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# Impacts of the e-centralized procurement platforms on business operations - Based on a study of Hebei Construction Group

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# IMPACTS OF THE E-CENTRALIZED PROCUREMENT PLATFORMS ON BUSINESS OPERATIONS - BASED ON A STUDY OF HEBEI CONSTRUCTION GROUP

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2024

I hereby declare that this DBA dissertation is my original work and it has been written by me in its entirety. I have duly acknowledged all of the sources of information which have been used in this DBA dissertation.

The DBA dissertation has also not been submitted for any degree in any university previously

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29 February 2024

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## ABSTRACT

Thanks to the rapid development of Internet technology, enterprises make an important innovation and they launch e-centralized procurement platforms in procurement activities. Taking Hebei Construction Group for a case study, this paper aims to explore the impact of E-Centralized Procurement Platforms on business operations, and comprehensively evaluates the impact of E-Centralized Procurement Platforms on enterprises' performance by means of theoretical review, case study, empirical research, and questionnaire.

Chapter 1 firstly presents the problems of this paper and introduces the background and significance of the selected topic. Hebei Construction Group is primarily engaged in the construction industry, so this paper is of great significance in exploring how E-Centralized Procurement Platforms affect business operations. Meanwhile, Chapter 1 outlines the methodology and structure of this paper in the research idea section.

Chapter 2 provides an in-depth discussion of the concept of E-Centralized Procurement Platforms and related theories and explains in detail the procurement costs and components as well as the advantages of centralized procurement. It also implies relevant theories such as transaction cost theory, bilateral market theory, and scale effect theory in the research to help understand how E-Centralized Procurement Platforms affect business operations. The literature review section reviews the procurement management of enterprises, procurement platform-related studies, and related

literature reviews to provide theoretical support for the subsequent research.

Two research hypotheses are specified in Chapter 3 based on theoretical analysis and real-world observation, laying a foundation for the subsequent empirical research.

Chapter 4 makes clear the research design, including the methods of case analysis, empirical research and questionnaire survey. The case study of Hebei Construction Group's centralized procurement platform reveals the basic features of the platform and its impact on business operations. The empirical research provides a solid foundation for the findings through synthetic control method and DID method. The questionnaire and empirical analysis also provide perspectives from suppliers, further supporting the findings.

Chapter 5 summarizes the research results. First, the case study of Hebei Construction Group's centralized procurement platform reveals the basic features of the platform and its positive impact on business operations. Next, findings of the empirical research show that E-Centralized Procurement Platforms have a significant impact on corporate profits, either through the synthetic control method or the DID method.

Finally, Chapter 6 showcases conclusions, emphasizes the positive impact of E-Centralized Procurement Platforms on business operations and puts forwards management recommendations. The findings are of reference value to Hebei Construction Group and other players in China's construction industry, helping to optimize the procurement process, enhance enterprises' performance, and achieve better business results.

**Keywords:** E-Centralized Procurement Platforms, case study, supplier questionnaires.

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# Chapter 1 Introduction

## 1.1 Problem formulation

Starting from the improvement of business performance by the ECPP in the construction industry, this paper is to analyze and demonstrate in a comprehensive and in-depth manner the significant impact of the E-Centralized Procurement Platforms (the "ECPP") in upstream and downstream companies in the construction industry. In particular, we will deepen our understanding by exploring the following key issues:

1. Advantages and value of the ECPP:

We will delve into the advantages and value of the ECPP and provide a comprehensive discussion of their contribution to improving business performance from different theoretical perspectives. First of all, the enterprise transaction cost theory will help us understand how the ECPP can reduce procurement costs, minimize information asymmetry, and streamline the procurement process. Sharing economy and platform economy theories will highlight how the ECPP create shared value, propel resource utilization efficiency, and facilitate multi-party collaboration. These theoretical frameworks will provide a profound theoretical foundation to explain why more and more traditional enterprises choose to establish or use the ECPP to realize enterprise upgrading and performance improvement.

2. The impact of the ECPP on the business performance of industrial chain core enterprises:

By taking the ECPP of Hebei Construction Group as a typical case, we will conduct an in-depth case analysis. In this process, we will collect a large

amount of platform and enterprise related data and adopt empirical research methods in order to gain an in-depth understanding of the actual impact of the ECPP on business performance. Through exhaustive case analysis and empirical research, we will provide sufficient evidence proving the significant positive impact of the ECPP on the business performance of core enterprises, including but not limited to increasing profits, reducing procurement costs, and improving supply chain efficiency. This in-depth empirical analysis will contribute to a more comprehensive understanding of the real and specific impacts of the ECPP on enterprises and provide a reliable basis for our subsequent conclusions and policy recommendations.

3. Impacts of the ECPP on affiliates:

To gain a more comprehensive insight into the global value of the ECPP, we will delve into the impact on upstream enterprises (i.e., suppliers of core enterprises in the industrial chain). Our results show that SMEs gain more orders and credit endorsements by participating in the ECPP, which is mainly attributed to the open and transparent procurement management model adopted by the ECPP. This model promotes fair competition among suppliers and reduces transaction costs. This provides opportunities for weaker SMEs to participate in the bidding and procurement of large construction companies and enjoy supply chain financial support. Therefore, by studying in depth the impact of the ECPP on the participating enterprises, we will gain a more comprehensive understanding of its importance to the industry as a whole, and in particular, its facilitating effect on SMEs.

This paper explores in depth the significant advantages of the ECPP in improving business performance, reducing costs, and promoting win-win

cooperation through rich theoretical analysis, insightful case studies, and detailed empirical research. This will provide rich data and profound insights for corporate decision makers, policy makers and relevant stakeholders, which will help guide future business strategies and policy making, and promote the construction industry to develop in a more sustainable and competitive direction, thus bringing positive impacts to the industry as a whole.

## 1.2 Background and significance

### 1.2.1 Macro background

The construction industry, as a pillar industry of China's national economy, plays an indispensable role and contributes greatly to the development of the national economy and society. China's construction industry has not only continued to expand in scale, but also promoted in quality and efficiency over the years, creating a series of achievements that have attracted the world's attention. According to the National Bureau of Statistics, the added value of China's construction industry has reached 7.01% of GDP in 2021. It is worth mentioning that under the construction industry has still maintained a steady growth with a share of over 7% even amid the Covid-19, consolidating its position as a pillar industry.

However, the current challenges and opportunities have also become increasingly obvious. China's urbanization process has entered the mid-to-late stage of rapid development. Urban renewal has become an important direction of development, and the growth space of new projects is gradually restricted. China's construction industry is also gradually leaving the "era of overall increase" and focusing more on high-quality development, and the business model has shifted from traditional large-scale new construction projects to the

co-existence of new construction and renewal of existing projects. From Japan's experience, although the growth rate of China's construction industry has slowed down, the overall scale has not declined significantly, and it is expected to maintain steady growth in the future and continue to play an important role as a pillar industry.

The Chinese government introduces high-quality development plans and policy advice, requiring the construction industry to undergo transformation and upgrading to boost quality and efficiency. However, a unique issue facing China’s construction industry is the conflict between scale and efficiency. Large enterprises have higher costs than small enterprises, which in turn have higher costs than project managers under the project contracting system. This has led to the relative competitive advantage of the contracting system in the construction industry. The deep-seated reason is that large enterprises have difficulty in taking full advantage of economies of scale, including economies of scale in procurement. The difficulty for large enterprises to take advantage of economies of scale in procurement is partly due to their lack of capacity to implement centralized procurement. The fundamental reason for this lack of capacity is that companies have difficulty accurately mastering project resource plans, adapting to the complex supply conditions of a project, and standardizing and operating procurement across the board. As a result, the procurement cost of equipment and materials accounts for about 60% of the project cost. Whether the procurement management of equipment and materials is efficient or not is directly related to the profit and loss of the whole project. The management of suppliers in the process of equipment material procurement management is particularly important.

ECPP has become an important strategic entry point for the digital transformation of Chinese construction enterprises. In recent years, large construction companies in China have launched ECPPs, optimizing and upgrading their procurement management and supply chains by making full use of the integration capabilities of the Internet. The ECPPs have not only advanced supply chain management and standardized the transaction process, but also greatly reduced transaction costs. ECPPs also promote standardized transactions and contracting between upstream and downstream enterprises, simplify the communication process, and greatly reduce transaction costs. For private SMEs, ECPPs provide more orders and credit endorsement, which helps enhance their market position. Taking Hebei Construction Group as an example, the group has significantly reduced costs and increased efficiency for participating enterprises since it launched its ECPP for the construction industry in 2015. This case provides us with a typical research sample that demonstrates the application and potential of ECPP in the construction industry.

Research and practice in this area will continue to drive the digital transformation of China's construction industry, providing more opportunities and possibilities for high-quality development. Through more in-depth research and practice, we can better understand the current situation and future trends of the construction industry and make more contributions to the upgrading and sustainable development thereof. Meanwhile, the sustained development of the construction industry will continue to make positive contributions to the stable growth of the national economy and the sustainable progress of the society.

### 1.2.2 Overview of China's construction industry

(1) Overall situation

As one of China's pillar industries, the construction industry is an important part of the national economy. With the deepening of reform and opening up and the sustained development of the national economy, the construction industry has also developed rapidly. According to the data of National Bureau of Statistics of China, the gross output value of China's construction industry has shown an increasing trend year by year in the past 10 years, as shown in Figure 1.1. It can be seen that the gross output value of the construction industry grew from RMB13.7 trillion in 2012 to RMB31.2 trillion in 2022, going up by 127.74%.

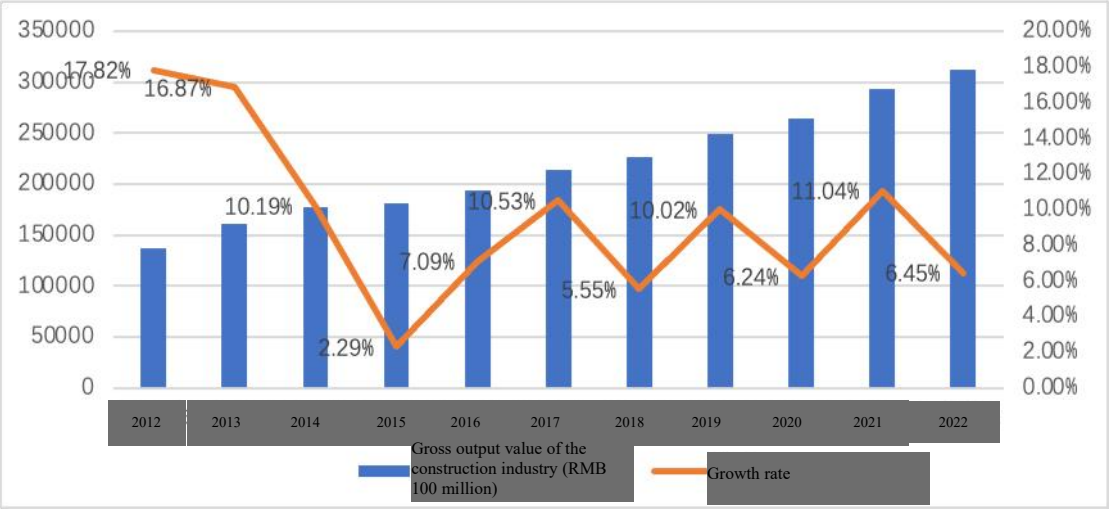



**Figure 1.1 Output value of China's construction industry, 2012-2022 (RMB 100 million)**

Source: National Bureau of Statistics of China

In recent years, China's construction industry has enjoyed mammoth development, which is mainly reflected in the following aspects. First, the gross output value of the construction industry increases continuously. It has

grown by about RMB17 trillion over the past 10 years or so, accounting for 26.1% of the GDP. Secondly, the number of enterprises in the construction industry has been increasing. According to the National Bureau of Statistics of China, the number of enterprises in China's construction industry has shown a year-on-year increasing trend, as shown in Figure 1.2. It can be seen that the number of enterprises in the construction industry grew by 91.47% from 75,000 in 2012 to 143,600 in 2022.

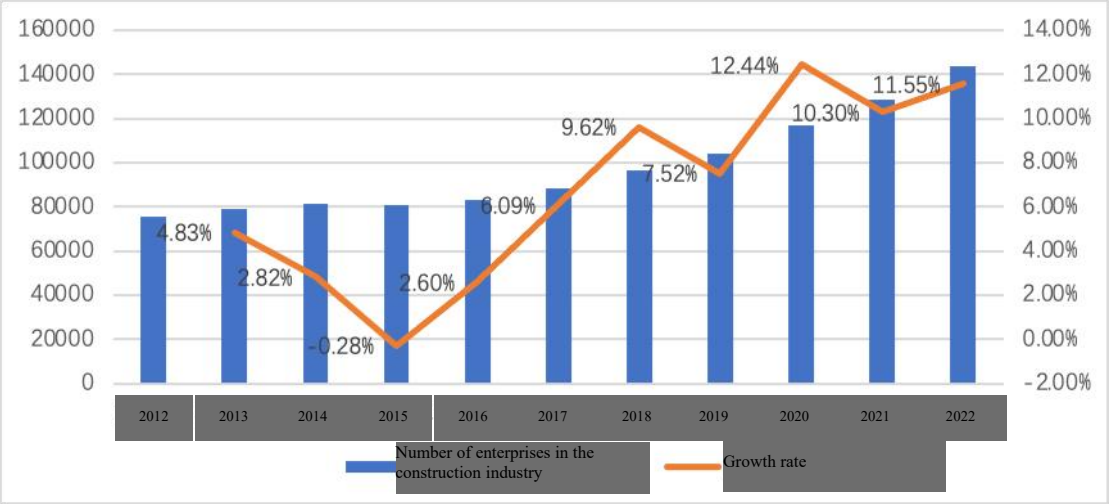



**Figure 1.2 Number of enterprises in the construction industry in China, 2011-2022**

Source: National Bureau of Statistics

Thirdly, China's construction industry has made outstanding contributions to employment. Although there is a slight decline in the scale of employment due to the Covid-19 outbreak in 2019-2022, the scale of employment in China's construction industry still remains at a high level, with 51,840,200 employees in 2022, accounting for 7% of China's total employment (11 provinces have more than 2 million employees in the construction industry).

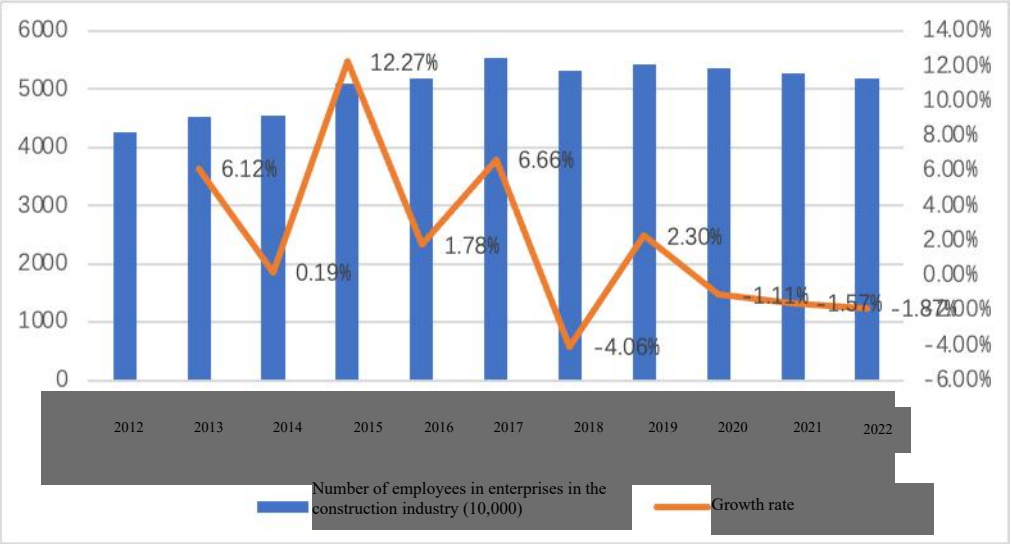



**Figure 1.3 Number of employees in China's construction industry, 2012-2022 (10,000)**

Source: National Bureau of Statistics of China

Fourthly, the total amount of contracts signed by China's construction industry continues to rise, from RMB24,734 billion in 2012 to RMB71,567 billion in 2022, and maintains a high growth rate, with an average growth rate of 11.27% from 2012 to 2022, and the actual average growth rate is still above 8% after excluding the factor of inflation, which indicates that the construction industry is still maintaining its growth trend.

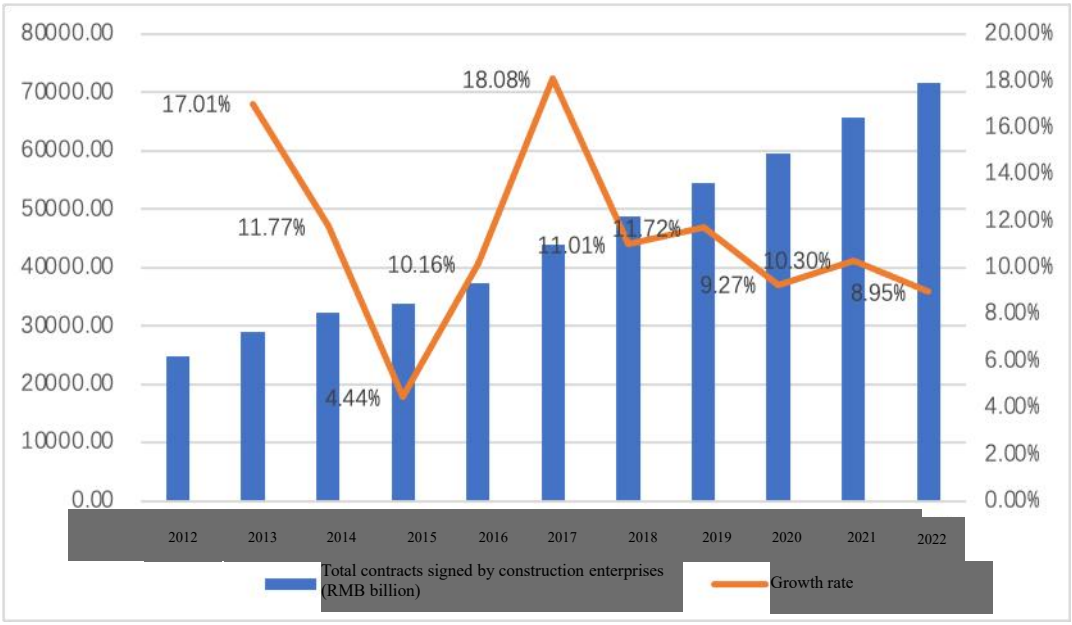



**Figure 1.4 Total contracts signed by China's construction industry, 2012-2022 (RMB billion)**

Source: National Bureau of Statistics of China

Fifthly, in terms of profit of China's construction industry, the profit of China's construction enterprises has continued to rise from 2012 to 2022, growing from RMB 477.6 billion in 2012 to RMB 863.9 billion in 2022, with an average growth rate of 6.24%, and taking into account that China's average inflation rate during the same period is at the highest of 3%, the actual average growth rate of profit of the construction industry in 2012-2021 is at least 2.24%, which is still a high level of growth, indicating that the overall business condition of China's construction industry is good.

