 0          | 4.36        |
| 600160     | 600160 | 2015 | 18.26 | 12.63     | 0.76     | 0          | 0          | 4.87        |
| 600160     | 600160 | 2016 | 61.57 | 18.06     | 11.51    | 10         | 17         | 5           |
| 600160     | 600160 | 2017 | 25.84 | 19.46     | 2.15     | 0          | 0          | 4.23        |
| 600160     | 600160 | 2018 | 25.27 | 21.22     | 0.56     | 0          | 0          | 3.49        |
| 600160     | 600160 | 2019 | 21.13 | 18.11     | 0.19     | 0          | 0          | 2.83        |
| 600026     | 600026 | 2010 | 52.4  | 15.09     | 11.5     | 7          | 15         | 3.81        |
| 600026     | 600026 | 2011 | 54.47 | 18.4      | 11.9     | 5          | 17         | 2.17        |
| 600026     | 600026 | 2012 | 55.47 | 9.85      | 12.62    | 5          | 23         | 5           |
| 600026     | 600026 | 2013 | 48.96 | 3.36      | 10.01    | 14         | 19.5       | 2.09        |
| 600026     | 600026 | 2014 | 5.79  | 9.07      | 1.11     | 0          | 0          | -4.39       |
| 600026     | 600026 | 2015 | 21.39 | 14.05     | 4        | 0          | 0          | 3.34        |
| 600026     | 600026 | 2016 | 25.8  | 19.99     | 4        | 0          | 0          | 1.81        |
| 600026     | 600026 | 2017 | 21.92 | 16.43     | 4        | 0          | 0          | 1.49        |
| 600026     | 600026 | 2018 | 18.33 | 9.33      | 4        | 0          | 0          | 5           |
| 600026     | 600026 | 2019 | 19.57 | 10.57     | 4        | 0          | 0          | 5           |
| 600500     | 600500 | 2010 | 65.38 | 13.26     | 11.12    | 12         | 23         | 6           |
| 600500     | 600500 | 2011 | 71.98 | 17.09     | 13.17    | 14         | 23         | 4.72        |
| 600500     | 600500 | 2012 | 56.87 | 18.57     | 12.05    | 9          | 14         | 3.25        |
| 600500     | 600500 | 2013 | 62.26 | 17.84     | 10.27    | 12         | 17         | 5.15        |
| 600500     | 600500 | 2014 | 22.35 | 15.23     | 2.21     | 0          | 0          | 4.91        |
| 600500     | 600500 | 2015 | 21.3  | 14.11     | 2.45     | 0          | 0          | 4.74        |
| 600500     | 600500 | 2016 | 54.55 | 12.06     | 12.93    | 7          | 18         | 4.56        |
| 600500     | 600500 | 2017 | 21.83 | 13.91     | 2.92     | 0          | 0          | 5           |
| 600500     | 600500 | 2018 | 23.69 | 15.68     | 3.01     | 0          | 0          | 5           |
| 600500     | 600500 | 2019 | 21.16 | 14.51     | 2.75     | 0          | 0          | 3.9         |
| 603713     | 603713 | 2015 | 19.62 | 14.62     | 0        | 0          | 0          | 5           |
| 603713     | 603713 | 2016 | 18.18 | 13.18     | 0        | 0          | 0          | 5           |
| 603713     | 603713 | 2017 | 20.15 | 14.1      | 1.05     | 0          | 0          | 5           |
| 603713     | 603713 | 2018 | 24.11 | 17.82     | 1.29     | 0          | 0          | 5           |
| 603713     | 603713 | 2019 | 23.97 | 18.4      | 1.14     | 0          | 0          | 4.43        |
| 603871     | 603871 | 2014 | 20.33 | 15.56     | 0        | 0          | 0          | 4.77        |
| 603871     | 603871 | 2015 | 20.36 | 16.46     | 0        | 0          | 0          | 3.9         |
| 603871     | 603871 | 2016 | 19.53 | 16.55     | 0        | 0          | 0          | 2.98        |
| 603871     | 603871 | 2017 | 24.03 | 18.4      | 2.29     | 0          | 0          | 3.34        |
| 603871     | 603871 | 2018 | 26.84 | 20.46     | 2.66     | 0          | 0          | 3.72        |
| 603871     | 603871 | 2019 | 28.36 | 22.26     | 2.6      | 0          | 0          | 3.5         |
| 603329     | 603329 | 2014 | 18.76 | 14.5      | 0        | 0          | 0          | 4.26        |
| 603329     | 603329 | 2015 | 19.04 | 14.84     | 0        | 0          | 0          | 4.2         |
| 603329     | 603329 | 2016 | 18.19 | 14.55     | 0        | 0          | 0          | 3.64        |
| 603329     | 603329 | 2017 | 24.35 | 19.09     | 0.91     | 0          | 0          | 4.35        |
| 603329     | 603329 | 2018 | 22.69 | 17.31     | 0.46     | 0          | 0          | 4.92        |
| 603329     | 603329 | 2019 | 1.93  | -0.57     | 0.47     | 0          | 0          | 2.03        |
| 600794     | 600794 | 2010 | 24.07 | 15.16     | 4        | 0          | 0          | 4.91        |
| 600794     | 600794 | 2011 | 23.35 | 17.69     | 4        | 0          | 0          | 1.66        |