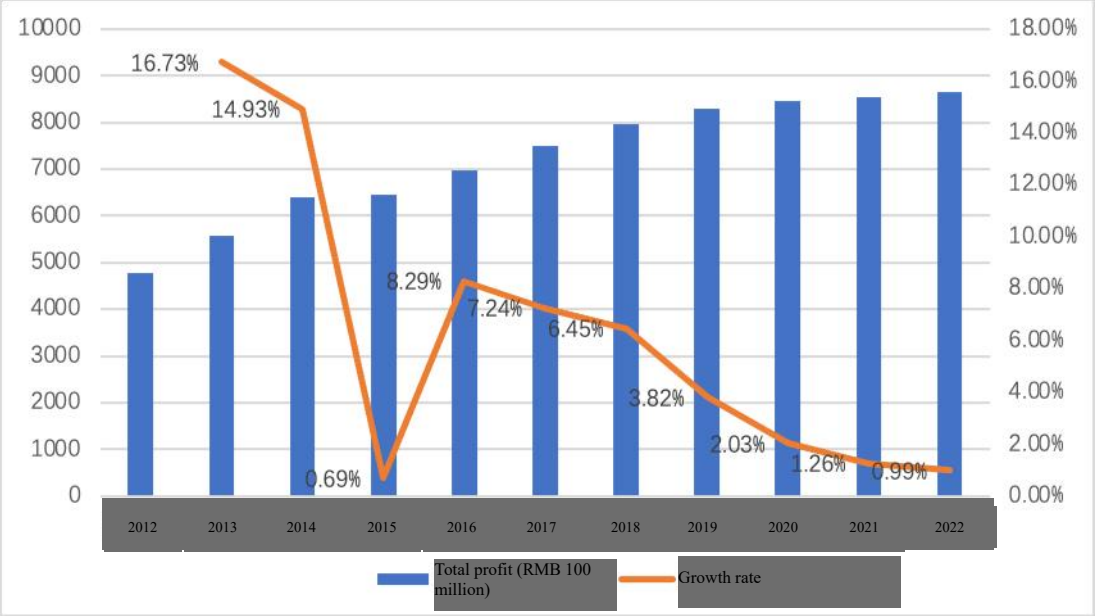



**Figure 1.5 Profit scale of China's construction industry, 2012-2022 (RMB 100 million)**

Source: National Bureau of Statistics of China

(2) Development trend of China's construction industry

In recent years, players of China's construction industry have established a series of landmark projects on the international stage, including the Qinghai-Xizang Railway, China's West-to-East Gas Transmission Project, and the Shanghai World Expo Exhibition and Convention Center Project. The successful construction of these projects highlights China's unique engineering appeal and outstanding construction capabilities, while also serving as a catalyst for China's modern construction industry to move forward.

The Qinghai-Xizang Railway, one of the world's highest-altitude and longest-spanning railways, represents the pinnacle of Chinese engineering. The railway not only breaks through the engineering challenges of extreme conditions such as high altitude and bad weather, but also closely connects China's western region to the mainland, boosting regional economic prosperity

and improving people's living standards. It demonstrates the outstanding ability of China's construction industry to carry out large-scale projects in complex geographic environments.

China's West-to-East Gas Transmission Project, on the other hand, faced unprecedented technical challenges. The complexity and variability of this project required the builders to overcome harsh geological conditions, extreme weather and changing engineering requirements. However, China successfully transmits natural gas from the western region to the eastern cities, providing a solid foundation for China's energy supply chain. This project not only demonstrates the ingenuity and skill of Chinese engineers, but also contributes significantly to the sustainable growth of the Chinese economy. The Shanghai World Expo Exhibition and Convention Center project represents China's technological prowess and modernity on the international stage. This project combines the latest technological achievements and provides a platform for the world to showcase innovation and technological achievements. By designing and constructing this modern pavilion, Chinese architects and engineers have demonstrated to the world China's ambitions and achievements in the fields of science, culture and technology.

However, despite the remarkable success of these landmark projects, China's construction industry is also facing increasing international competition and internal challenges. The number of Chinese construction companies continues to grow and competition in the sector is becoming more intense. This situation has been particularly pronounced in recent years and requires practical and effective measures to deal with it. China's construction industry is therefore in urgent need of transformation and upgrading. This

includes continuous innovation in technology and management to improve project efficiency and quality. At the same time, Chinese construction companies need to actively expand their international markets, strive for more international projects and enhance their international competitiveness. In addition, focusing on environmental protection and sustainable development will also become the future development trend of China's construction industry to meet the global demand for sustainable construction. In conclusion, China's construction industry has made noteworthy achievements in the international arena, but also faces challenges and opportunities. Through innovation, internationalization and sustainable development, China's construction industry can continue to lead and contribute to the future of the global construction industry.

China's construction industry has faced tremendous opportunities and challenges in recent years. Although China's engineering and construction is highly regarded worldwide, the traditional construction industry is facing a number of dilemmas and needs to be transformed and upgraded to meet increasingly complex market demands and the pressures of international competition.

First, China's manufacturing sector is facing a number of bottlenecks, which also have a direct impact on the construction industry. Manufacturing is an important part of the construction industry, and the cooperation between the two is increasingly significant. However, the construction industry must look for breakthroughs to settle bottlenecks in manufacturing development. This includes improving productivity, optimizing supply chain management, and efficiently conducting engineering projects. To meet this challenge, the

construction industry needs to strengthen its collaboration with the manufacturing industry to jointly drive innovation in technology and production processes and thus achieve high quality and efficiency in construction projects.

Second, new materials bring new opportunities and challenges to the construction industry. The application of new materials usually requires new technologies and processes, so the construction industry must continue to break down technical barriers and explore and innovate native technologies. New materials offer more options in terms of building construction, energy efficiency, environmental protection and safety, but the construction industry needs to continuously learn and adapt to them to ensure their successful application in projects. It also provides the construction industry with the opportunity to lead the way in technological and material innovation to meet escalating market demands.

Thirdly, the Internet and information technology boom has led to new work patterns and efficiency gains across a wide range of industries. However, the construction industry has a lower fit with the Internet when compared with the Internet industry. Although the construction industry has accumulated certain experience in academic research, the full application and integration of the Internet is still in the exploratory stage in the construction industry. The construction industry needs to more actively integrate Internet thinking and utilize Internet platforms and information and communication technologies to organically integrate the Internet with the industry chain in the sector. This includes not only digital project management and optimization of the construction process, but also innovation in areas such as marketing, project

bidding and information sharing. The wide application of Internet technology will help improve the efficiency, transparency and customer satisfaction of the construction industry, thus promoting the transformation and upgrading of the entire industry.

As we enter the era of a new round of technological revolution, countries are striving to become technological powerhouses and actively responding to the rapid development of digital technology. Technological terms such as Internet, Internet of Things, cloud computing, blockchain, big data, artificial intelligence and so on have become hotspots in people's lives, and the development of digital technology has set off a global boom. This wave of technological revolution has brought infinite opportunities and challenges to the construction industry, especially in China, a country with strong technical and engineering strength.

The Chinese government has set the goal of building a "Digital China" to accelerate the construction of a digital society. The core concept of this goal is to promote the in-depth integration of digital technology with the real economy, to realize the transformation and upgrading of traditional industries, give rise to new industries, new business forms and new models, and further strengthen the new engine driving economic development. This initiative provides a solid policy foundation for China's digital development. Especially in China, the construction of digital cities is rapidly emerging as a wave. In this wave, the construction industry has also begun to take steps towards digitization and application industrialization. Promoting digital transformation, the comprehensive development strategy is an important measure to lead the construction industry towards digital social and economic development.

China's smart city construction is a breakthrough, which not only improves the digitalization level of the city, but also brings broad opportunities for the construction industry. Intelligent construction is an important direction in China's digital city construction. The wide application of digital technology enables the construction industry to achieve a higher level of automation, intelligence and informationization. Intelligent construction is a huge opportunity for the future of the construction industry, which drives the industry into the digital era and redefines the way of working and efficiency of the traditional construction industry. Through digital technology, the construction industry can digitize the building environment and achieve a high degree of information interoperability during the design, construction and maintenance phases of a project. It helps boost efficiency, reduce waste and improve the quality and safety of projects. The application of big data analytics and artificial intelligence also enables the construction industry to better predict and solve problems. In short, China's digital development and digital city construction present unprecedented opportunities for the construction industry. Digital transformation is complex but urgent, but also offers great potential for the future of the industry. Through the wide application of digital technology, the construction industry can continue to increase efficiency, reduce costs, improve project quality, and provide more powerful support for China's urban development and international competition.

(3) The current situation of procurement in China's construction industry

There is a strange phenomenon in China's construction industry: there is no economy of scale, as most projects are implemented under the contracting

system. That is, the cost of large enterprises is higher than the cost of small ones; the cost of small enterprises is higher than the contracting project manager, and the project contracting system is quite competitive. The deep-seated reason behind this phenomenon is that large enterprises cannot give full play to the advantages of economies of scale, including economies of scale in procurement as they lack of ability to implement centralized procurement. The lack of centralized procurement ability lies in the inability of the headquarters to accurately grasp the project resource plan, and their failure to adapt to the project's complex conditions of supply, and realize the standardized and online operation of procurement. Therefore, in the project cost, the procurement cost of equipment and materials accounts for about 60%, and good management of equipment and materials procurement will be related to the profit and loss of the whole project. The management of suppliers is an important part in the process of equipment material procurement management.

To be specific, there are several problems in China's current construction materials procurement management work:

(1) Information on construction material procurement management is not perfect. First of all, material procurement in construction projects usually involves a large number of types of materials and quantities, which makes information management complicated. Information exchange and collaboration between suppliers, purchasers, construction project managers and other relevant parties are needed to ensure the smooth supply and procurement of materials. However, due to information asymmetry, there may be barriers to information transfer, leading to miscommunication and misunderstanding. Secondly, procurement of construction materials will

generate high economic profits, thus attracting many suppliers to compete in the market. This competition, while favoring purchasers, also makes information more complex. Suppliers are highly competitive with each other and are usually reluctant to share information for fear of losing their competitive edge. This leads to information asymmetry, and it is often difficult for purchasers to obtain true information about material suppliers, including price, quality, delivery capacity and reliability.

One way to address this problem is to facilitate information sharing by establishing more transparent and efficient information platforms. It may include the establishment of digital supply chain management systems that allow suppliers and buyers to exchange information on a single platform. This will help reduce information asymmetry, increase supply chain visibility and reduce transaction costs. In addition, buyers can request more information from suppliers, such as quality certifications, delivery history and customer feedback, to ensure they can make informed decisions.

(2) The quality of purchased materials is difficult to control. First of all, the quality of materials to be purchased is an integral part of construction projects. If the quality of the materials is substandard, it may lead to structural instability of the building, deterioration of the construction quality, or even jeopardize the safety of the project. Therefore, purchasers need to ensure that the selected suppliers can provide construction materials that meet the standards and specifications to reduce the risks of the project. However, it is difficult for purchasers to conduct in-depth review and monitoring of suppliers' production process and quality control system under short-term contracts. Secondly, the timeliness of delivery is crucial to the management of

the progress of construction projects. Construction projects usually have tight schedules. Any delays in material supply may lead to a lag in the progress, increase construction costs, or even lead to contractual disputes. Short-term contracts and supplier instability make it difficult for purchasers to ensure that materials are delivered on schedule. This requires close collaboration between the purchaser and the supplier to ensure that the supplier can deliver on time and proactively address any potential delivery delays.

One way to address this issue is to build stronger supply chain partnerships. Purchasers can choose long-term partners and establish long-term contracts and strategic relationships with suppliers. This will help increase suppliers' accountability and ensure quality control and timely delivery. In addition, buyers can require more quality assurance and commitment from suppliers to reduce the risk of quality. Another approach is to use modern technology, such as supply chain management software and IoT technology, to monitor the production and delivery process of materials. It will increase buyers' visibility to suppliers, allowing them to track the production and delivery of materials in real time, identify potential problems and take action in a timely manner. The said digital approach helps reduce the risk of substandard materials and delivery delays.

(3) Unstandardized procurement process for construction materials. First of all, connection issues are a major cause of unregulated procurement of construction materials. Construction projects usually involve multiple parties, such as designers, project managers, architects, and construction teams. These parties need to work closely together to ensure that material procurement coincides with the progress of the project. However, problems with

information transfer and collaboration can lead to poorly developed and executed procurement plans. For example, changes in project design or construction progress may require adjustments to the material procurement plan, which can lead to irregularities in procurement if there is poor communication between the parties involved or if changes are not properly managed. Secondly, delay in procurement plan is also a common problem. Material procurement for construction projects usually needs to be planned in advance to ensure that materials can be delivered to the site on time. However, procurement planning is often delayed due to various factors in project management, including project changes, budget constraints, and changes in demand. This can incur emergency purchases, stock-outs and additional costs, reducing the efficiency and quality of procurement. In addition, the complexity of the procurement list is one of the problems that lead to unregulated procurement. Large construction projects involve building materials of multiple types and sizes, so procurement lists can often be long and contain a great deal of detailed information. If the procurement lists are not well managed, problems such as loss of information, wrong ordering, duplicate procurement or failure to procure the required materials can easily occur. This not only wastes time and resources, but may also affect the progress and quality of the project.

To solve these irregular procurement problems, the construction industry can take a series of measures. First, strengthen collaboration and communication between all parties to ensure that the design, budget and construction progress of the project can be coordinated. Second, develop a detailed procurement plan in advance and adjust it according to project needs

at any time. Finally, use modern procurement management software and information systems, to better manage procurement lists, monitor the supply chain and reduce the risk of procurement errors.

(4) Insufficient procurement quantities and unstable suppliers are also important causes of inefficiency in procurement management. First of all, insufficient procurement quantity is a common problem that can lead to a broken material supply chain in construction projects. Different types of materials and equipment usually need to be purchased in large quantities for construction projects, including cement, steel bars, bricks, cables, pipes and so on. Insufficient procurement quantities may result in workers on the construction site having no enough materials to carry out the work, which can lead to stagnation of the project and prolongation of the project cycle. In addition, insufficient procurement quantities can lead to emergency purchases, which are usually more expensive, thus increasing the cost of the project. Then, instability of suppliers is also a common problem, especially in large-scale construction projects. Construction projects usually require the procurement of large quantities of materials in different locations and at different times, thus necessitating cooperation with multiple suppliers. However, supplier instability can lead to untimely supplies, inconsistent quality and delivery problems. Suppliers may interrupt deliveries for various reasons, such as production problems, logistical difficulties or market fluctuations. This can have a serious impact on project progress and quality. High material prices are another issue related to the efficiency of procurement management. Construction projects often require large quantities of materials, including cement, steel, bricks and other building materials. If the price of materials

remains high, it will directly increase the cost of the project. The high cost of materials may force the contractor to cut other aspects of the budget, affecting the quality and schedule of the project. Therefore, price fluctuations and supply instability in the procurement of materials have far-reaching effects on the economic effects of construction projects.

To address these issues, the construction industry can take a number of measures to bolster up the efficiency of procurement management. First, establish long-term supply chain partnerships to stabilize suppliers and reduce supplier instability. Second, establish a rational inventory management system to ensure that there is sufficient inventory to cope with insufficient purchasing quantities. Finally, adopt reasonable procurement strategies, such as regular review of contracts and searching for alternative suppliers, to reduce material costs.

In summary, in response to the above procurement issues, many large Chinese construction companies have optimized their procurement management by establishing their own ECPPs. Currently, there are 14 construction enterprises that have established ECPPs among the 143 listed construction enterprises in China, of which only 3 private enterprises have established ECPPs. From the distribution of the time of the establishment of the ECPP, the existing ECPPs in China were established in 2015-2017, and individual platforms were in 2020. Overall, the experience of the Chinese construction industry in the construction of the ECPP has yet to be accumulated, and the specific impact of the ECPP on enterprises has yet to be further examined.

### 1.2.3 Research significance

Research on the impact of the ECPP on China's construction enterprises and the industry, not only can enrich the existing theoretical research, but also has a very important practical value for promoting the development of China's construction industry and improving the operational efficiency of enterprises. It has a major policy significance for how to promote the high-quality development of China's construction industry. In particular, this paper has the following values:

First, the study of the impact of the ECPP on the performance of construction industry enterprises has strong theoretical significance. The innovative development of traditional industries is always a hot topic in the business and academic circles. The research on the innovative development of the construction industry's ECPPs can enrich the relevant theories such as transaction costs, sharing economy, platform economics, business model innovation in traditional industries, and economies of scale. At present, the research on the innovation model of the construction industry and the ECPP is still in its infancy, and there is a lack of theoretical discussion on the combination of the ECPP and construction enterprises. Academics have yet to form a systematic theoretical framework for this, so the study of the performance improvement of the ECPP on the traditional construction industry is a theoretical contribution to the academic research.

Second, this paper has strong practical significance for the transformation and upgrading of traditional industries. In the era of digital economy, traditional industries can make important progress in improving efficiency, expanding business scope, reducing costs, and improving performance by

adopting digital tools such as Internet platforms. This paper can provide practical references and experiences for traditional enterprises to understand how to realize digital upgrading with the help of Internet platforms by deeply studying the application of the ECPP in the construction industry. This will help improve the competitiveness of traditional industries in the digital economy, maintain their market position, and even create new business opportunities. Especially when the global economy is currently facing many challenges and uncertainties, traditional industries need to innovate and upgrade continuously to adapt to market needs and changes. Traditional industries such as construction need to adapt to rapid changes in society, environment, regulations and technology to provide higher quality products and services. Examining the performance improvement of ECPP for traditional industries can serve as an example to help other traditional industries develop strategies to better cope with real challenges.

Third, this paper has strong policy implications for developing countries to promote the innovative development of traditional industries. The development of China's construction industry is a micro microcosm of China's growth miracle, and exploring the transformation and upgrading of China's construction industry and the application of digitization has strong reference value for all other developing countries. This paper’s theoretical and empirical analysis of ECPP in terms of promoting the development of construction industry enterprises from the micro enterprise level also provides a certain scientific basis for relevant policy makers, and has strong policy significance, i.e., the government can promote the upgrading and innovation of the economy by encouraging and supporting the adoption of digitalization tools,

such as ECPP, in traditional industries. This helps make China's industry more competitive, create more employment opportunities and promote economic growth.

## 1.3 Research idea

The research idea of this paper is shown in Figure 1.1. First of all, the three questions expected to be researched in the paper are initially proposed by sorting out the research background: (1) the advantages and value of the ECPP. (2) The performance enhancement and role mechanism of the ECPP on the core enterprises of the industrial chain. (3) The impact of ECPP on upstream enterprises. Secondly, different research methods will be adopted for the three questions expected to be raised in this paper. This paper mainly discusses the first question from the literature and theory, so as to provide a theoretical basis for the research hereof. For the second question, an empirical analysis is adopted to objectively evaluate the specific impact and transmission mechanism of the ECPP on enterprises in the construction industry. Due to the existence of a large number of SMEs on the ECPP, whose financial data and other information are not publicly available, this paper plans to analyze through interviews or questionnaires for the third question. Finally, this paper unfolds research conclusions and policy recommendations for the above three aspects.

In view of the above research objectives and ideas, this paper is expected to use the following research methods: theoretical analysis, empirical research, questionnaires or interviews. The empirical research is expected to use the combined case study method and multiple regression, which are widely used in the fields of policy evaluation, mechanism analysis and so on.

Questionnaires or interview mainly focuses on the upstream enterprises on the ECPP, and the questions of questionnaires or interview mainly focus on the impact of enterprises joining the ECPP.

The potential innovations in this paper mainly include (1) There is no rigorous quantitative research on the impact of ECPPs on enterprises, and we use cutting-edge econometric methods to accurately calculate this impact. (2) The specific mechanisms of the ECPP's impact on core and upstream and downstream enterprises are not yet clear, either theoretically or empirically, and our study provides a pioneering analysis of the mechanisms involved. (3) By scientifically demonstrating the impact of the ECPP on enterprises, we are able to draw more reliable conclusions, which will provide lessons for the development of the industry and the formulation of policies.

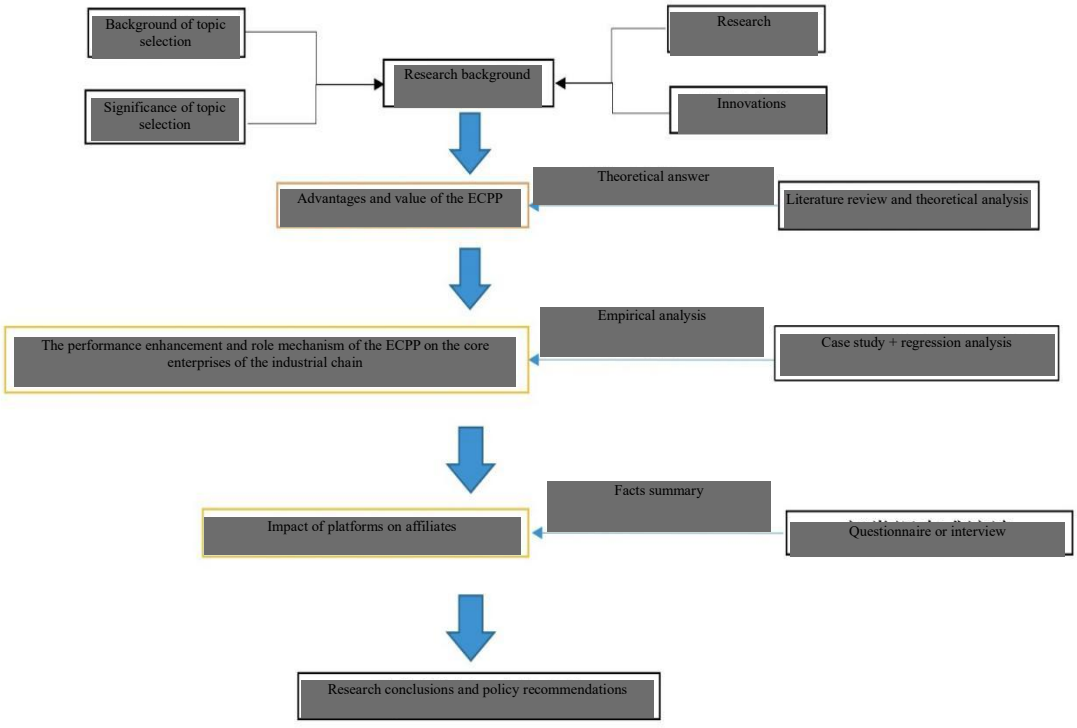



**Figure 1.6 Research ideas**

# Chapter 2 Theory and literature review

## 2.1 Definitions and identification

### 2.1.1 Procurement cost and composition thereof

Procurement usually refers to the behavior of enterprises to obtain products or services from the supply market to meet their needs. Procurement behavior starts from the placement of orders to the end of inventory management, and its responsibility is to form an effective supply of materials to meet the material needs of the enterprise, and to enhance the efficiency by minimizing the cost of materials in the procurement process. Procurement activities play an important role in maintaining the good operation of the project, and procurement cost has gradually become one of the most important aspects of project cost control.

Procurement cost is the sum of costs incurred by all procurement activities. Specifically, it includes the sum of human, material and financial resources invested in each procurement process, such as purchasing from suppliers, packaging, transportation, acceptance and storage. As shown in Figure 2.1, procurement cost includes explicit and implicit costs. Explicit costs mainly refer to the purchase cost of procurement management, office travel costs, material storage costs and so on. Hidden costs are mainly composed of quality costs, stock-out costs, etc., including costs incurred for the disposal of nonconforming products, after-sales service, work stoppages, returns, employee training, supplier evaluation, and other types of procurement-related activities.

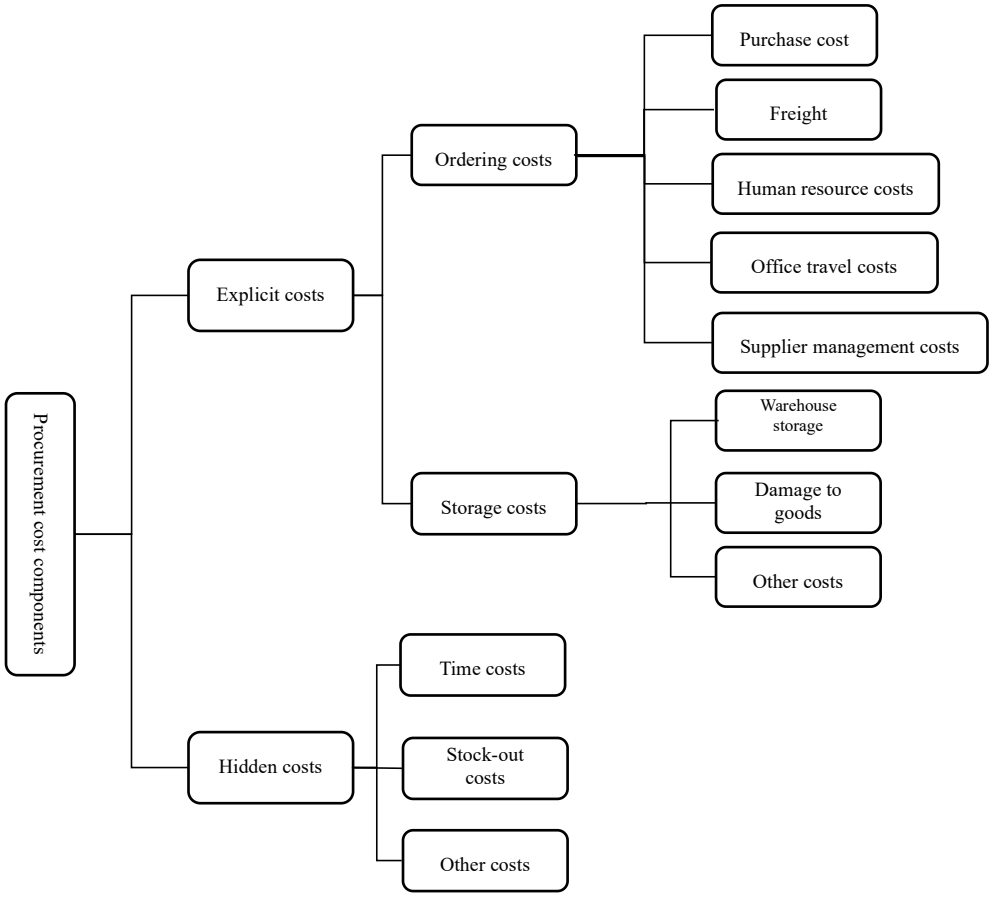



**Figure 2.1 Procurement cost components**

(1) Purchase price and freight and miscellaneous expenses

The purchase price is the price that the buyer is willing to pay to the seller when purchasing a good or service. It is the actual price of the good, usually expressed in monetary units. The purchase price usually varies according to market supply and demand, the quality and quantity of the good and other factors. When discussing the price of a commodity, it is usually the purchase price. Freight and miscellaneous expenses are the various costs associated with the transportation and delivery of goods. These may include freight, loading and unloading, storage, insurance, customs fees, and so on. The exact content of the freight and miscellaneous expenses may vary

depending on the nature of the goods, the mode of transportation and the terms of international trade (e.g. CIF, FOB, etc.). Freight and miscellaneous expenses are usually not included in the purchase price, so buyers need to pay these charges additionally to ensure that the goods reach their destination from the seller.

(2) Order variation costs

Order variation costs are the additional costs associated with changes in order quantities during the production and sales process. These additional costs usually occur when changes or adaptations in production and supply chain management are required. Example:

Changes in direct material costs: If order quantities change, this usually affects the demand for direct materials. More orders typically result in higher direct material costs, while fewer orders may reduce costs.

Changes in direct labor costs: Changes in order quantities may result in the need to adjust the number of workers or hours worked, which will affect direct labor costs. More orders may require more workers, while fewer orders may require fewer workers.

Utilization of production equipment: More orders may require increased utilization of production equipment, such as longer working hours or increased overtime costs. These additional costs can lead to a rise in the cost of order variation.

Changes in inventory management costs: Changes in ordering may result in the need to adjust inventory levels, such as reserve and storage costs. More orders may require more inventory space and overhead.

Changes in transportation and distribution costs: More orders typically

require more transportation and distribution, which may require additional logistics costs.

Changes in other related costs: Other costs associated with changes in order quantities, such as ordering costs, packaging costs, and quality control costs.

(3) Warehousing fixed costs

Warehousing costs are primarily costs associated with warehousing facilities and management that do not vary with changes in storage volume or production. These costs are associated with maintaining and operating warehousing facilities, managing warehousing inventory, and logistics operations, and they exist regardless of the amount of product actually stored. Warehousing fixed costs typically include the following:

Rent or mortgage: If a business leases or owns warehouse space, rent or mortgage payments are usually fixed, regardless of the amount of inventory.

Wages and salaries: Costs associated with the wages and salaries of warehouse employees, including the salaries of warehouse managers, operators and other staff. These costs are usually related to maintaining the warehouse facility and inventory, rather than being proportional to the amount of product actually stored.

Equipment maintenance and depreciation: Costs associated with maintaining and repairing warehouse equipment and depreciating equipment, such as forklifts, shelving, warehouse management systems, etc.

Security and insurance: Costs associated with warehouse security, insurance and security monitoring systems.

Equipment and software: Fixed costs associated with warehouse

management systems or other automated equipment and software.

Real estate and other taxes: Costs associated with real estate taxes, local taxes, and other government taxes and fees on warehouse properties.

Insurance: Costs associated with insurance for warehouse and stored inventory.

(4) Warehousing variable costs

Warehousing variable costs are costs associated with the variable costs of the warehousing and inventory management process. These costs vary with the size of the storage activity and the level of inventory, and are typically associated with the handling, storage, and transportation of inventory. Calculation and management of warehousing variable costs is critical to effective inventory management and cost control. The followings are some of the typical warehousing variable costs:

Freight: include the costs of transporting products from the supplier to the warehouse and distributing them from the warehouse to the customer. It is usually related to transportation distance, weight of goods and delivery service level.

Packaging material costs: the costs of packaging products to protect them during transportation and storage, such as boxes, bags, foam padding, and so on.

Handling costs: associated with logistics and inventory management such as placing products on shelves, removing them from shelves for picking under orders, etc.

Inventory custody costs: costs associated with storing products in the warehouse, including warehouse rent, shelves, shelf maintenance, electricity,

heating, air conditioning, etc.

Inventory insurance costs: costs associated with insuring the stored in inventory.

Order processing costs: costs associated with processing orders, picking, packing, labeling, and shipping products.

Inventory spoilage and expiration costs: the handling and disposal costs associated with products in inventory when they deteriorate, are damaged, or expire.

Inventory capital costs: interest and capital costs incurred as a result of inventory holdings.

(5) Stock-out costs

Stock-out costs, also known as stock-out expenses, are the costs and losses incurred by a business or organization as a result of failing to meet customer demand or failing to provide the required products in a timely manner. This cost is mainly associated with inventory management and supply chain management. Stock-out costs include the following:

Lost sales costs: when a product is out of stock, the business is unable to meet customers' demand, resulting in the loss of potential sales opportunities. The customer may cancel the order, find another supplier, or choose not to purchase the product again. The cost of lost sales is due to the loss of sales resulting from the failure to adequately meet market demand.

Decreased customer satisfaction: Out-of-stocks can damage customer satisfaction with a business, reduce customer loyalty, and may lead to customer churn. Maintaining customer satisfaction and customer loyalty requires a business to invest in additional costs, such as customer service and

maintenance.

Expedited transportation and inventory replenishment costs: to make up for stock-outs, a business may need to take urgent measures, such as air freight or express delivery, to meet customer demand, and these are usually accompanied by high freight. In addition, enterprises may need to purchase much-needed products from suppliers at a higher price to cover inventory gaps.

Rising production or procurement costs: When a business finds that its inventory is insufficient to fulfill orders, it may need to take emergency measures, such as increasing production or expediting the purchase of raw materials. These additional costs may include temporary employee wages, additional production capacity costs, or temporary inventory management expenses.

Reputation and brand damage: Frequent stock-outs may damage the reputation and brand value of a business. Customers may have negative perceptions of a company's reliability and supply chain management, which may have a negative impact on its long-term competitiveness.

Production line downtime costs: For manufacturing companies, stock-outs can lead to production line downtime, which can result in loss of production capacity and efficiency.

Goods expiration costs: Especially for products that are perishable or have a shelf-life, stock-outs may lead to the expiration or deterioration of some of the goods in the inventory, which may result in a loss of the value of the inventory.

(6) Other costs

There are some other costs in procurement activities that also affect procurement costs, such as reasonable losses incurred in procurement activities, selection and sorting costs before the materials are put into stock, loading and unloading and handling costs incurred in procurement activities, and relevant taxes and fees arising from the purchase of materials, etc. Usually, these costs are also included in the cost of materials when they are incurred in procurement activities.

### 2.1.2 Centralized procurement and its advantages

Centralized procurement, in a general sense, refers to the tendency to centralize procurement management within the same enterprise or within the same enterprise group. That is, by centralizing the procurement of the same type of material to reduce the selection risk and time cost of procurement. Specifically, it is to conduct centralized procurement for batch within a certain period of time, time and manpower. "Centralized" function is embodied in the planning budget, procurement commissioning, operation process and logistics acceptance, etc., and it plays a role in promoting the institutionalization, systematization and refinement of materials management of large group enterprises. Centralized procurement gives full play to the advantages of resources, reduces supply costs, strengthens the level of project management, and ultimately maximizes the benefits of enterprises.

Compared with traditional procurement modes, such as unified purchase by the Group, unified purchase and distribution of allocated materials, and decentralized procurement of materials by the project departments centralized procurement has many advantages. In terms of procurement mode, it can adopt various forms such as strategy and bidding. In terms of supplier

selection, it can form an information advantage and boost the quality and quantity of potential suppliers. Regarding the procurement price, it can give full play to the scale effect and occupy the negotiation advantage. With respect to inventory management, it can fully mobilize the resources and give full play to the role of the group's optimal allocation. In terms of procurement funds, centralized settlement can better monitor the flow of funds and at the same time play the role of financing within the group. In the construction of information systems, the group-level management can further promote the promotion and deep application of information technology. In terms of the supervisory function, it can better play the role of preventing and reducing corruption.

For construction enterprises, centralized procurement is to procure products in bulk such as steel, cement, pre-purchased parts, etc. by headquarters or a specialized department when the warehousing, logistics and other supply channels permit, so as to achieve the centralized control of the group's procurement business. The centralized procurement is a mode that collects requests on a regional, variety, project, organization basis and otherwise, and makes procurement according to a unified or prescribed method.

The application mode of centralized procurement generally includes centralized pricing and separate procurement; centralized ordering but separate receipt and payment; centralized ordering, but separate receipt and centralized payment; centralized procurement and then redeployment and other operational modes. Due to characteristics of the project, such as high similarity of purchasing varieties, wide distribution of receiving locations,

non-uniformity of payment cycle, and the actual payer being the user instead of the purchaser, most construction enterprises place orders and make payment on a centralized basis, but receive products separately. To be specific, the project departments, branches and subsidiaries raise procurement application, which will be summarized and adjusted by the headquarters or procurement departments. They will place orders according to the final results and issue notices to the procurement departments for receipt of products; the project departments take and store products according to the notices or purchase orders; the procurement departments gather the in-store forms for settlement with external suppliers, and make internal settlement respectively with the project departments or branches and subsidiaries as per the in-store forms of the project departments.

The significance of centralized procurement is mainly reflected in the centralized quantity, high volume and good price. It saves procurement cost and enhances profitability, unifies procurement standards and optimizes resource allocation, strengthens supervision and reduces management cost and risk. Strategically, it is conducive to the establishment of the strategic system of supply-procurement linkage; in the establishment of the organization, it will promote the management hierarchy and the division of authority; in the budget, it helps implement the comprehensive budget more accurately; in the costing, it can benefit the unification of the parameters, improvement of the timeliness, and the informatization of the management of the materials; in the process control, it can strengthen the supervision and simplify the procurement process; in the financial control, it can better combine procurement and financial management from budget, payment, settlement and other aspects, which is

conducive to the reinforcement of the management level of the whole enterprise in all aspects.

Centralized procurement methods mainly include bidding and bargaining. Among them, bidding procurement is divided into open bidding procurement and inviting bidding procurement according to the form of invitation. In addition, due to the development of centralized procurement, strategic procurement and framework agreement procurement have gradually become common procurement modes.

Grouped construction enterprises have large scale, a large number of projects, wide geographical area, sound organization, many talents, strong management ability and financial strength, which also provide a platform for the implementation of centralized procurement mode and a solid management foundation. For projects under construction, domestic construction enterprises usually take their headquarters as an independent legal person identity (the headquarters will provide all the qualifications for the project preparation). But each project will be subject to independent financial accounting in its construction and the project department is actually responsible for the procurement and for the payment of funds and the use of goods. Therefore, there are primary four procurement modes at this stage: decentralized procurement with each project as the main body, regional procurement with adjacent regions or the same project as a group, centralized procurement led by the group company and e-commerce procurement with the help of a third-party e-commerce platform.

## 2.2 Related theories

### 2.2.1 Transaction cost theory and sharing economy

The centralized procurement platform is essentially an intra-group resource sharing management model. The sharing economy does not extend to the driver analysis. The sharing economy was first seen in the famous assertion made by Nobel economist (Coase, 1960) in The Problem of Social Cost, that is, "when the market is free to transact and the transaction costs tend to zero, no matter who the property rights belong to, the market can spontaneously tend to the optimal allocation of resources". The fees and costs on both sides of the transaction process directly determine the resource allocation and resource substitution between the enterprise and the market (Coase, 1960). Transaction costs are an extremely important part of an enterprise's day-to-day business activities in order to elevate its financial performance, either by increasing profits or reducing costs. Enterprises have to maintain good relationships with all their stakeholders in order to minimize transaction costs. Before a transaction begins, the consideration must be paid for finding and searching for information about raw materials in order to seek comparisons between different suppliers. During the process of transaction, the consideration must be paid for information exchange, bargaining, and bidding with the other party. The consideration must be paid for after-the-fact supervision and service after the transaction is completed.

Many group enterprises are now vigorously developing the sharing economy mode, such as building platforms to promote the sharing of information resources, funds (pool of funds), materials and even space within the group, etc., all of which are cases that group enterprises achieve the

optimization of the allocation and industrial structure upgrading using the "sharing economy". Related studies, such as Lin (2019), take the procurement of Canadian digital resources group as an example, explaining in detail the efficiency growth brought by resource sharing within the book enterprise. Anderson (2016) studies that the "pool of funds" formed as a result of centralized sharing of funds will elevate the group's financing ability, and with the expansion in scale, the group's cost of independent financing will continue to decline. In addition, Wang (2017), through questionnaires, statistically found that at present most of the group informationization system construction is seriously insufficient, and further strengthening a group's information sharing ability can significantly bolster up the reasonable returns of enterprises. Zhou (2019), on the other hand, takes the group pool of funds pioneered by Country Garden as an example to draw out the efficiency changes brought about by Country Garden's cash capital sharing model, which provides references for other enterprises to accelerate intra-group capital turnover.

Centralized procurement is also a form of sharing in the field of procurement. Centralized procurement is characterized by prompting the centralization of supply and demand of materials, management and suppliers, and ultimately forming the sharing of resources and information among subsidiaries. China's scholars have in-depth study on Group centralized material supply. For example, Shao (2002) analyzes the necessity of the group centralized material supply in Chinese enterprises. Through the study of state-controlled large groups, Li (2014) found that how to establish a centralized procurement and supply system that can not only ensure the supply of production and construction materials, but also reduce procurement costs

and efficient operation of materials, has become a very urgent task for large state-owned group companies. Gu (2013) also argues that the centralized procurement management facilitates the sharing of resources and the professional division of procurement business, to enable enterprises to focus on long-term strategies. Shen's (2019) article in Management World summarizes that, by reviewing New China's 70-year procurement history, both the "planned economy" stage and the current "scientific management" "transformation and development" stage in China are essentially the group's integrated planning and is the resource sharing of procurement. Foreign scholars even study China's centralized control market mechanism. Byrd (2019) concludes that, after studying China's market economy and economic reform, China's reformers are trying to implement the "package plan", which has an important impact on the planning and coordination of enterprises, making the sharing of group supplies, equipment and other resources become easier.

### 2.2.2 Bilateral market theory and platform economics

(1) Bilateral market theory

A market in which two groups of participants need to trade through an intermediary layer or platform, and in which the benefits of one group of participants joining the platform depend on the number of the other group of participants joining the platform (Armstrong, 2006), is called a bilateral market. Bilateral markets involve two distinct types of users, each of which derives value from interacting with the other through a shared platform (Wright, 2004). Rochet and Tirole (2004) define and distinguish between bilateral and unilateral markets in the presence of only usage externalities.

Consider a platform that charges buyers and sellers $A_B$ and AS, respectively, for each transaction. If the volume of transactions V realized on the platform depends only on the aggregate price level $A = A_B + A_S$, i.e., the market in which the two parties interact is a unilateral market if it is insensitive to the reallocation of the aggregate price across buyers and sellers. In contrast, if V varies with $A_B$ when A remains constant, the market is bilateral.

Bilateral markets are characterized by distinctive features: first, there are network externalities between the two groups of participants, i.e., inter-market network externalities. Since Katz and Shapiro (1985), there is a large literature on network externalities within markets. However, in some cases, network externalities occur between two markets, such as the media industry, where the utility of a product produced in a particular market varies with the quantity of demand for the product produced in the other market, and vice versa, which is referred to as bilateral network externalities.