|        |        |      |       |       |       |    |      |       |
|--------|--------|------|-------|-------|-------|----|------|-------|
| 600794 | 600794 | 2012 | 25.78 | 20.81 | 2.04  | 0  | 0    | 2.93  |
| 600794 | 600794 | 2013 | 26.47 | 21.06 | 2.05  | 0  | 0    | 3.36  |
| 600794 | 600794 | 2014 | 24.35 | 18.43 | 0.92  | 0  | 0    | 5     |
| 600794 | 600794 | 2015 | 20.55 | 12.27 | 3.28  | 0  | 0    | 5     |
| 600794 | 600794 | 2016 | 16.89 | 9.82  | 2.07  | 0  | 0    | 5     |
| 600794 | 600794 | 2017 | 0.53  | 0.81  | 1.71  | 0  | 0    | -1.99 |
| 600794 | 600794 | 2018 | 16.68 | 10.42 | 1.26  | 0  | 0    | 5     |
| 600794 | 600794 | 2019 | 22.13 | 13.42 | 4     | 0  | 0    | 4.71  |
| 600787 | 600787 | 2010 | 58.49 | 12.26 | 11.45 | 13 | 17   | 4.78  |
| 600787 | 600787 | 2011 | 55.31 | 15.28 | 11.3  | 10 | 14   | 4.73  |
| 600787 | 600787 | 2012 | 62.96 | 17.41 | 14.91 | 12 | 14   | 4.64  |
| 600787 | 600787 | 2013 | 66.59 | 15.68 | 11.33 | 14 | 19.5 | 6.08  |
| 600787 | 600787 | 2014 | 20.17 | 13.13 | 2.71  | 0  | 0    | 4.33  |
| 600787 | 600787 | 2015 | 64.88 | 14.6  | 13.28 | 15 | 17   | 5     |
| 600787 | 600787 | 2016 | 59    | 13.8  | 13.37 | 10 | 17   | 4.83  |
| 600787 | 600787 | 2017 | 23.9  | 16.5  | 2.59  | 0  | 0    | 4.81  |
| 600787 | 600787 | 2018 | 19.46 | 12.53 | 1.93  | 0  | 0    | 5     |
| 600787 | 600787 | 2019 | 15.88 | 8.98  | 1.9   | 0  | 0    | 5     |
| 600803 | 600803 | 2010 | 7.75  | 4.64  | 3.11  | 0  | 0    | 0     |
| 600803 | 600803 | 2011 | 4.19  | 2.3   | 1.89  | 0  | 0    | 0     |
| 600803 | 600803 | 2012 | 6.39  | 4.16  | 2.23  | 0  | 0    | 0     |
| 600803 | 600803 | 2013 | 13.73 | 13.15 | 0.23  | 0  | 0    | 0.35  |
| 600803 | 600803 | 2014 | -0.15 | -0.44 | 0.59  | 0  | 0    | -0.3  |
| 600803 | 600803 | 2015 | 0.24  | -1.2  | 1.48  | 0  | 0    | -0.04 |
| 600803 | 600803 | 2016 | 17.06 | 13.83 | 1.18  | 0  | 0    | 2.05  |
| 600803 | 600803 | 2017 | 19.3  | 13.31 | 2.01  | 0  | 0    | 3.98  |
| 600803 | 600803 | 2018 | 28.88 | 21.26 | 2.62  | 0  | 0    | 5     |