Second, a multi-product pricing approach is used. The intermediary or platform must price both products or services it offers. From an empirical and normative point of view, bilateral markets are different from multi-product oligopoly or monopoly (Rochet & Tirole, 2003). However, the literature on multi-product pricing does not consider the issue of externalities in the consumption of different products: using a well-known example to illustrate that the buyer of a razor internalizes the net surplus received from the purchase of a razor blade in his purchase decision. In contrast, bilateral market theory starts from the idea that one type of end-user does not internalize the welfare effects that its use of the platform has on other types of users (Rochet & Tirole, 2004).

(2) Platform Economics

Platform Economics is a new economic discipline which, on the basis of clarifying that platforms are the embodiment of markets, emphasizes the role of market structure by studying the economic nature, attributes and organizational structure of platforms, the competition between and the evolution of platforms, analyzes the development modes of different types of platforms by means of theories of transaction costs and contracts, discusses the impacts of platforms on the society, and puts forward corresponding policies and recommendations (Xu, 2013).

The main characteristics of platforms include the existence of bilateral or multilateral platform structures, cross-network externalities, bilateral dependence on bilateral market demand, long-tailed economic types, asymmetric pricing, platform synergies, and platforms' multigenerational behavior. Platform network externalities are that the externalities of users on one side are determined by the number of users on the same side and the number of users on the other side. These include indirect network externalities (membership externalities), where the number of users on one side of the platform affects the value of users on the other side, and direct network externalities (usage externalities), where the value of the platform is correlated with the number of consumer transactions using the same. The long-tail characteristics subvert the traditional "Pareto's Law", that is, under the platform effect, to reduce marginal costs through the Internet means, enterprises will no longer rely on 20% of high-quality customers for their profits, but begin to focus on a huge number of 80% of the long-tail customers to meet the demand for personalized products.

(3) Platform-based enterprises

Platform-based enterprises are characterized by network externalities, resource integration, functional synergy and derivativeness. Platform-based enterprises mainly operate based on the market environment, regulatory system, users and profit model to promote their long-term stable operation. Wang (2016) analyzes domestic and international research on platform-based enterprises, and concludes that platform-based enterprises provide an openly linked channel for buyers and sellers under reasonable transaction rules, and collect access fees from buyers and sellers through continuous improvement of the transaction experience, and benefit from the transactions between buyers and sellers. Li et al. (2016) consider platform-based enterprises as a form of organization that can provide services to satisfy the transaction groups of two or more parties, facilitate transactions and trigger network effects through a series of means, and then subtly reap the benefits from them. Yuan (2016) argues that platform-based enterprises are characterized by unique value, multi-customer, and openness and complexity, and proposes that platform-based enterprises can act as a media to conclude desirable yet efficient transactions. Based on the bilateral market theory, Wang (2019) focuses on analyzing the types, characteristics, and key success factors of the business model of platform enterprises. With the development of the economy, the gradual integration of the real economy and the information economy has prompted the rapid growth of platform-based enterprises. Xu (2013) categorizes them into open, closed and monopoly platforms based on the degree of openness; and into vertical, horizontal and audience platforms based on the nature of platform connections. Wang (2015) categorizes

platform-based enterprises into transactional platforms, payment platforms, software platforms, media platforms, and ecosystem-based platforms based on the platforms' functions. Gao (2019) uses the grounded theory to explore the operation mode of Internet platform-based enterprises. Gao believes that the value grabbing behavior helps enterprises ultimately acquire commercial value, and platform-based enterprises can realize the goal of sustainable value grabbing through the operation mode of multilateral platforms and the design of a reasonable profitability mechanism, with the profitability win-win as the constraint. Jiang and Li (2016) combine theoretical basis of value co-creation and put forward the concept of "value network +", summarizing the five attributes of the platform-type business operation mode, namely, resource diversity, resource heterogeneity, network density attributes, connection transparency and connection strength.

Platform-based ecosystem is a new organizational form formed by platform-based enterprises, platform value communities and social resources on the platform. From the perspective of bilateral market, value theory stimulates, extends and consolidates the value creation of e-commerce platforms, and network effects play an important role in the successful operation of e-commerce platforms. Wang et al. (2011) implement a large number of analyses on the market platform structural system and the operational mechanism, emphasizing the impact of the inherent perspectives such as value chain and value network on the business model. Wang et al. (2017) use the grounded theory to make innovation from the perspective of value proposition, value source, value production, and value exchange. Wang constructs an interactive spatio-temporal hierarchical structure with a

diversified business innovation platform as the core, and emphasizes that the aggregation of diversified values and the accumulation of hidden resources are the key to business model innovation in the Internet era. Domestic research is mainly based on the procurement mode under the perspective of supply chain management, and in recent years, scholars have gradually begun to study the mode of e-procurement. Zhou et al. (2002) elaborate the advantages of the third-party logistics procurement mode in the supply chain environment. Wang et al. (2011) compare the advantages and disadvantages of the three major e-procurement modes, and propose that Chinese enterprises should choose e-procurement strategies according to their own characteristics.

### 2.2.3 Scale effect theory and vertical integration

Vertical integration is a corporate strategy that involves closely combining different segments or industries of an enterprise. This strategy is usually categorized into two main directions in business development, i.e. forward integration and backward integration, to achieve better internal collaboration and control. The choice depends on the objectives of enterprises and the market needs.

Forward integration means that the enterprise focuses on the development of industries related to consumer products or services. This means that the enterprise explores ways to better meet market needs and provide more value. This integration covers everything from product manufacturing to marketing. By interacting with consumers, enterprises can obtain feedback about their products so that they can improve them, meet consumer needs, and seize more market share. That raw material manufacturers expand into semi-finished product processing or semi-finished product further processing enterprises

expand into wholesale and retail product segments are both forward integration strategies. This strategic model is realized by establishing economic alliances, integrating front-end technological resources and sales channels, etc. to achieve distribution and better control over retailers.

On the contrary, backward integration refers to the extension of an enterprise's operations into industries related to the supply of its products or services. This integration encompasses everything from raw material sourcing to manufacturing or production. Through backward integration, enterprises can explore ways to better control the supply of raw materials, reduce costs, improve efficiency, and even boost competitiveness. Backward integration strategies are realized through self-construction, mergers and acquisitions, franchising, and strategic alliances.

The goal of a vertical integration strategy is to connect an enterprise to different links throughout the supply chain to achieve better control and collaboration. This strategy can help enterprises better meet market demand, optimize internal operations, reinforce competitiveness, and ultimately increase profits. Regardless of whether they are forward or backward integration, these strategies help enterprises better understand and meet market demands and lay a solid foundation for sustainable growth.

(1) A backward integration strategy is a corporate strategy that centers on the idea of using an enterprise's original product production or business scope as a starting point to extend its business scope upstream in the supply chain in order to better control the supply of raw materials and the production process. A typical example of this strategy would be a seller of a product that originally relied solely on raw material suppliers, but as the strategy evolves, it begins to

produce its own raw materials to ensure supply chain stability and cost control. A backward integration strategy can be realized in a variety of ways and can be implemented through mergers and acquisitions, combination, strategic alliances, etc. to expand business. However, it is worth emphasizing that implementing a backward integration strategy is not an easy task, and it requires certain conditions and careful considerations on the part of an enterprise. Enterprises need to recognize the following important factors when considering backward integration:

Assessment of economic benefits: Enterprises need to carefully assess whether producing raw materials on their own will be economically beneficial. This includes consideration of production costs, quality control, supply chain management and other factors. If producing its own raw materials does not significantly reduce costs or boost up quality, then this strategy may not be the best option.

Financial burden: A backward integration strategy may require a significant financial commitment, including expenditures on equipment purchases, human resource training, etc. Enterprises need to ensure that their financial position is strong enough to cope with these financial burdens without falling into financial distress.

Risk management: Backward integration is also accompanied by certain risks, including fluctuations in raw material markets and production technology risks. Enterprises need to establish effective risk management strategies to mitigate the impact of potential risks.

Long-term planning: The backward integration strategy should be consistent with the long-term planning of an enterprise. Enterprises need to be

clear about their development goals and ensure that backward integration is a powerful means of realizing those goals.

(2) Forward integration strategy takes the original product or business scope as a starting point and expands the business scope in the downstream direction of the supply chain in order to enhance the market influence and competitiveness of the enterprise. The development mode of this strategy is very diverse, and it can be realized through a variety of ways, including technological upgrading, product innovation, sales channel expansion and so on. The gradual expansion of raw material producers into semi-finished product manufacturing business, and the further penetration of semi-finished product manufacturers into the field of deep processing are typical examples of forward integration strategies. This strategic model can be realized in a variety of ways, and enterprises can expand their business by improving production technology, launching new products, and strengthening the management of sales channels. The key objectives of such a strategy are to enhance the enterprise's control over the market, increase the value added to its products, and reduce external dependence in order to improve competitiveness. However, on the part of enterprises, they must have certain conditions and careful consideration before conducting a forward integration strategy. Certain key factors are set forth below:

Resources and capabilities: enterprises need sufficient capital, technology and talent reserves to support the implementation of forward integration strategies. They include technological improvements, R&D capabilities, production facilities, etc.

Market demand: Enterprises should have a good understanding of market

demand to ensure that their forward integration strategies are in line with market trends and customers' needs. This helps to ensure the effectiveness of the investment.

Competitive landscape: Enterprises need to consider the competitive landscape, including the strength and market share of competitors. When applying the forward integration strategy, enterprises may need to respond to intense market competition.

Risk management: a forward integration strategy is accompanied by certain risks, including market risk, technology risk and management risk. Enterprises need to establish effective risk management strategies to mitigate the impact of potential risks.

There are many internal and external interferences and influences on the implementation of vertical integration strategy. They are listed as follows with reference to the company's data on various indicators:

First, the choice of whether or not to adopt a vertical integration strategy is highly dependent on the industry and market environment in which the company operates. First, the choice of vertical integration strategy may be related to the competitive situation of the industry in which it operates. If the competition in the company's industry is already quite intense, the vertical integration may exacerbate the competition as the company is penetrating further into that market. In this case, the company would need to consider carefully to ensure that it is able to cope with the increased competition and whether it will be able to realize the expected economic benefits after vertical integration.

Second, the complexity of the company's product portfolio and

peripherals is also a factor in considering vertical integration. If a company's products require a large number of accessories and peripherals to provide a comprehensive solution, vertical integration may be a reasonable option. By owning or controlling these related products and equipment, a company can offer a more complete solution, thereby attracting more customers and increasing market share. On the other hand, if a company operates in multiple small market environments, it may find a vertical integration strategy more difficult to implement. As managing multiple small environments can become complex and the company's resources may be spread, making it difficult to realize economies of scale. In this case, a company may prefer to focus on its core business and rely on its supply chain partners for other products or services.

Finally, economic benefits are an important factor in deciding whether to adopt a vertical integration strategy. If an enterprise can achieve better economic benefits through vertical integration, such as reducing production costs, improving quality control, or realizing higher profit margins, then this strategy may be a wise choice. However, enterprises need to conduct a detailed cost-benefit analysis before implementation to ensure that vertical integration will provide them with tangible benefits.

Second, there is a close relationship between the degree of vertical integration and an enterprise's own capital structure. An enterprise's own capital structure refers to the composition of its capital, including its own funds and debt. This structure determines to a large extent the financial soundness and risk level of the company. The followings are some of the factors that correlate with the degree of vertical integration and own capital

structure:

Debt conversion ratio: when an enterprise's debt conversion ratio augments, it means that the enterprise tends to borrow to finance its operations. Although debt can provide additional funds, it comes with high risk as the enterprise has to pay interest and repay the principal. In this case, the enterprise may be more cautious and avoid increasing its financial leverage through vertical integration strategies such as large-scale mergers and acquisitions to minimize risk.

Own capital ratio: the own capital ratio is the proportion of an enterprise's own capital to its total capital. When the own capital ratio is high, the enterprise has more own capital that can be used to support the vertical integration strategy as it reduces the need for external financing and thus reduces financial risk.

Product life cycle: a vertical integration strategy is usually closely related to the product life cycle. In the early stages of a product life cycle, vertical integration can be fully utilized for quick financial returns. However, as the product market matures, the enterprise may focus more on product differentiation and innovation to remain competitive. This may lead to a reduction in vertical integration.

Market environment and laws and regulations: The market environment in which an enterprise operates business and the laws and regulations of the country or region in which it is located, may also affect the degree of vertical integration. Some markets may make it easier to implement vertical integration, while others may face legal and regulatory restrictions. Regional governments' incentives and ownership costs will also play an important role

in this decision.

Reputational value and owned control system requirements: The value of an enterprise's reputation and the need for an owned control system may also influence the decision to vertically integrate. Some enterprises may value their reputation more highly and therefore choose vertical integration strategy more carefully to maintain the integrity of their reputation. At the same time, owned control system may require enterprises to be more proactive in vertical integration to ensure quality and controllability of products and services.

## 2.3 Literature review

### 2.3.1 Procurement management in large enterprises

(1) Procurement mode for engineering projects

First, centralized procurement. There have been early studies abroad on procurement mode. Gurnani (2001) calculates the cost difference under different procurement methods from a global perspective and concludes that centralized procurement saves 10~30% of cost than decentralized procurement. VanWeeleAJ (2009), on the other hand, constructs a two-difference procurement mode based on the supplier's perspective and proves that discounts play a role in supply and demand relationships. Li and Liu (2006) further demonstrate the superiority of centralized procurement over other models based on Gurnani. In the book Purchasing and Supply Chain Management written, Leenders (2009) clarifies the important position of centralized procurement in the supply chain relationship network.

Many domestic scholars have also conducted theoretical research in this regard. On the part of enterprises, the ability to control procurement costs is often reflected in the choice of procurement mode. Scholar Lu (2003) has long

recommended the implementation of e-centralized procurement to reduce procurement costs and increase procurement transparency. Xiang (2005) demonstrates the economic benefits of centralized procurement at an early stage and proposes the optimal ordering model under centralized procurement. Hou (2011) points out that centralized procurement should be vigorously implemented within the enterprise, and to construct, based on foreign advanced experience, strategic partnership with suppliers to control the cost of material procurement. Chang (2013), on the other hand, make a preliminary description of the e-procurement system, including the type, structure and main process architecture, while clarifying the advantages of e-centralized procurement. Chen (2015) analyzes the case of dual procurement mode in Tarim Oilfield and concluded that the procurement modes have certain defects when they are used separately, and are more conducive to reducing the procurement cost and improving the procurement management level when they are used in combination. Yang (2018) conducts a literature review on the centralized procurement mode and advantages of B2B e-commerce platforms, and argues that Chinese enterprises have already had mature centralized procurement platform building experience to draw on. Many other scholars have studied the design and implementation of e-procurement systems under different computer technologies and have verified the practicality of the system with examples. These studies have laid a theoretical foundation for the flourishing development of centralized procurement platforms in recent years.

Second, decentralized procurement. The main studies at home and abroad are: Robert Monczka (2004) and others believe that large enterprises tend to combine centralized and decentralized procurement, and small ones tend to

procure between the two. Liang (2007) and others analyzed the risk factor analysis of decentralized procurement in government procurement and how to prevent it, and put forward practical countermeasures. Liao et al. (2002) analyze centralized procurement and decentralized procurement from their definition and development trend, and point out the development direction of procurement in China. Liu (2009) analyzes the weak point of government supervision in the expansion project of Southwest Petroleum University and finds the countermeasures of procurement supervision on the basis of analyzing the advantages and disadvantages of government supervision behavior and procurement methods. Wang (2014) proposed the scope of decentralized procurement and centralized procurement respectively after comparing the advantages and disadvantages of centralized procurement and decentralized procurement theories, and the development status thereof. Fan et al. (2009) study how government departments conduct centralized and decentralized procurement under the current macroeconomic conditions, and proposed that every effort should be made to conduct procurement in a mixed mode combining the two. Gao (2014) probes into how to use the idea of decentralized procurement limits to achieve decentralized procurement economy and maximize the benefits.

Third, mixed procurement, a new model based on the research of centralized and decentralized procurement modes. It overcomes the shortcomings of the first two modes used separately and combines the advantages of centralized and decentralized procurement modes. Procurements can be divided according to the size of the amount. Materials in large amount, large quantity and with high quality requirements can be purchased under the

centralized procurement management mode, and put under the management by a special procurement department. For a small number of special types of materials for which procurement planning is not strong, branches can independently procure them in a decentralized manner.

Both fully centralized and decentralized procurement have certain shortcomings. Therefore, most countries around the world use a combination of the two methods to achieve complementary advantages. Centralized procurement lacks autonomy and decentralized procurement lacks economy, and mixed one can overcome these two shortcomings. Representative countries of mixed purchasing are Switzerland and South Korea. Switzerland and South Korea are similar in that they adopt the form of national centralized procurement for goods exceeding the prescribed standard, and adopt departmental procurement for those below that standard. The Ministry of Finance of Malaysia adopts centralized procurement for public supplies, and divides whether to adopt centralized procurement or not according to the amount of procurement.

Domestic studies mainly include: for real estate enterprises' multi-project parallel development management mode, Liu (2015) analyzes the shortcomings in the procurement management of a specific company, and puts forward a mixed procurement management mode to solve this problem. Li (2007) conducts, on the basis of the ABC method of categorizing the materials required by the manufacturing industry, an example study on the logistics operation mode of the manufacturing industry using mixed purchasing and supply, confirming the value of its application. He (2002) and others carry out a detailed study of what procurement methods are taken by the government, in

the study of the advantages and disadvantages of the three procurement modes and China's actual situation and argue that currently mixed purchasing can save financial resources to a greater extent. Wu (2015) and others uses the expected utility theory to establish a risk aversion decision model for futures contract procurement, and after determining the relationship between the optimal procurement volume and risk, they study the role of mixed purchasing strategy in improving manufacturers' expectation level.

(2) Procurement process of engineering projects

The concept of process optimization originates from scholars Hammer and Champy. Both propose that continuous thinking and adaptation of process is the essential characteristic of process, and formulate an optimization framework mainly containing four parts: business process, business objectives, corporate structure and application platform. Based on Hammer and Champy's theoretical framework, there has been an explosion of literature on the integration of procurement processes and corporate governance. Grant (2012), for example, argues that project procurement process optimization is a group-level issue that involves not only the deletion and reorganization of the procurement process, but also the restructuring of the corporate business structure, staffing, information technology, and even the scope of business. Albadvi (2013) believes that procurement process optimization is not a quick fix, but should be carried out in a long-term adaptation to meet the needs of the project and pursue long-term optimization effects.

Meanwhile, reducing material costs by studying the procurement process has also begun to be studied in China in recent years. Zhang (2013) proposes that the application of BPR (business reorganization) technology in the

procurement of construction enterprises can significantly improve the procurement management level. Shi and Xu (2014) propose that procurement cost is a key factor in whether construction units can lead other peers, and process efficiency is the primary factor in controlling process cost. Li (2017) argues that to reduce the cost of materials, the application of ERP platform should be promoted, and at the same time, it should be adapted by combining the latest process improvement methods. Li also illustrates the case application using the ESIA method. Wang (2017) combines the use of ANC method and flowchart method in the system process transformation, and compares cost data before and after optimization.

### 2.3.2 Research related to ECPPs

In terms of theoretical research, Barret and Konsynsk (1982) elaborate the concept of inter-organizational information systems. William and Presutti (2003) argue that e-procurement is a value-added part of the supply chain, and also a powerful asset used by companies to enhance their competitiveness. Malone, Yates (2003) and other scholars suggest that with the widespread use of information technology, IT leads to e-communication, e-mediation and integration effects. Bakos (1991) explains in detail the characteristics and roles of the electronic trading market under the Internet from a micro perspective. Bakos also argues that it excels in a number of areas such as information retrieval and market services. Rayport (1994) and others explore both products and sales, noting that products are the aggregation of content, context and infrastructure and that marketplaces disaggregate the above three elements to create new ways of added value. Stephen P. Bradley and Richard L. Nolan (1998) suggest that the traditional "make and sell" approach is unsustainable

and can be solved by utilizing web-based technologies to communicate with buyers online. Lindemann and Schmid (1997), among others, propose the e-market model, which outlines a two-dimensional model of e-market trading activities from both a technological and a commercial perspective. Lu (2003) et al. clarify the advantages of e-procurement in comparing the advantages and disadvantages of traditional procurement and e-procurement. Han (2005) studies the development history of e-procurement from the supply chain perspective. Chang (2013) studies the type, process and structure of e-procurement system on the basis of analyzing the disadvantages of e-procurement, and also standardizes the supply chain procurement management system. Luo (2010) establishes an organizational structure model based on supply chain information structure by combining the definitions of supply chain information structure and organizational structure from the impact of the procurement system on supply chain. Many other scholars have conducted a lot of research on the design and realization of e-procurement systems under different computer technologies and verified the practicality of the system with examples. On this basis, many scholars have also carried out thematic studies on issues such as system payment security and information security.

In practice, many foreign industries and companies have their own e-procurement centers. General Motors, Ford and DaimlerChrysler - three major Chrysler automobile companies, establish the world's largest auto parts COVISINT system through combination. It supports global optimization of procurement via the synergistic support for the automotive manufacturing industry. Subsequently, Renault, Nissan, Toyota and Mitsubishi Motors also

became a member of this combination. This e-procurement approach utilizes scale effects to reduce the cost of parts purchases (Ageshin, 2000). Well-known companies such as Dell, IBM and Wal-Mart have also followed suit and established their own e-procurement centers to reduce procurement costs.

Many Chinese companies have also developed procurement management systems. Superdata Software Technology (Guangzhou) Limited develops a procurement system, which successfully realizes the effective control and tracking of the procurement process and bolsters up the supplier supply information management. Baosteel has set up its own ECPP - Oriental Steel Material Procurement Platform. It makes available online centralized procurement, with turnover reaching RMB 2 billion. Certain large-scale construction enterprises in China have also turned their attention to online procurement. For example, in 2000, China State Construction General Contracting Company took the lead in online transactions, and it utilized China's indoor e-commerce platform to release public bidding information. On the basis of the study of Foxconn Group's procurement management and centralized procurement mode, six improvement measures, procurement management intelligence, supplier management, procurement business process, management system, and specialized procurement team are raised (Wu, 2014). Guo (2015) compares and analyzes the advantages and shortcomings of the decentralized procurement mode, centralized procurement mode, mixed procurement mode, joint procurement mode, and online transaction, etc. and analyzes the traditional procurement management mode in the domestic construction industry and its problems. Through the optimization of the mixed

procurement mode, the procurement mode with flexible adjustment of centralized and decentralized procurement is proposed, namely, mixed between purchasing information (“IMP procurement”). The IMP procurement carries out a clear division of the procurement hierarchy and procurement authority, and improves the organizational structure in combination with the characteristics of projects. According to the ABC classification method, the enterprise procures to an appropriate degree key materials on a centralized basis on the network trading platform, and procures other materials on a decentralized basis according to the actual demand. Taking China Railway as an example, Chang (2016) analyzes the salient problems in the regional centralized procurement of railroad projects, and clarifies the objectives of the regional centralized procurement and priorities in terms of resource channel, procurement organization, supply organization, fund management, Internet service and other aspects. Construction Engineering Group achieves intensive operation and standardized management, and improves the management level through the establishment of the ECPP for the three levels of the construction enterprises (headquarters, regional enterprises, and project manager departments) (An, 2016).

The study of ECPP based on framework construction has gradually become a new direction. In the past ten years, large state-owned enterprises, represented by PetroChina and Sinopec, have begun to implement ECPPs. From the initial e-catalog procurement to the successive launch of e-tendering procurement after 2012, domestic scholars have begun to focus on the construction of ECPPs. With the rise of "Internet+", a small number of scholars have begun to study the application of the entire centralized

procurement based on e-commerce platform. Early research on e-commerce in centralized procurement only focuses on the electronic optimization of centralized procurement. Zhang (2004) puts forward the model of electronic centralized procurement earlier. Through the analysis of the centralized procurement of South Korea's POSCO, Zhang introduces e-procurement based on the application of B2B and conducts an initial exploration on the centralized procurement on an electronic basis. With the rapid development of Internet technology and the extensive use of e-commerce, many enterprises tend to apply e-commerce manner in procurement. After conducting SWOT on centralized procurement and supply, Kan (2015) proposes the concept and model of centralized procurement and supply management platform, and demonstrates the operation process of each functional module and describes the implementation of some functions. Luo (2016) focuses on analyzing and describing the management functions and effectiveness analysis, and studies the development trend of the ECPP. Research on the application based on large enterprises also came into being. Cui (2015) details the development mode of the e-commerce platform of China Railway Luban. Hu (2014) describes the development and application of the e-commerce procurement platform of Shanghai Shentong Metro Group Company, and so on. There has also been some research one after another on the problems in e-procurement. Liu (2016) discusses the security problems of e-tendering and procurement, and points out the frequently occurring problems and optimization countermeasures in the tendering and procurement based on network management platforms from the overall structure and process design of network tendering system. In recent years, with the rapid development of

e-commerce platforms, the research of procurement mode based on e-commerce platforms has begun to deepen from the surface to the inside. Zhou (2016) proposes that the large enterprises will develop projects on ECPPs along the trend of vertical deepening, specialization, nationalization, and integration. For the centralized procurement and supply mode of high-speed railroad construction materials, Li (2017) unveils the effect of the application of Beijing-Shenzhen Passenger Line with the combination of centralized procurement and the new technology of the Internet, and verifies the role of the foregoing innovative procurement mode in reducing the procurement cost, improving the procurement efficiency, preventing corruption and other aspects. Scholars are also beginning to explore and research centralized procurement under the new situation and from new perspectives. They analyze the current situation and prospects of the development of e-commerce and supply chain centralized procurement under the perspective of e-commerce B2B and explore the e-commerce platform centralized procurement mode and its value. Moreover, taking Group S as an example, they propose to establish a B2B e-supply chain centralized procurement mode with the upper reaches of the suppliers (Yang, 2018).

### 2.3.3 Thinking on literature

Supply chain management is a crucial part of modern enterprise operation and related to all aspects of production, distribution, sales and delivery of products. Research at home and abroad shows that under the trend of globalization and digitalization, supply chain management has become more complex and therefore requires continuous improvement and innovation. In this context, research on supply chain management based on e-commerce

platforms is particularly important as e-commerce platforms provide a more efficient and traceable way to coordinate the various links.

International research on supply chain management has been relatively mature, regarding areas such as logistics management, inventory management, and supplier relationship management, with a wealth of theoretical and practical experience. However, in recent years, there has been relatively little research on supply chain management based on e-commerce platforms. This may be due to the fact that the application of e-commerce platforms varies across countries and industries, and in-depth localized research is needed to adapt to various contexts.

China’s research and application of supply chain management has made significant progress in some specific areas, such as government procurement, the pharmaceutical industry, and the energy sector. In the area of government procurement, for example, government procurement e-commerce platforms have been widely used nationwide, improving procurement efficiency and transparency. The pharmaceutical industry and the energy sector have also made certain innovations in supply chain management, improving product safety and traceability.

However, research on supply chain management for construction companies working on large infrastructure projects has lagged behind. Existing research eyes on either centralized procurement modes and judging factors, or only on the system building of e-commerce platforms. Therefore, there is still a huge research and application potential waiting to be tapped in this field. Especially in the era of "Internet +", ECPPs have more roles to play. In addition to the basic catalog procurement and bidding platform functions,

we can also explore how to realize financing, supplier management and other applications on this platform. For large infrastructure project construction enterprises, the ECPP will help improve the transparency and coordination of the whole supply chain, reduce costs and improve efficiency.

In terms of research methods and programs, firstly, we can adopt the case study method to analyze in depth the enterprises and projects that have already succeeded in this field and draw lessons from them. Meanwhile, questionnaires and interviews can be conducted to understand the actual needs and challenges of enterprises in supply chain management. Second, a multi-level model can be developed to study the role of the ECPPs in supply chain management. This model can include multiple factors such as suppliers, purchasing department, logistics department, finance department, etc. to fully get to know the impact of ECPPs on supply chain. Finally, ways to achieve more effective supply chain management through collaboration and sharing of data can be explored in the research program. This may involve measures in terms of data standardization, digital collaboration and supplier cooperation.

In conclusion, e-commerce platforms have great potential for innovation in supply chain management, and large-scale domestic infrastructure project construction companies should actively explore this area to improve competitiveness and efficiency. The research and practice can combine to help promote the innovation and progress of supply chain management and bring more opportunities and benefits to enterprises and the whole industry.

# Chapter 3 Research hypothesis

The important role of adopting the centralized procurement method in the material procurement process of large construction enterprises is reflected in the following points:

(1) Through the application of centralized procurement of materials, enterprises can obtain the corresponding material procurement information of different projects in the whole region in the shortest possible time in an accurate and perfect manner. The dispersed material procurement information and procurement plan can be arranged for integrated planning, to achieve the overall information, scale and centralized development. This way can not only save more procurement costs for enterprises, but also fully improve their procurement efficiency. Enterprises are encouraged to set up a good image in the social market, and form a long-term and good cooperative relation with high-quality suppliers. In the centralized procurement management of materials, a top-down management approach can be taken to provide a guarantee for the smooth development of construction and production.

(2) The centralized procurement mode helps realize the intensive management of material procurement. On the basis of the continuous implementation of the regional procurement strategy, enterprises can build a more perfect supplier system. Through the collection of project information in the whole region, enterprises can make a comprehensive assessment of the services, prices, technologies, reputation and guarantee ability of the participating suppliers, and summarize the corresponding supplier directory. The continuous identification and training of strategic partners can save more time for materials procurement of new projects, avoid repeated visits or

screening, save more transaction costs for enterprises, avoid bad companies from entering into the market competition to bring corresponding supply risk, legal risk and financial risk against other enterprises.

(3) Through the reasonable application of centralized procurement mode in the material procurement of large construction enterprises, it can realize the horizontal comparison of prices among projects, has a correct grasp of the unit price of materials, and supervise and manage the execution of contracts during the period of procurement and supply, and prevent the cost of decentralized procurement from being on the high side. In this process, the actual situation can be combined to build the procurement price early warning, supervision and assessment mechanism and the specific price information on centralized procurement of materials will be combined for summarization and analysis. It can facilitate supervision and management, to avoid high-priced procurement, or random replacement of material suppliers.

(4) The centralized procurement can effectively reduce the integrity risk exposed to material procurement of large-scale construction enterprises. Large-scale construction enterprises have a great number of construction project departments, wide distribution and more frequent personnel changes and are exposed to difficult supervision of material decentralized procurement and greater risk of integrity. Centralized procurement will greatly reduce objects subject to integrity supervision and supervision workload, can enhance the supervision of integrity risk points and reduce the integrity risk of material procurement of large-scale construction enterprises.

Therefore, we propose the following hypothesis:

H1: Due to the network externality of platform economy, the

establishment of a procurement platform will increase the profits of enterprises.

H2: Procurement platforms help reduce transaction costs for suppliers, thereby improving their operational performance.

# Chapter 4 Research design

## 4.1 Case study: impacts of the ECPP on business operations

### 4.1.1 Case selection

The importance of case adoption for case studies cannot be overstated. In general, representative and typical cases should be selected for the case study, and the characteristics of the samples must be consistent with the research topic and more prominent. Therefore, this paper chooses the ECPP of Hebei Construction Group as the research object mainly considering the following aspects:

First, due to the specificity of the construction industry where Hebei Construction Group operates business, it involves many types of suppliers and raw materials and price fluctuates greatly to some extent, and therefore it is more dependent on centralized procurement via ECPPs. Moreover, the construction industry has always been China's pillar industry, and its use of ECPPs is more common and mature.

Secondly, Hebei Construction Group is the largest construction player in Hebei Province, with a revenue of RMB47.828 billion in 2021, ranking second in China's housing construction industry and 269th among China's top 500 enterprises, which is representative enough. Meanwhile, Hebei Construction Group is listed on the Hong Kong stock market, and its financial and operational information is easier to obtain.

### 4.1.2 Data collection

This paper conducts a longitudinal study based on a single case. To ensure the reliability of the findings of this paper, we fully consider the authenticity

and typicality of the information obtained when collecting relevant information. Primary data case used in enterprise research are often obtained through interviews with relevant personnel of the enterprise or the distribution of questionnaires, and this process is usually affected to a certain extent by the subjective factors of the two sides of the interview or defects in the design of the questionnaire, so it is difficult to guarantee the validity of the information obtained. Therefore, this paper will use more objective secondary data for analysis. To ensure that the information in the case study phase of this paper is true and correct, this paper will collect the public information and financial data of Hebei Construction Group from multiple channels to comprehensively understand the background of the company and the development of the relevant industry, and at the same time, verify the information obtained from different channels using the "triangulation method"; the information from different sources will be mutually corroborated to ensure that the information is true and correct, to decrease defects in details that may exist in the secondary data, and to enhance the credibility of the conclusions of this paper.

The information of Hebei Construction Group in this paper is mainly obtained through internal system data, official website, annual reports, relevant books, reports of major media, interview with executives and other relevant materials and the relevant financial data are mainly obtained from websites such as cninfo.com, GTA database, State Intellectual Property Office and so on. The official website makes available the basic information of Hebei Construction Group, major events in the development history, innovations and achievements and main business scope. Relevant books and various media reports reveal the governmental support Hebei Construction Group has

received in the course of its development, the process of innovations as well as the analysis and evaluation from industry insiders and the society. The enterprise's relevant financial indexes can be obtained via the enterprise's internal platform data, annual reports, and database website. Finally, we get together all the collected information for a comprehensive summary and analysis of the impacts of the ECPP on business operations.

## 4.2 Empirical study: impacts of the ECPP on business performance

### 4.2.1 Synthetic control method

This paper mainly simulates based on the synthetic control method proposed by Abadie & Gardeazabal (2003) the business conditions of the enterprise when it does not have a procurement platform, in a bid to examine the impact of procurement platforms on business operations.

(1) Modeling

Given $K+1$ enterprise's business operations during $t \in [1, T]$ period, where $\pi_{it}^{N}$ denotes the business operations of the $i \in [1, K+1]$ enterprise at the $t$ point in time if it does not have an ECPP; and $\pi_{it}^{t}$ denotes the business operations of the $i$ enterprise at the $t$ point in time when it sets up an ECPP. Assuming that the $i$ enterprise establishes an ECPP at the $t = T_0$ point in time, the business performance of an enterprise during the $[1, T_0]$ period is not affected by the ECPP, $\pi_{ii}' = \pi_{iu}^{N}$; after the ECPP is established, i.e., during the period $[T_0 + 1,\ T]$, let $\alpha_{it} = \pi_{it}^{l} - \pi_{ii}^{N}$ denote the change in the business performance brought about by the ECPP to the $i$ enterprise at the point in time $t$. For the enterprise that really has an ECPP, we can observe its business

operation data $\pi_{it}'$, but it is assumed that the data $\pi_{ii}^{N}$ when this target does not have an ECPP is unobservable, so this paper uses the factor model proposed by Abadie et al. (2010) to estimate $\pi_{i_{\circ}}^{N}$ .

$$\pi_{it}^{N} = \delta_t + \theta_t Z_i + \lambda_i \mu_i + \varepsilon_{it} \tag{4-1}$$

In equation (4-1), $\delta_i$ is a time fixed effect that affects the business performance; $Z_i$ is an observable $(r \times 1)$-dimensional covariate indicating a control variable that is not affected by the establishment of an ECPP; $\theta_1$ is a $(1 \times r)$-dimensional vector of unknown parameters; $\lambda_t$ is a $(1 \times F)$-dimensional vector of unobservable common factors; $\mu_i$ is a $(F \times 1)$-dimensional unobservable enterprise fixed effect, and $\varepsilon_{it}$ is an unobservable short-run shock that has a mean of 0 at the enterprise level.

Structurally, equation (4-1) extends the traditional DID model. The traditional DID model allows the presence of unobservable confounders and limits the impact by converting the effect of these confounders into a constant in time. Whereas equation (4-1) sets the synthetic control to provide efficient estimation in a wider range of domains compared with the previous factor model.

Assume that the first enterprise $(i = 1)$ has an ECPP and none of the remaining $K$ enterprises $i = 2, \cdots, K+1$ have no similar platforms. Consider a vector of $(K \times 1)$-dimensional weights $W = (w_2, \cdots, w_{k+1})$ to make $w_k \geqslant 0, k = 2, \cdots, K+1$, and $w_2 + \cdots, w_{k+1} =$ 1. Each particular value of the vector $W$ represents a potential synthetic control group, i.e., a particular weight for $K$ enterprises. The values of the outcome variables for each control group of enterprises are weighted to obtain:

$$\sum_{k=2}^{K+1} w_k \pi_{ks} = \delta_t + \theta_t \sum_{k=2}^{K+1} w_k Z_k + \lambda_t \sum_{k=2}^{K+1} w_k \mu_k + \sum_{k=2}^{K+1} w_k \varepsilon_{kt} \tag{4-2}$$

It is assumed that there is $(w_2^*, \cdots, w_{k+1}^*)$ that makes

$$\sum_{k=2}^{K+1} w_k^* \pi_{k1} = \pi_{11}, \sum_{k=2}^{K+1} w_k^* \pi_{k2} = \pi_{12}, \cdots, \sum_{k=2}^{K+1} w_k^* \pi_{kT_0} = \pi_{1\tau_0}$$

$$\text{and} \quad \sum_{k=2}^{K+1} w_k^* Z_k = Z_1 \tag{4-3}$$

able to show that if $\sum_{t=1}^{T_0} \lambda_i' \lambda_s$ is nonsingular, then

$$\pi_{1t}^N - \sum_{k=2}^{K+1} w_k^* \pi_{kt} = \sum_{k=2}^{K+1} w_k^* \sum_{s=1}^{T_0} \lambda_t \left( \sum_{n=1}^{T_0} \lambda_n' \lambda_n \right)^{-1} \lambda_s' (\varepsilon_{ks} - \varepsilon_{1s}) - \sum_{k=2}^{K+1} w_k^* (\varepsilon_{kt} - \varepsilon_{1s}) \tag{4-4}$$

Abadie et al. (2010) show that under general conditions, if the pre-policy time period is long relative to the time horizon of the ECPP policy implementation, the mean of the right-hand side of equation (4-4) will converge to 0. Therefore, during the implementation period, we can obtain an estimate of the policy effect using an unbiased estimate of $\pi_{1t}^N$, $(\Sigma_{k=2}^{K+1} w_k^* \pi_{k1})$:

$$\hat{\alpha}_{1t} = \pi_{1t} - \sum_{k=2}^{k+1} w_k^* \pi_{kt}, t \in [T_0 + 1, \cdots, T] \tag{4-5}$$

The key to obtaining $\hat{\alpha}_{1t}$ is to find the particular weights $W^* = (w_2^*, \cdots, w_{k+1}^*)$。$W^*$ that make equation (4-3) hold requires that the eigenvectors $(\pi_{11}, \cdots, \pi_{1r_0}, Z_1')$ of the 1st enterprise lie within the convex combination of the sets of eigenvectors of the other enterprises $\{(\pi_{21}, \cdots, \pi_{2T_0}, Z_2'), \cdots, (\pi_{k+11}, \cdots, \pi_{k+170}, Z_{k+1}')\}$. In general, however, it is difficult to find such weights in real data so that equation (4-3) holds strictly,

and therefore the weights need to be determined by approximate solutions. Define a $(T_0 \times 1)$ vector $M = (m_1, \cdots, m_{\pi_0})$ to be a linear combination of the outcomes before policy implementation: $\bar{\pi}_i^M = \sum_{s=1}^{T_0} m_s \pi_{is}$. For example, if $m_1 = m_2 = \cdots = m_{T0-1} = 0, m_{T0} = 1$, then $\bar{\pi}_i^M = \pi_{i\tau_0}$. It denotes that the value of the outcome variable is exactly what it would have been in a certain time period before the policy was implemented. If $m_1 = m_2 = \cdots = m_{T-1} = 1/T_0$, then $\bar{\pi}_i^M = T_0^{-1} \sum_{s=1}^{T_0} \pi_{is}$, denoting that the value of the outcome variable is the average of the outcomes in the pre-implementation period of the policy. Define $F$ as a linear combination of vector $M_1, \cdots, M_F$, $X_1 = (Z_1', \pi_1^{M1}$, and $\cdots, \pi_1^{MF})'$ as the target enterprises' pre-policy implementation $((r + M) \times 1)$ dimensional feature vectors. Similarly, define $X_0$ as a matrix of $(r + M) \times K)$ covering the corresponding eigenvectors of $K$ ECPP policies that have not been implemented, i.e., the $k$ column of $X_0$ is $(Z_k', \bar{\pi}_k^{M1}, \cdots, , \bar{\pi}_k^{MF})$. $W^*$ is determined by minimizing the distance $\|X_1 - X_0 W\|$ between $X_1$ and $X_0 W$ while making $w_k \geqslant 0, k = 2, \cdots, K + 1$ and $w_2 + \cdots w_{k+1} = 1$. Abadie et al. (2010) use $\|X_1 - X_0 W\|_v = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 \bar{W})}$ to measure the distance, where $V$ is a symmetric and positive semidefinite matrix of $((r + M) \times (r + M))$. Although our inference procedure is valid for any V, the choice of V affects the mean square error of the estimates. The optimal choice of V is to assign a reasonable weight to the variables in $X_1$ and $X_0$, to

minimize the mean square error of the synthetic control values. In this paper, we use a data-driven approach, to obtain a symmetric and positive semidefinite matrix $((r+M)\times(r+M))$ in order to make the synthetic enterprises approximate the pre-policy operations of the enterprises that set up the ECPP. The business situation of the synthetic enterprise obtained through the weighting simulates the situation assuming that the target enterprise does not have an ECPP, and the difference in business performance between the target enterprise and the synthetic enterprise is the impact of the ECPP on business performance.