| 600803 | 600803 | 2019 | 31.42 | 24.29 | 2.34  | 0  | 0    | 4.79  |
| 600180 | 600180 | 2010 | 7.76  | 7.28  | 0.48  | 0  | 0    | 0     |
| 600180 | 600180 | 2011 | 4.65  | 4.1   | 0.55  | 0  | 0    | 0     |
| 600180 | 600180 | 2012 | 18.62 | 14.3  | 1.04  | 0  | 0    | 3.28  |
| 600180 | 600180 | 2013 | 18.24 | 13.89 | 1.88  | 0  | 0    | 2.47  |
| 600180 | 600180 | 2014 | 16.61 | 13.15 | 0.94  | 0  | 0    | 2.52  |
| 600180 | 600180 | 2015 | 62.1  | 13.96 | 11.85 | 15 | 17   | 4.29  |
| 600180 | 600180 | 2016 | 19.58 | 13.95 | 1.07  | 0  | 0    | 4.56  |
| 600180 | 600180 | 2017 | 19.43 | 14.49 | 0.82  | 0  | 0    | 4.12  |
| 600180 | 600180 | 2018 | 16.3  | 13.03 | 0.49  | 0  | 0    | 2.78  |
| 600180 | 600180 | 2019 | 16.66 | 14.04 | 0.24  | 0  | 0    | 2.38  |
| 600119 | 600119 | 2010 | 15.73 | 8.86  | 1.87  | 0  | 0    | 5     |
| 600119 | 600119 | 2011 | 21.13 | 13.9  | 2.23  | 0  | 0    | 5     |
| 600119 | 600119 | 2012 | 21.91 | 15.05 | 1.86  | 0  | 0    | 5     |
| 600119 | 600119 | 2013 | 17.96 | 13.98 | 1.89  | 0  | 0    | 2.09  |
| 600119 | 600119 | 2014 | 21.41 | 14.44 | 2.08  | 0  | 0    | 4.89  |
| 600119 | 600119 | 2015 | 20.8  | 16.69 | 1.9   | 0  | 0    | 2.21  |
| 600119 | 600119 | 2016 | 21.86 | 18.99 | 1.56  | 0  | 0    | 1.31  |
| 600119 | 600119 | 2017 | 2.59  | 2.19  | 1.81  | 0  | 0    | -1.41 |
| 600119 | 600119 | 2018 | -2.41 | -3.44 | 1.26  | 0  | 0    | -0.23 |
| 600119 | 600119 | 2019 | 18.13 | 11.5  | 1.63  | 0  | 0    | 5     |
| 300350 | 300350 | 2011 | 20.2  | 14.78 | 0.92  | 0  | 0    | 4.5   |
| 300350 | 300350 | 2012 | 19.73 | 17.68 | 0.4   | 0  | 0    | 1.65  |
| 300350 | 300350 | 2013 | 18.58 | 14.85 | 0.75  | 0  | 0    | 2.98  |
| 300350 | 300350 | 2014 | 15.29 | 10.81 | 0.88  | 0  | 0    | 3.6   |
| 300350 | 300350 | 2015 | 17.1  | 13.7  | 0.72  | 0  | 0    | 2.68  |
| 300350 | 300350 | 2016 | 17.74 | 14.63 | 0.58  | 0  | 0    | 2.53  |
| 300350 | 300350 | 2017 | 11.29 | 7.05  | 0.54  | 0  | 0    | 3.7   |