(2) Strengths and limitations of the model

This paper is intended to compare and objectively evaluate the impact of the ECPP on business performance and to judge the effectiveness of the ECPP by comparing the business performance of the target enterprise and the synthetic enterprise before and after the establishment of the ECPP. The advantage of the synthetic control method is to construct a control object exactly similar to the target group by weighting multiple control group objects in a data-driven way. The advantages are: (1) As a nonparametric method, it extends the traditional double difference method. (2) Determining the weights through data-driven determination reduces the error of subjective selection and avoids the problem of policy endogeneity. (3) By weighting multiple control objects to simulate the situation before policy implementation, we cannot only clearly reflect the contribution of each control object to the "counterfactual" events, but also avoid excessive extrapolation. (4) Synthetic control subjects can be provided for each individual study, avoiding averaging, not affecting the results of policy evaluation due to different policy implementation times in

each country, and avoiding the bias caused by subjective choices. (5) Researchers can design experiments without knowing the effects of implementation. The synthetic control method is now widely used in other policy evaluation fields (Abadie et al., 2010; Campos & Kinoshita, 2010).

### 4.2.2 Double difference method

(1) Identification ideas

Figure 4.1 demonstrates the identification idea of the double difference method. We will use the Rubin causal framework for a clearer elaboration. The causal effect $\tau(X)$ we are interested in can be written (the superscript 1 represents acceptance of the treatment, and 0 represents non-acceptance of the treatment):

$$\begin{aligned}\tau(X) = {} & E(Y|X, D = 1, T = 1) - E(Y|X, D = 1, T = 0) \\ & - [E(Y|X, D = 0, T = 1) - E(Y|X, D = 0, T = 0)] \\ & = E(Y^1|X, D = 1, T = 1) - E(Y^0|X, D = 1, T = 0) \\ & - [E(Y^0|X, D = 0, T = 1) - E(Y^0|X, D = 0, T = 0)] \\ & = [E(Y^1|X, D = 1, T = 1) - E(Y^0|X, D = 1, T = 1)] \\ & + [E(Y^0|X, D = 1, T = 1) - E(Y^0|X, D = 1, T = 0)] \\ & - [E(Y^0|X, D = 0, T = 1) - \\ & E(Y^0|X, D = 0, T = 0)]\end{aligned} \tag{4-6}$$

The identifying assumption of the double difference method (parallel trend test) is at the heart of:

$$\begin{aligned}& [E(Y^0|X, D = 1, T = 1) - E(Y^0|X, D = 1, T = 0)] \\ & = [E(Y^0|X, D = 0, T = 1) - E(Y^0|X, D = 0, T = 0)]\end{aligned} \tag{4-7}$$

Under this assumption, the DID estimator identifies the ATT at the post-treatment period for the treatment group receiving the treatment:

$$\tau_{DID} = E(Y^1 - Y^0|D - 1, T = 1) = E_X[\tau(X)|D = 1, T = 1] \tag{4-8}$$

At this point, equation (4-7) can be abbreviated:

$$E(Y^0|X, D = 1) - E(Y^0|X, D = 0) \tag{4-9}$$

That is, given X, the $\Delta Y^0$ means are independent of D, i.e., the treatment variable D is about $\Delta Y^0$ random grouping, not about Y random grouping.

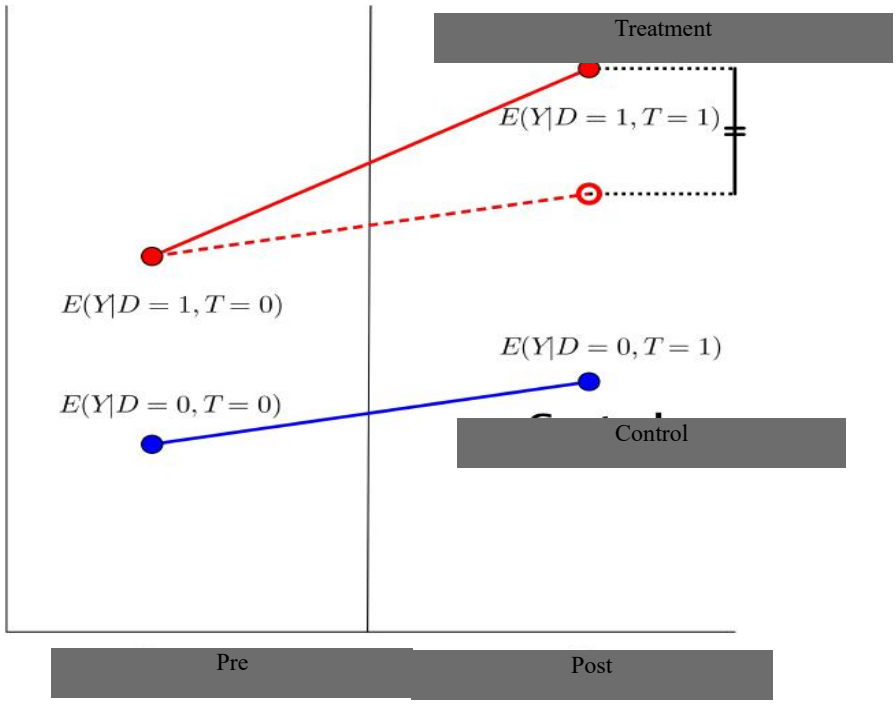



**Figure 4.1 DID method**

(2) Modeling

We can therefore set up the following double difference model:

$$performance_{it} = \beta_0 + \beta_1 platform_{it} + \sum_j \beta_j \times Control + \gamma_t + \mu_i + \varepsilon_{it} \tag{4-10}$$

Wherein, $performance_{it}$ is the business performance of enterprise i in year t; $platform_{it}$ is whether enterprise i has established a procurement platform in year t, and is assigned a value of 1 if it has, and 0 if it has not. $Control$ are a series of firm-level control variables to be controlled. $\gamma_t$ and

$\mu_i$ are time and enterprise fixed effects to control for factors that do not vary over time and enterprises, respectively. The coefficients of $\beta_1$ we focus on represent the causal effect of an enterprise's establishment of a procurement platform on the enterprise's business performance.

Next, we combine the above counterfactual framework to understand the implications of equations (4-10). A dummy variable $D_i = \{0,1\}$ indicates whether enterprise $i$ has established a procurement platform, with 1 indicating yes and 0 indicating absence. $D_i$ is often called the "treatment variable" and reflects whether the $i$ enterprise has been "treated" or not. In our research, the future business status is the outcome of our interest, denoted as $y_i$. The question we are interested in is whether $D_i$ has a causal effect on $y_i$, and this depends on whether the enterprise has established a procurement platform or not, i.e.

$$y_i = \begin{cases} y_{1i}, & \text{if } D_i = 1 \\ y_{0i}, & \text{if } D_i = 0 \end{cases} \tag{4-11}$$

where $y_{0i}$ denotes the future business performance where the $i$ enterprise does not establish a procurement platform and $y_{1i}$ denotes the future business performance where the enterprise $i$ establishes the same. What we want to know is ($y_{1i} - y_{0i}$), i.e., the enterprise $i$ establishes a procurement platform. If the $i$ enterprise establishes a procurement platform, $y_{1i}$ is observable but $y_{0i}$ is not visible, and conversely, if the $i$ enterprise does not establish a procurement platform, $y_{0i}$ is observable but $y_{1i}$ is not visible. Write equation (4-11) in the form of a segmented function as

$$y_i = (1 - D_i)y_{0i} + (y_{1i} - y_{0i})D_i \tag{4-12}$$

where $(y_{1i} - y_{0i})$ is the causal effect of an enterprise's $(i)$ establishing ECPPs. Obviously, the treatment effect may be different for different individuals, and $(y_{1i}, y_{0i}, D_i)$ is therefore regarded as a random sample from the totality of the three-dimensional random vectors $(y_1, y_0, D)$. Since the treatment effect $(y_{1i} - y_{0i})$ is a random variable, we are interested in its expected value, i.e., the "average treatment effect" (ATE). ATE is the expected treatment effect of a randomly selected individual from the population, regardless of whether that individual has a procurement platform or not. But clearly we are not interested in the expected treatment effect of the randomly selected enterprises, we care the average treatment effect on enterprises that have procurement platforms, i.e., the "average treatment effect on the treated" (ATT).

$$ATT = E(y_{1i} - y_{0i})|D_i = 1 \tag{4-13}$$

The ATT expressed in the above equation is the actual meaning in our regression equation $\beta_1$ : the change in future business performance of enterprises that have established a procurement platform because they have been treated by the "procurement platform". Therefore, it is clear that $\beta_1$ is a difference in expectation (mean) before and after the individual treatment, which is why it is called the "average treatment effect".

### 4.2.3 Data sources

To construct a suitable control group, we select enterprises in the construction industry that have been listed in A-share market as the counterfactual control group of the target enterprise. The data on the business performance were obtained from the GTA database. In addition, we cause personnel to collect information on ECPPs established by A-share listed

enterprises in the construction industry and retained the 82 listed companies that never established ECPPs. The following figure shows the geographical distribution of the 82 listed companies:

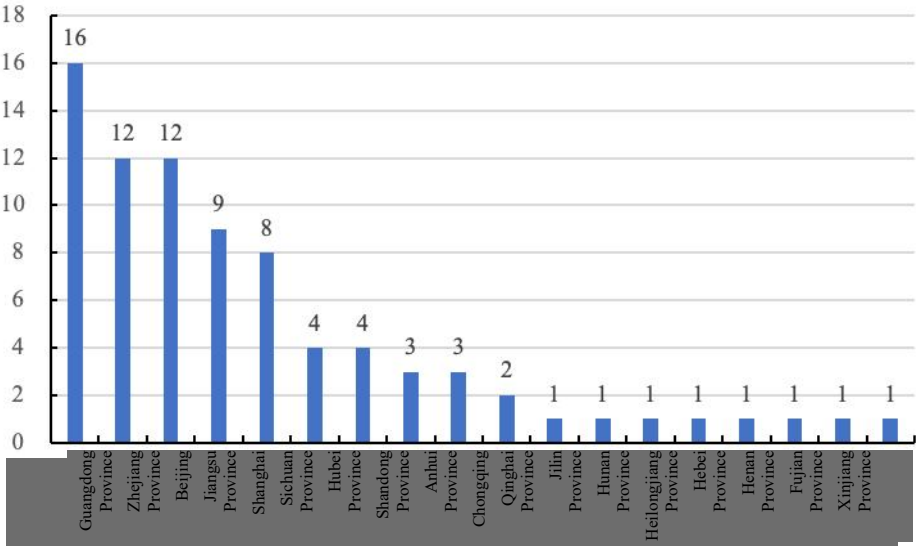



**Figure 4.2 Geographical distribution of enterprises in the control group**

## 4.3 Questionnaire and empirical analysis: impacts of the ECPP on suppliers

### 4.3.1 Questionnaire design

Due to the lack of corresponding detailed financial data of upstream and downstream enterprises in the supply chain within the ECPP, we are unable to rigorously discuss the impact of the ECPP on upstream and downstream enterprises. Therefore, this paper collects relevant information by distributing questionnaires to suppliers on Hebei Construction Group's ECPP, with an attempt to figure out the impact of the ECPP on upstream and downstream enterprises.

Through the datatization of the above questionnaire questions, we can get

the subjective feelings of the upstream and downstream enterprises in the supply chain of Hebei Construction Group in response to the ECPP, which involves the business volume, profit, cost and many other aspects. The above questionnaire can help us systematically analyze the specific impact of the ECPP on the group's upstream and downstream enterprises. The questionnaire mainly involves the following aspects:

(1) Basic characteristics of enterprises

This part mainly defines the characteristics of the interviewed enterprises and collects relevant data that can be used as a supplier's characterization and explain the composition of variables and control variables. Relevant questions include the nature of the interviewed enterprises, the date of joining the ECPP of Hebei Construction Group, and the primary business dealings with Hebei Construction Group.

(2) Suppliers' business operations after joining the ECPP

This part mainly collects the impact on the suppliers' operational efficiency and financial services after they join in the ECPP, mainly involving profit, cost, scale of sales and other indicators. Relevant indicators can be used to intuitively reflect the suppliers' changes in business operations after the entry into the ECPP and also can be used as predicated variables for empirical analysis.

### 4.3.2 Empirical analysis

Through the indicators and data obtained from the questionnaire, the regression model set in this paper is as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \gamma_i + \tau_i + \varepsilon_i \quad (4\text{-}14)$$

Wherein, $X_i$ is an explanatory variable, with the length of time suppliers join the ECPP. $Y_i$ are a series of predicated variables, mainly cost, scale of sales, profit. The subscript i represents the individual, and $\tau_i$ is the control variable. To exclude the interference of factors such as the region in which the supplier is located, this paper uses $\gamma_i$ as fixed effects of provinces to control. Specifically, Equation (4-14) is the regression model of the impact of suppliers joining the ECPP on reducing costs, increasing scale of sales, and increasing profit. This paper focuses on the sign and significance of the coefficients $\beta_1$, which is the impact of joining the ECPP on the changes in suppliers' operations.

# Chapter 5 Research results

## 5.1 Case study of the ECPP of Hebei Construction Group

### 5.1.1 Hebei Construction Group's operation of the ECPP

Hebei Construction Group, founded in 1997 and located in Baoding City, Hebei Province, China, is a large listed private construction enterprise with a certain degree of influence in China. With assets of RMB66.947 billion and revenue of RMB47.828 billion in 2021, Hebei Construction Group ranks second in China's housing construction industry and 269th among China's top 500 enterprises. With the popularization of Internet technology, Hebei Construction Group keeps exploring new development modes and realizes further development by introducing digital technology.

To achieve refined, standardized and efficient procurement management, Hebei Construction Group began to explore the establishment of an ECPP in 2015 and its ECPP was officially operated in 2017. So far, the ECPP has more than 38,000 material suppliers, more than 5,500 equipment suppliers, more than 1,700 labor subcontractors, and more than 4,700 professional contractors, with nearly 120,000 material inquiries and tenders, 15,000 equipment leasing inquiries and tenders, and nearly 10,000 labor ones. The ECPP realizes the advantages of scale in procurement, reduces the cost of purchasing materials and the management cost of procurement, promotes the co-ordination of procurement business, avoids the backlog of inventory, and enhances the business performance.

The Hebei Construction Group's ECPP is composed of internal control management platform and bidding management platform. As shown in Figure

5.1, ECPP has four primary functions including online bidding and procurement, online shopping mall, supply chain financial services and supply chain management. Among them, bidding and procurement is the main core service of enterprise procurement, including the entry of purchasers, bidding, inquiry, bidding and purchasing, registration and quotation module and MRO mall module. The enterprises on the ECPP can publish announcements on bulk material purchase, project subcontracting, labor service, machinery leasing, bidding, inquiry, etc., and realize the online operation and management of enterprise procurement and bidding through the open and transparent bidding mode.

Hebei Construction Group's ECPP has a low threshold for joining, and suppliers only need to submit appropriate corporate materials, including business license, etc. The open and transparent management of bidding and procurement is conducive to reducing transaction costs and attracts a large number of SMEs. Online procurement management realizes the normalization and standardization of the procurement process, which enables a large number of SMES to obtain the supply chain financial services provided by the bank thanks to the credit endorsement of Hebei Construction Group, which is another important function of the ECPP.

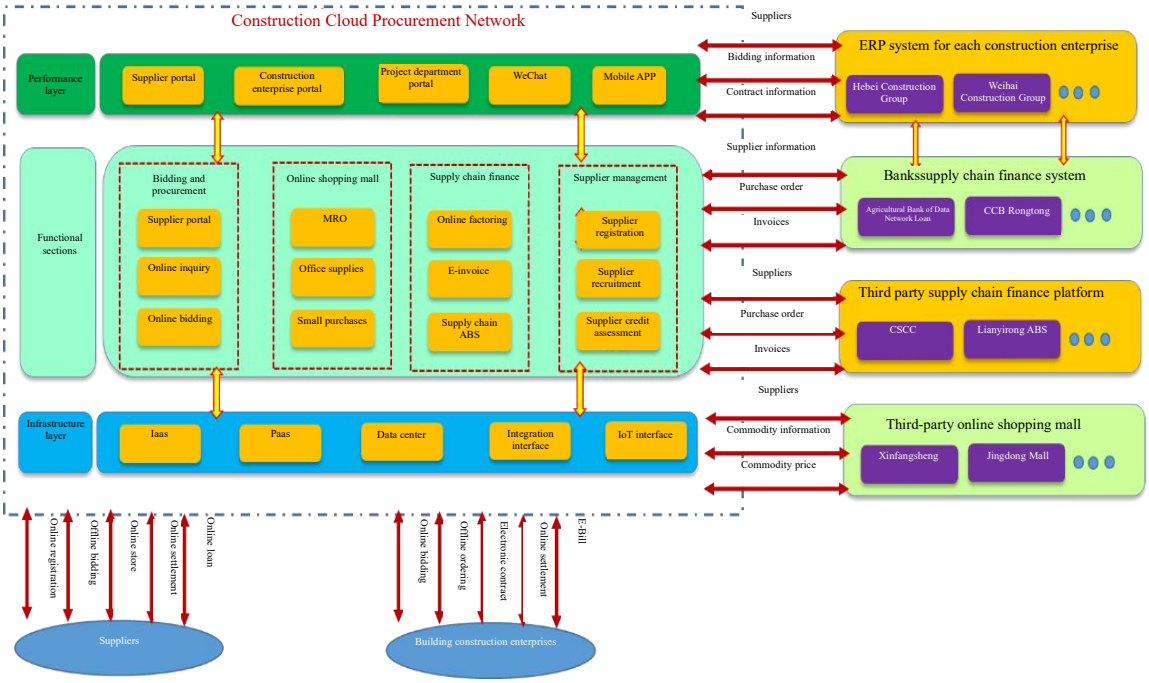



**Figure 5.1 Hebei Construction Group's ECPP**

For the ECPP of the target enterprise group, we obtained the list of suppliers by quarter and possible related business transaction information through the company's internal information. Figure 5.2 below demonstrates the changes in the number of new material suppliers on the ECPP since 2017. Figure 5.3 demonstrates the movement in overheads to the ECPP.