|        |        |      |       |       |      |   |   |       |
|--------|--------|------|-------|-------|------|---|---|-------|
| 300350 | 300350 | 2018 | -2.62 | -2.88 | 0.67 | 0 | 0 | -0.41 |
| 300350 | 300350 | 2019 | -3.51 | -3.22 | 0.69 | 0 | 0 | -0.98 |
| 002930 | 2930   | 2015 | 18.2  | 13.34 | 0    | 0 | 0 | 4.86  |
| 002930 | 2930   | 2016 | 18.47 | 13.48 | 0    | 0 | 0 | 4.99  |
| 002930 | 2930   | 2017 | 20.15 | 13.88 | 1.27 | 0 | 0 | 5     |
| 002930 | 2930   | 2018 | 25.71 | 19.49 | 1.22 | 0 | 0 | 5     |
| 002930 | 2930   | 2019 | 28.15 | 22.02 | 1.13 | 0 | 0 | 5     |
| 002889 | 2889   | 2014 | 17.93 | 12.12 | 0    | 0 | 0 | 5.81  |
| 002889 | 2889   | 2015 | 17.77 | 11.74 | 0    | 0 | 0 | 6.03  |
| 002889 | 2889   | 2016 | 20.71 | 11.62 | 1.67 | 0 | 0 | 7.42  |
| 002889 | 2889   | 2017 | 19.03 | 11.39 | 1.33 | 0 | 0 | 6.31  |
| 002889 | 2889   | 2018 | 19.79 | 12.02 | 0.93 | 0 | 0 | 6.84  |
| 002889 | 2889   | 2019 | 22.16 | 13.63 | 1.29 | 0 | 0 | 7.24  |
| 002800 | 2800   | 2013 | 15.68 | 14.03 | 0    | 0 | 0 | 1.65  |
| 002800 | 2800   | 2014 | 15.19 | 13.23 | 0    | 0 | 0 | 1.96  |
| 002800 | 2800   | 2015 | 18.34 | 13.85 | 2.14 | 0 | 0 | 2.35  |
| 002800 | 2800   | 2016 | 21.45 | 15.64 | 3.45 | 0 | 0 | 2.36  |
| 002800 | 2800   | 2017 | 22.04 | 16.01 | 2.51 | 0 | 0 | 3.52  |
| 002800 | 2800   | 2018 | 15.84 | 9.26  | 1.58 | 0 | 0 | 5     |
| 002800 | 2800   | 2019 | 19    | 11.17 | 2.83 | 0 | 0 | 5     |
| 002769 | 2769   | 2012 | 14.78 | 12.03 | 0    | 0 | 0 | 2.75  |
| 002769 | 2769   | 2013 | 14.9  | 11.78 | 0    | 0 | 0 | 3.12  |
| 002769 | 2769   | 2014 | 17.64 | 12.33 | 2.9  | 0 | 0 | 2.41  |
| 002769 | 2769   | 2015 | 22    | 16.47 | 2.88 | 0 | 0 | 2.67  |
| 002769 | 2769   | 2016 | 22.93 | 17.8  | 2.42 | 0 | 0 | 2.71  |
| 002769 | 2769   | 2017 | 16.19 | 10.71 | 2.34 | 0 | 0 | 3.14  |
| 002769 | 2769   | 2018 | 18.66 | 12.71 | 2.35 | 0 | 0 | 3.6   |
| 002769 | 2769   | 2019 | 17.97 | 10.62 | 2.35 | 0 | 0 | 5     |
| 002492 | 2492   | 2010 | 19.12 | 14.66 | 0.2  | 0 | 0 | 4.26  |
| 002492 | 2492   | 2011 | 21.62 | 16.68 | 0.17 | 0 | 0 | 4.77  |
| 002492 | 2492   | 2012 | 23.14 | 18.09 | 1.13 | 0 | 0 | 3.92  |
| 002492 | 2492   | 2013 | 19.87 | 14.05 | 2.07 | 0 | 0 | 3.75  |
| 002492 | 2492   | 2014 | 18.8  | 13.36 | 1.95 | 0 | 0 | 3.49  |
| 002492 | 2492   | 2015 | 18.25 | 12.55 | 1.77 | 0 | 0 | 3.93  |
| 002492 | 2492   | 2016 | 18.56 | 13.48 | 1.64 | 0 | 0 | 3.44  |
| 002492 | 2492   | 2017 | 18.35 | 14.56 | 1.6  | 0 | 0 | 2.19  |
| 002492 | 2492   | 2018 | 20.32 | 13.97 | 1.98 | 0 | 0 | 4.37  |
| 002492 | 2492   | 2019 | 20.83 | 14.07 | 1.76 | 0 | 0 | 5     |
| 002010 | 2010   | 2010 | 22.59 | 15.14 | 4    | 0 | 0 | 3.45  |
| 002010 | 2010   | 2011 | 20.49 | 13.88 | 4    | 0 | 0 | 2.61  |
| 002010 | 2010   | 2012 | 22.94 | 15.78 | 4    | 0 | 0 | 3.16  |
| 002010 | 2010   | 2013 | 24.92 | 17.75 | 4    | 0 | 0 | 3.17  |
| 002010 | 2010   | 2014 | 24.91 | 17.05 | 4    | 0 | 0 | 3.86  |
| 002010 | 2010   | 2015 | 25.01 | 16.62 | 4    | 0 | 0 | 4.39  |
| 002010 | 2010   | 2016 | 23.61 | 14.61 | 4    | 0 | 0 | 5     |
| 002010 | 2010   | 2017 | 20.34 | 11.34 | 4    | 0 | 0 | 5     |
| 002010 | 2010   | 2018 | 23.67 | 14.67 | 4    | 0 | 0 | 5     |
| 002010 | 2010   | 2019 | 25.93 | 18.23 | 4    | 0 | 0 | 3.7   |

## **APPENDIX B**

### **Interview Questions**

#### **Introduction**

Thank you for agreeing to take part in this interview. I am a research student from London Metropolitan University. My research topic is “Green Finance and Corporate Social Responsibility Management for Business Development and Sustainability in the Chinese Chemical Logistics Industry”.

The aims of the research are to seek CSR management and green finance for business development to support business sustainability under the global call for carbon peak and carbon neutrality. The general research question is ‘How will CSR and Green Finance influence the business finance performance and sustainable development in Chinese Chemical Logistics industry?’.

I would like to conduct an interview with you to have a better understanding of the relationship between Corporate Social Responsibility and company performance, Green Finance and sustainable development in the Chinese Chemical logistics industry.

The interview will take approximately about 30 minutes depending on how much information you would like to share. With your permission, I would like to record the interview in note form because I don’t want to miss any of your comments. All responses will be kept confidential. This means that your de-identified interview responses will only be used by myself for my research and data analysis under this research topic. I will ensure that any information I include in my thesis does not identify you as a respondent. You may decline to answer any question or stop the interview at any time and for any reason. I understand that all your responses are just based on your knowledge from this industry and not reflect any views from the companies where you are employed.

Are there any questions before I start the interview?

Interview Questions :

1.
  - a) First of all, would you mind doing some introduction for yourself?
  - b) Then would like to tell me something about the risk management of Chinese chemical logistics industry/company?
2. What is your attitude or suggestion for making good risk management in Chinese chemical logistics industry?
3. Based on your general knowledge, how would you describe CSR development in Chinese Chemical Logistics Industry?
4. In current practice, per to your view, Does CSR contribute to company performance? Should Chinese Chemical logistics companies promote CSR practice as part of their risk management?
5. Would you mind introduce how have been the Chinese Chemical logistics companies financed?
6. Have you ever worked/involved in the Green Finance project? If yes, please kindly share some your views, if not yet, would you mind share some examples/information you know from the industry.
7. In your opinion should Chinese chemical logistics companies to promote Green Finance? And tell me more about your thinking for it.

Thank you for participating!