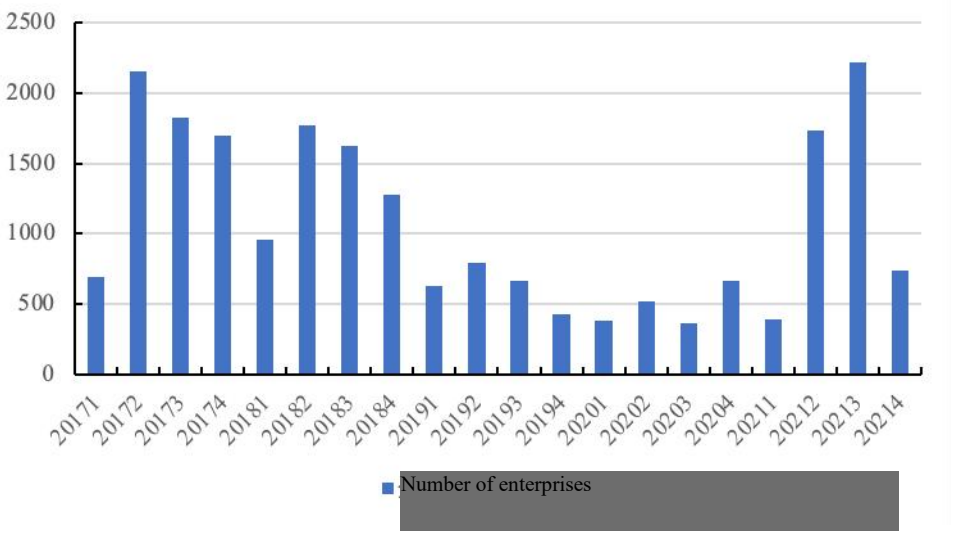


**Figure 5.2 Number of new enterprises within the ECPP**

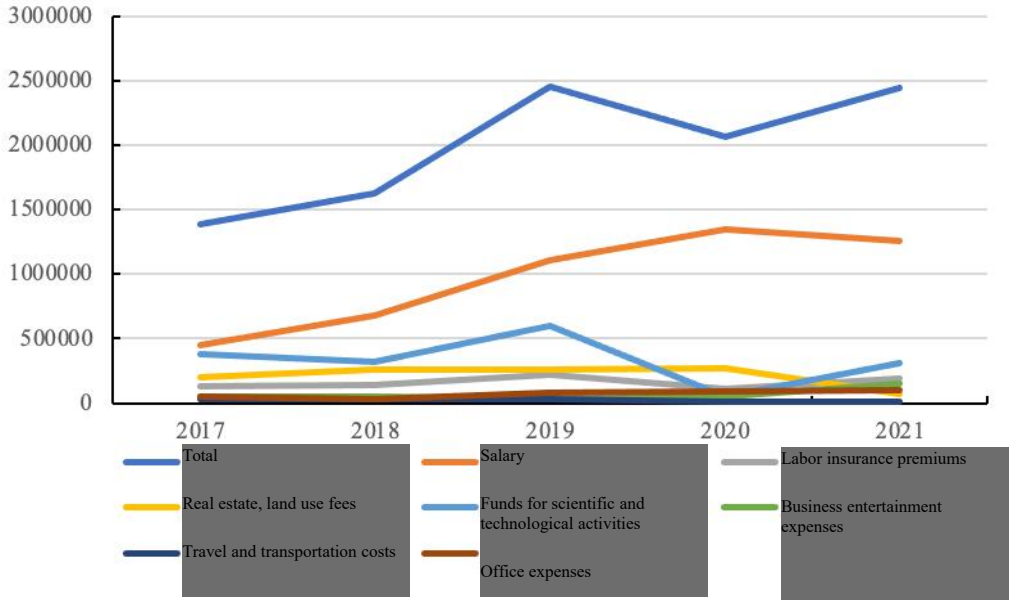



**Figure 5.3 Platform management expenses**

### 5.1.2 Impacts of the ECPP on operations

The impact of Hebei Construction Group's exploration of the ECPP in the field of procurement on business operations is mainly reflected in the following aspects:

(1) Solving the problem of insufficient refinement of the traditional procurement management mode

The low entry threshold in the construction industry, the year-on-year growth in the number of enterprises engaged in the industry, and the need for state-owned large-scale construction industry for market share, have led to an imbalance between supply and demand and intensified the competition in the industry. On the other hand, the high cost in the industry has squeezed the profit space of downstream construction enterprises, leading to the savage growth and sloppy management of construction enterprises. The traditional procurement management mode can no longer adapt to the new trend

prevailing in the industry, and refined management is gradually put on the agenda. As a main component of cost, refined procurement management is particularly vital.

Since the promotion of the ECPP, Hebei Construction Group has increased the transparency of procurement, standardized the bidding process and promoted the fair competition among suppliers. Hebei Construction Group realizes the online procurement management via the ECPP. The ECPP further optimizes the procurement management system through big data, which not only improves the efficiency of procurement management, but also enhances Hebei Construction Group's digitalization level in terms of operation and management.

(2) Improving corporate tax management

The Chinese government began to fully implement the value-added tax in lieu of business tax in 2016. This tax reform rebuilds the original tax system, designating the input tax in cost expenditure in the construction industry as an important element of procurement costs, which means that an enterprise's procurement costs will grow if it cannot adapt to the new tax system due to poor management. Therefore, the management of suppliers and transaction is very indispensable.

Thanks to the continuous optimization of the procurement management on the Internet, Hebei Construction Group functions more accurate and standardized in the management of capital flow. It reduces the tax management cost, and the brand-new digital procurement management system significantly improves through the real-time monitoring of the factual data of logistics, information flow, and capital flow, the operation efficiency, makes

the management of capital flow more efficient, and perfectly adapts to the new tax system.

(3) Integrating resources for full competition

Procurement costs including raw materials, equipment and services take up for 85% of the total cost and above, and centralized procurement has incomparable advantages in terms of resource integration, cost reduction, risk prevention and control and market expansion. Hebei Construction Group provides financial and other services for a large number of SMEs through the ECPP, which not only revitalizes the entire industrial chain, but also promotes the healthy development of the industry, thus creating a healthy industrial ecology, cultivating a large number of loyal upstream and downstream business partners, and realizing win-win situation through the digitized and efficient management mode.

(4) Reducing procurement risks

As Hebei Construction Group (boasting of large scale) often undertakes large-scale construction projects requiring multiple types and great quantity of products, the traditional procurement management process is no longer able to realize procurement risk management. It is difficult and costly to manage non-compliance, illegality, or false invoicing of suppliers, etc., and it is not possible to realize risk prevention and control, which leads to lawsuits and other problems arising from the quality of materials. Therefore, the establishment of the ECPP enhances Hebei Construction Group's control and management of the entire procurement process and greatly reduces the procurement risk.

(5) Promoting industry progress

China launched the "Internet+" or "+Internet" policy orientation in 2015 to promote the transformation and upgrading of traditional industries. State-owned construction enterprises took the lead in launching the "Internet+" development strategy to further consolidate the industry's position, which weakened Hebei Construction and other large private construction enterprises. To develop, Hebei Construction Group had to carry out the "Internet + Procurement" platform building.

Hebei Construction Group achieves through the ECPP a more legal and compliant management of the procurement process, and establishes an effective and replicable procurement management model. The centralization of procurement functions helps to reduce the waste of manpower, facilitates the cultivation and training of procurement talents, implements the specialized division of labor, reduces the cost and improves the procurement efficiency.

## 5.2 Empirical findings

### 5.2.1 Impacts of the ECPP on profits: based on the synthetic control method

Using the financial data of 83 listed companies in the construction industry from 2010 to 2019, this paper uses the synthetic control method to analyze the impact of Hebei Construction Group's ECPP on their business performance after 2017 when the ECPP was established. Our sample is cut off in 2019 due to the outbreak of Covid-19 in 2020, which has a great impact on the construction industry that requires outdoor work. Meanwhile, since the cost item in Hebei Construction Group's public financial data only discloses the cost of goods sold, this paper directly analyzes Hebei Construction Group's profit. Our data includes the panel data of Hebei Construction Group and the

remaining 82 listed companies in the construction industry from 2010 to 2019, totaling 830 observations.

In this paper, we use Stata 17.0 software and synth program package of synthetic control method to conduct empirical analysis and test. First, Hebei Construction Group is synthesized as a linear combination of enterprises in the control group through Stata software; after fitting, the weights of each firm are different, and the sum of the weights is 1. This article synthesizes the 2010 enterprise's market value, scale, ROA, and debt ratio using the synth command to ultimately select three companies: Sichuan Road & Bridge, Chongqing Construction Engineering, and Ningbo Construction Engineering. Their weights are 0.797, 0.112, and 0.091 respectively.

The profit changes of Hebei Construction Group and other control group enterprises are shown in Figure 5.4 below. The dotted line is the real Hebei Construction Group; the solid line is the Hebei Construction Group fitted by the synthetic control method; the vertical dotted line is the period when Hebei Construction Group establishes the ECPP, and the right side of the dotted line is the period after the establishment of the ECPP. The impact of the ECPP on profits is represented by the difference in profits between Hebei Construction Group and other enterprises in the control group. As shown in Figure 5.4 below, the profit growth of the enterprises in the control group almost overlapped with Hebei Construction Group before 2017, which indicates that there is no significant difference between theoretical growth rate of the two before Hebei Construction Group set up the ECPP, which also indicates that the selection of the control group in this paper is reasonable. Also, the profit of Hebei Construction Group deviated from the rest of the enterprises in 2017,

significantly higher than them and continued to rise in 2018 and 2019. This suggests that the establishment of the ECPP in 2017 led to a soar in the profit of Hebei Construction Group.

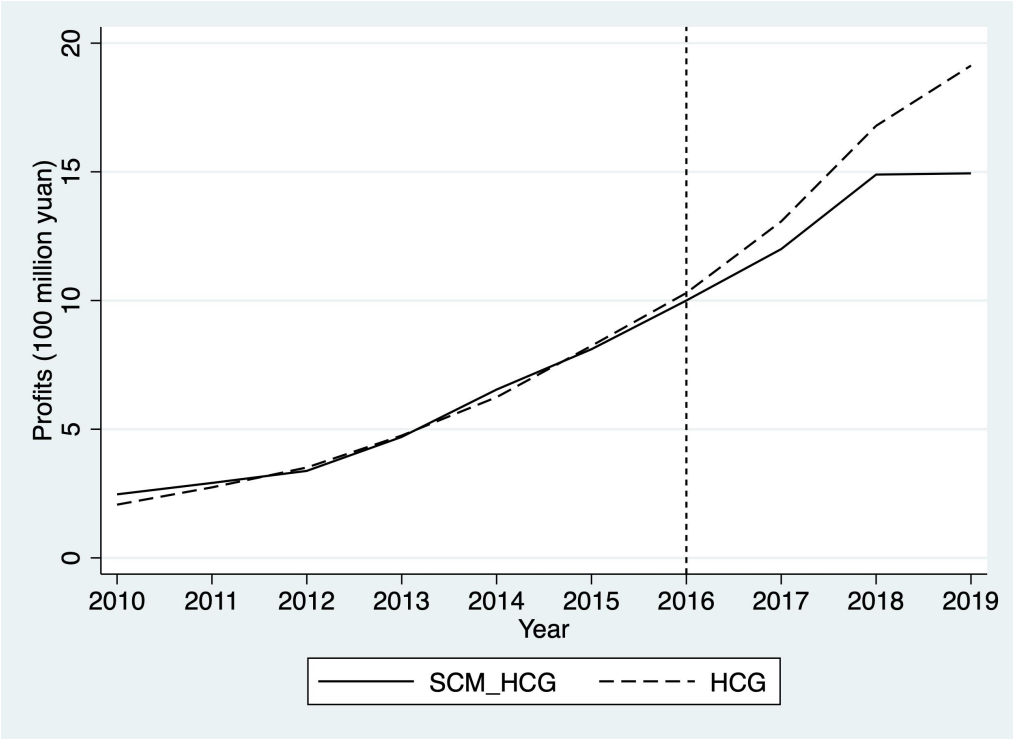



**Figure 5.4 Fitting results under the synthetic control method**

Further, this paper intends to clarify how much the establishment of the ECPP affects the profit of Hebei Construction Group. On the basis of the synthetic control method, we keep the profits of the real Hebei Construction Group and the synthetic Hebei Construction Group for each year in Figure 5.4, and subtract the two to get the difference of the profits for each year. As shown in Figure 5.5 below, the profit difference between the synthetic Hebei Construction Group and the real Hebei Construction Group is basically at around 0 before 2017, which is also consistent with the results in Figure 5.4 above. The profit of Hebei Construction Group significantly grew in 2017, about RMB100 million higher than the profit of the synthetic Hebei

Construction Group. And, this profit gap continues to expand over time. In 2019, this profit gap began to widen to about RMB400 million. On average, over the three years that Hebei Construction Group has had the ECPP, the average increase in profits has been RMB230 million.

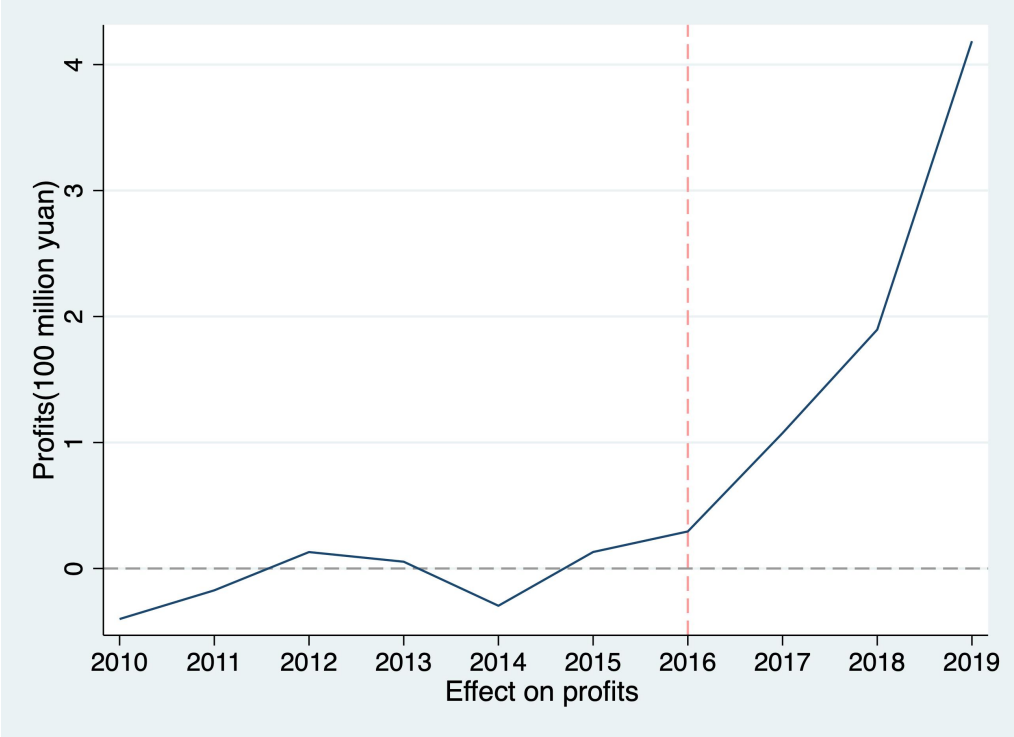



**Figure 5.5 Fitting result of the synthetic control method: profit analysis**

### 5.2.2 Impacts of the ECPP on profits: based on the double difference method

It needs to be emphasized that due to the limitations of the synthetic control method, if Hebei Construction Group made significant strategic adjustments during the same period, these strategic adjustments would have a significant impact on the company's operational performance. The synthetic control method cannot rule out the interference of such policy confusion on results. Therefore, to further verify the effect of ECPP on Hebei Construction Group's profits, this paper uses the double difference method and controls

variables related to strategic adjustments as much as possible to conduct a robustness test based on the synthetic control method. We can construct the following model:

$$y_{it} = \beta_1 + \beta_2 \times platform_t + X_{it} + \delta_i + \gamma_t + \epsilon_{it} \quad (5\text{-}1)$$

Wherein, $y_{it}$ is the operating profit and ROA of each company; $platform_t$ is a dummy variable, assigned a value of 0 before the establishment of the ECPP, and assigned a value of 1 after the establishment of the ECPP. $X_{it}$ are a series of control variables. We have selected the size (total number of employees), the debt ratio and the fixed assets; $\delta_i$ is the fixed effects of the enterprise, and $\gamma_t$ is the fixed effect of the year. According to the above regression, we can get the effect on the profit of Hebei Construction Group after the establishment of the ECPP.

The regression based on the above formula is presented below. In column 1, we only control the size (total number of employees), debt ratio and fixed assets, and did not control the fixed effects of the enterprise and the year. The results show that the ECPP significantly contributed to the profit: on average, the profit grew by RMB703 million. Column 2 of this paper did not control the size (total number of employees), debt ratio and fixed assets, but control the fixed effects of the year and the enterprise; the results show that the coefficients dropped significantly, but are still significant at the 1% significance level, which indicates that the fixed effects have a relatively large explanatory power for profits. In column 3, after we control for both size (total number of employees), debt ratio and fixed assets, as well as the two fixed effects, the coefficients show only a slight slip from the second column, implying that our results are relatively robust. The effect of ECPP on profits is

about RMB 400 million.

**Table 5.1 Regression results based on the double difference method**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Profit | Profit | Profit | ROA | ROA | ROA |
| Platform | 7.03** | 4.24*** | 4.12*** | 1.13*** | 0.67*** | 0.62** |
| | (2.67) | (1.23) | (1.07) | (0.34) | (1.23) | (1.07) |
| Size | 0.29*** | | 0.18*** | 0.15*** | | 0.23*** |
| | (0.08) | | (0.06) | (0.04) | | (0.08) |
| Debt ratio | -0.17** | | -0.14** | -0.62** | | -0.77** |
| | (0.07) | | (0.06) | (0.19) | | (0.39) |
| Fixed assets | 1.45 | | 1.72 | 1.12 | | 1.99 |
| | (1.34) | | (1.65) | (1.67) | | (1.54) |
| Year fixed effects | No | Yes | Yes | No | Yes | Yes |
| Enterprise fixed effects | No | Yes | Yes | No | Yes | Yes |
| Observations | 830 | 830 | 830 | 830 | 830 | 830 |
| Adjusted $R^2$ | 0.71 | 0.94 | 0.95 | 0.71 | 0.94 | 0.95 |

Note: (1) t-values of estimated coefficients are in parentheses and standard errors are adjusted for clustering at the province level; (2) *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively.

The core assumption of the double difference method is the parallel trend assumption, which means that in the absence of policy shocks, there should be no significant difference between the ex ante development trends of the treatment and control groups. If this paper assumes that there is no construction of the ECPP, there should not be a significant difference between the profit growth of Hebei Construction Group and the other 82 peers in the construction industry before 2017. In this regard, we tested this using event study analysis, and the results are shown in Figure 5.6 below. We take the year before the establishment of the ECPP (2016) as the control group, and each dot in the figure means the difference between the profits of Hebei Construction Group and enterprises in the control group in each year relative

to the change in 2016, and the black dotted line is the 95% confidence interval. The figure shows that before 2017, the difference between the two is not significant and hovers around 0, implying that the parallel trend test of this paper is satisfied and that theoretical growth trend of Hebei Construction Group becomes very obvious after 2017. This is consistent with the basic results of this paper.

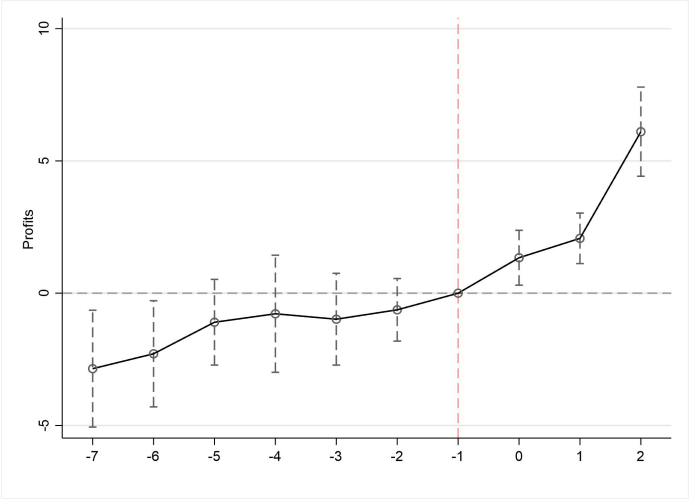



**Figure 5.6a Parallel trend test - Profits**

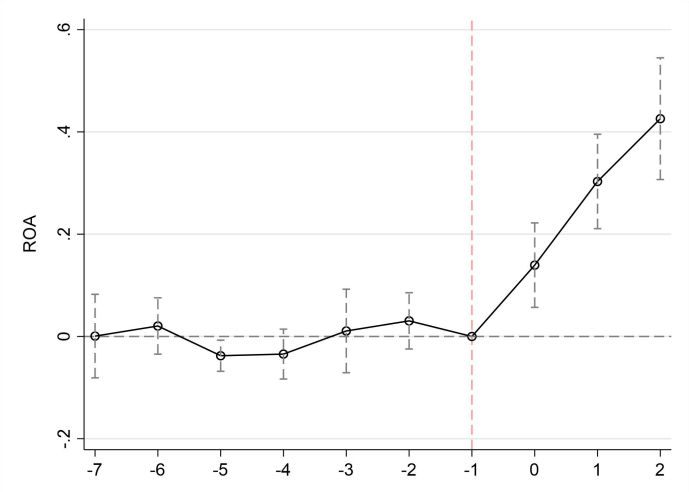



**Figure 5.6b Parallel trend test - ROA**

**Figure 5.6 Parallel trend test**

This result is estimated to be larger compared to the results of the

synthetic control method, as different control groups are selected for the two measures. In the synthetic control method, we use 82 mainland listed companies to fit out the Hebei Construction Group, which is a data-driven approach to select companies that are very similar to the Hebei Construction Group in all categories of indicators, and does not use all 82 sample companies. In the double difference model, our control group is all eight listed companies in the construction industry. Therefore, the average profitability of the control group is weaker in the double difference model, and the estimated coefficients are naturally larger. However, overall, the results of both the double difference and the synthetic control methods show that the effect of the ECPP on the profit growth of Hebei Construction Group is very obvious.

## 5.3 Impacts of the ECPP on suppliers: based on questionnaires

In order to collect information on suppliers, this paper utilizes the stratified random sampling method. It firstly divides the sample into different levels, and then carries out independent random sampling in each level to ensure that each subgroup is sufficiently representative. A total of 300 questionnaires were distributed on the WeChat applet, and we finally obtained 208 valid questionnaires. In the questionnaire, we asked suppliers in detail about their subjective feelings and objective changes in their operations after joining the ECPP, so as to further discuss the impact of the ECPP on business operations from the suppliers' perspective.

### 5.3.1 Basic description

We will first provide in this section, a brief description of the basic information effectively collected from suppliers. Figure 5.7 below illustrates when sample suppliers joined the ECPP. We find that only a small number of

suppliers joined the ECPP before it was officially operational in 2017. The number of downstream suppliers joining gradually grew as the ECPP went online and operated. Since the questionnaire for this paper was distributed in mid-2023, it is clear that the largest number of samples joined the ECPP in 2023, accounting for close to about 40%. This may indicate a considerable mobility of the incoming merchants on the ECPP, whereas the share of suppliers who have survived on the ECPP for a longer period of time is only around 20%.

There are multiple reasons behind this trend. One reason may be that the ECPP may have attracted some early followers during the initial operational phase, who join in the early stages of the ECPP's establishment with a desire to gain a competitive advantage. Then, over time, the increasing visibility and attractiveness of the ECPP attracted more suppliers, especially in 2023, and the number of new followers may have grown rapidly due to the increased demand for ECPP in the market.

Another reason may be that the construction industry may be a highly competitive industry with more frequent entries and exits between companies. Some suppliers may attempt to enter the market but ultimately choose to exit due to intense competition or other factors. This market dynamism may also lead to an increase in the number of suppliers joining the ECPP in 2023, as they may view the ECPP as a way to increase business opportunities and exposure.

From the distribution of suppliers' date of entry, understanding which suppliers joined in the early years of the ECPP and which joined in the later years help us understand the characteristics and behaviors of different

suppliers in the ECPP. Suppliers with different entry dates may have different experiences and performance on the ECPP, which will be an important dimension to be considered in the subsequent study.

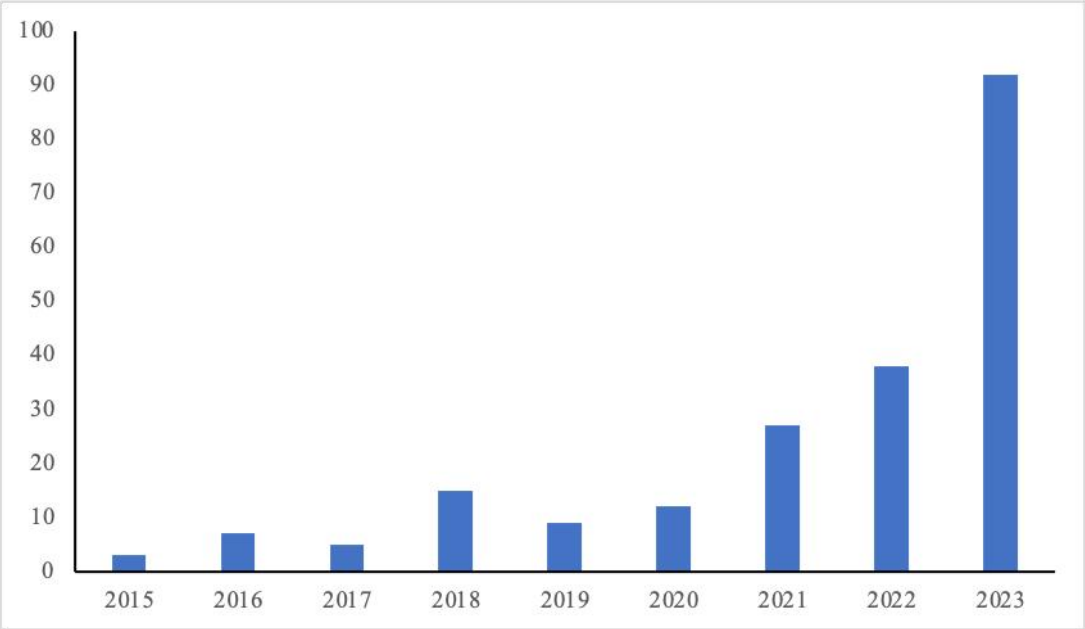



**Figure 5.7 Distribution of date of the suppliers' entry into the ECPP**

we conducted detailed statistics and analysis with respect to the geographical distribution of the ECPP enterprises and obtained some interesting findings based on the location of enterprises indicated in the questionnaire. Among them, the number of suppliers from Hebei Province is the largest, accounting for more than 50%. Next, the number of suppliers from Beijing, Tianjin and Shandong Province is also relatively high. This shows a clear tendency for the upstream suppliers of Hebei Construction Group to be localized, which coincides with the group's main business scope.

Geographically, it is clear that the vast majority of suppliers are from the northern provinces of China. Suppliers from southern provinces, such as Shanghai, Guangdong, Jiangsu, Sichuan, Chongqing, Zhejiang and Hubei,

take up for a lesser extent. This suggests that Hebei Construction Group has a closer supply chain network in the northern provinces, especially Hebei Province, while in the southern regions, especially in South China, there is still a large potential for market expansion. In this regard, cooperation with suppliers in Hebei Province should continue to be strengthened, which may help to reduce logistics costs and improve supply efficiency in the supply chain. In addition, focusing on the expansion of the southern market is also a potential strategic direction. Depending on the market demand, the Group may consider expanding its market share in southern China provinces so as to secure wider market coverage.

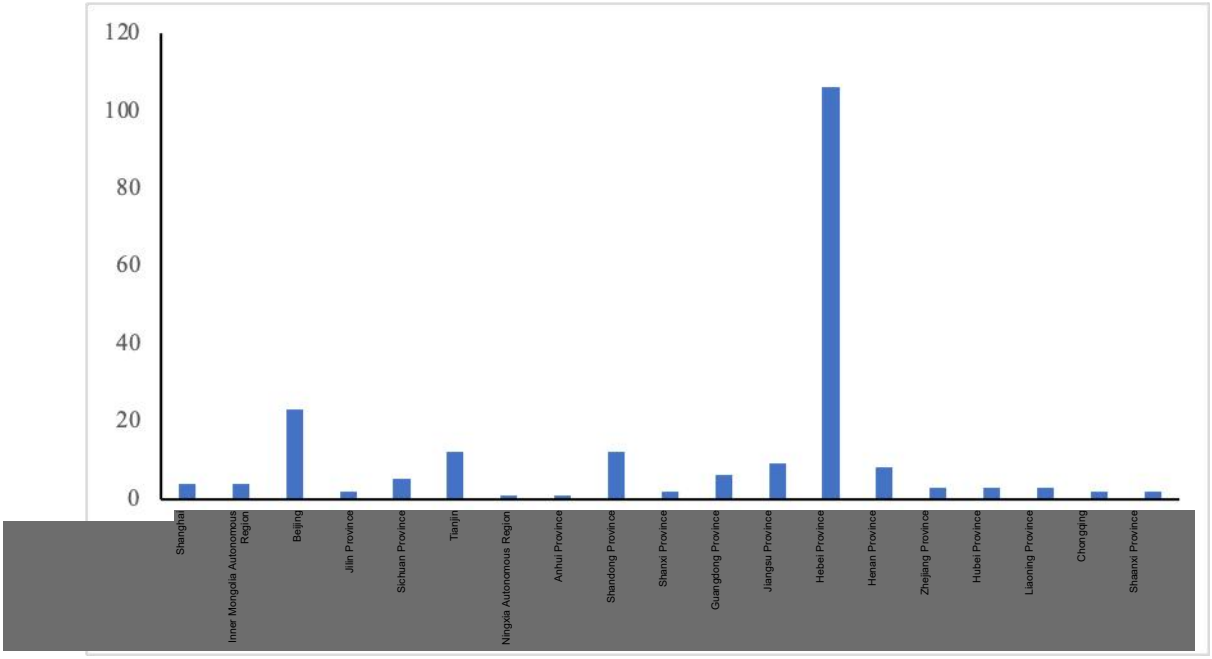



**Figure 5.8 Regional distribution of suppliers**

Joining the ECPP is an important initiative in modern enterprise management with wide application and influence. Especially for a large-scale enterprise like Hebei Construction Group, it has huge procurement demand and scale of sales, which is a market with great potential for upstream

suppliers. This paper will explore the motivation of upstream suppliers to join the ECPP and the impact on their business results after joining the ECPP.

First, in terms of upstream suppliers' motivations for joining the ECPP, the highest demand is to expand scale of sales (77% of the total). This indicates that upstream suppliers are eager to expand scale of sales by cooperating with Hebei Construction Group, a huge customer. The high percentage reflects the market potential, and the ECPP provides a broader sales channel for suppliers, thus satisfying this demand.

Secondly, the buyer's need and demand for cost reduction is also quite important. This means that upstream suppliers are longing to reduce their production and operation costs through cooperation with Hebei Construction Group, thus improving their competitiveness. Costs cut can help players better cope with market competition and increase profit margins, which is one of the important factors attracting suppliers to join the ECPP.

So, how does joining the ECPP affect the business results of upstream suppliers? We asked three key questions in the questionnaire, namely whether it reduces the cost of sales, whether it increases the scale of sales, and whether it increases the profit. Suppliers were asked to answer on each of these three questions, ranging from "useless" to "greatest". The answers to these questions will help us get a fuller picture of the actual benefits of the ECPP for suppliers. If the majority of suppliers answered "general" or "greatest", then it can be inferred that joining the ECPP has had a positive impact on their business results, which may include costs cut, increased scale of sales, and improved profitability. The results are shown in Figure 5.9 below.

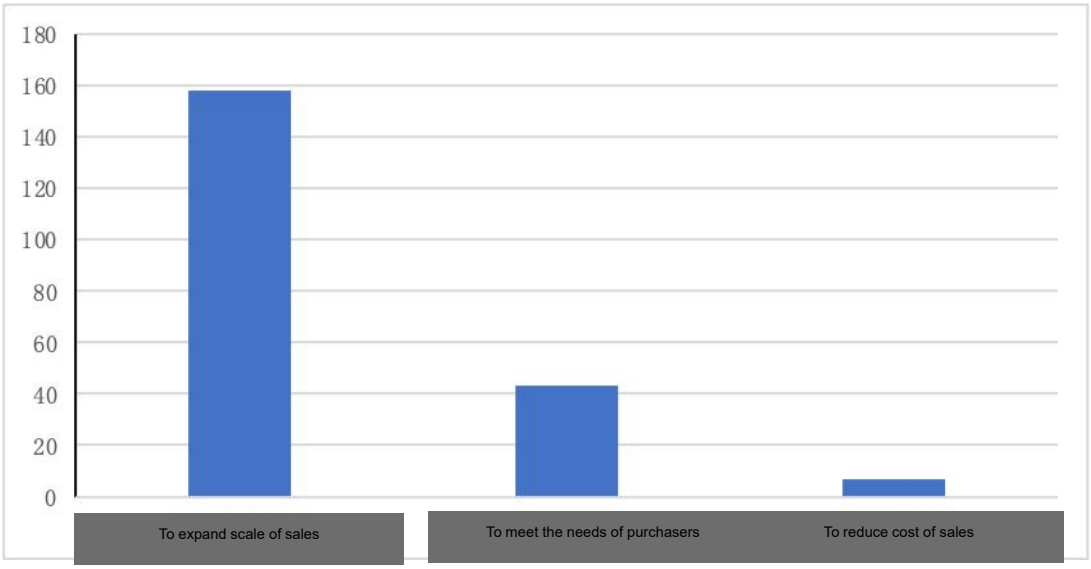



**Figure 5.9 Impact of joining the ECPP on suppliers' operations**

Figure 5.10 below uncovers responses on cost, scale and profit. These responses uncover important information about the actual impact of the ECPP on their business.

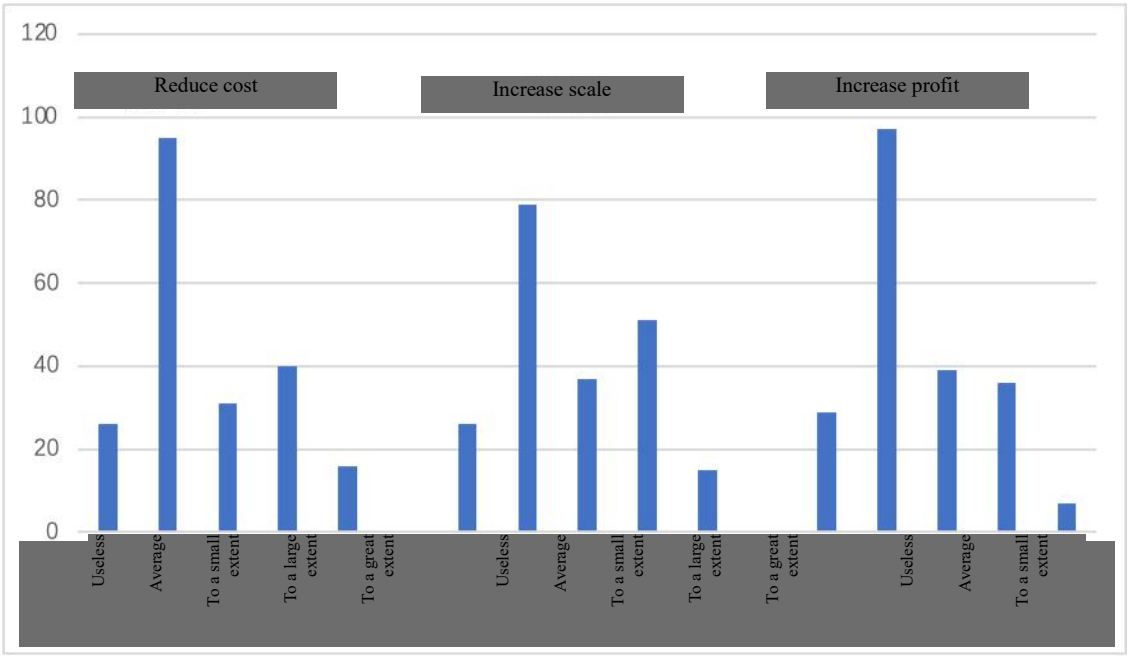
First, cost. According to the graph, the highest percentage of responses is "average" at around 47%. This suggests that a significant proportion of upstream suppliers believe that joining a ECPP has not led to significant improvements in their cost control. This may be due to the fact that they expected more substantial cost reductions, but the actual results were not as good as they would have liked. It also requires further research to understand what factors are contributing to this phenomenon. It could be due to specific procurement arrangements or contract conditions, or it could be due to market factors.

Then scale. It is encouraging to see that a significantly higher proportion of suppliers answered general" relative to cost and profit. This means that more suppliers believe that the ECPP has had a positive effect on their scale.

This is in line with the high demand from upstream suppliers to scale up their sales as mentioned earlier. The ECPP provide them with a wider market and increased sales opportunities, thus fulfilling their longing for business expansion.

Finally, profit. Although "general" still dominants, we can see that there is also a certain percentage of suppliers who believe the ECPP is "greater". This discloses that some suppliers are indeed benefiting from the ECPP and have improved profits. This may be because they are able to operate more efficiently or because the ECPP provides more sales opportunities. However, some other suppliers may need further support or optimization to get higher profits.

To summarize, the impact of ECPP on upstream suppliers is multifaceted, covering cost, scale and profit. While some suppliers feel average about the benefits of the ECPP, others clearly benefit a lot, especially in terms of scale-up. This means that the actual effectiveness of the ECPP depends on the suppliers' own circumstances and expectations, and further optimization and collaboration may be needed to better meet the needs of all parties.



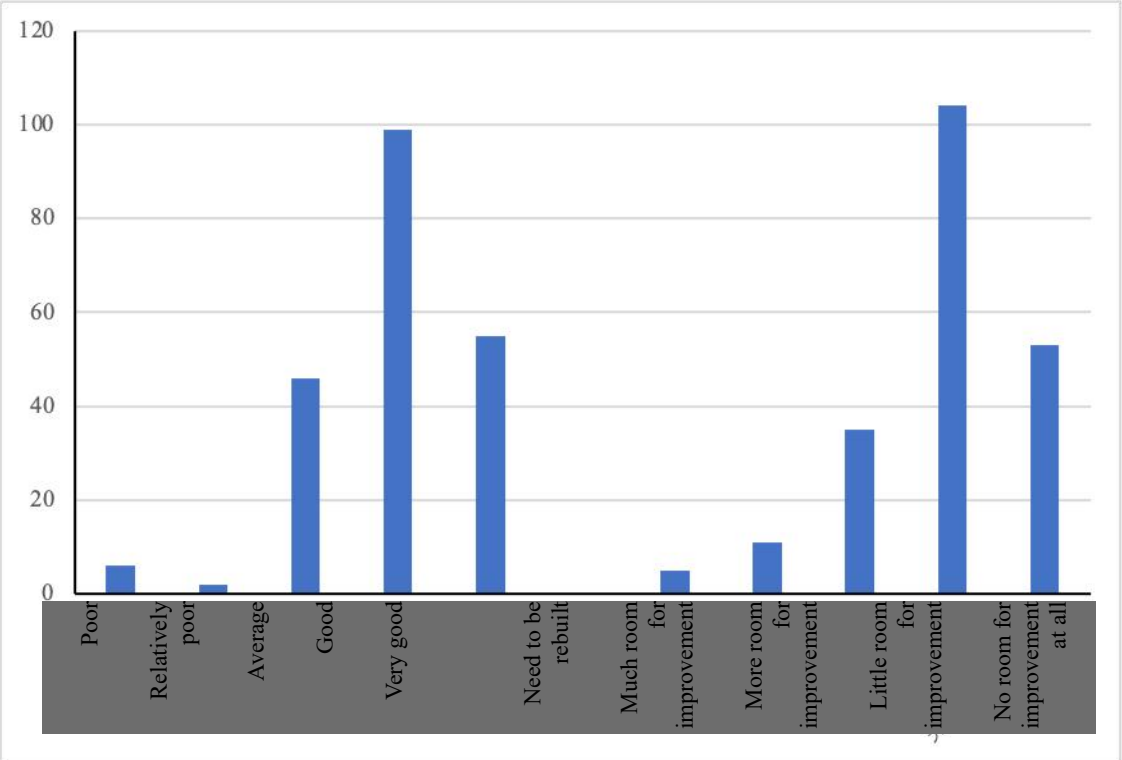

Note: The above chart shows the responses to the three questions "has the ECPP reduced your costs?" "has the ECPP increased your scale of sales? and "has the ECPP increase your profits?".

**Figure 5.10 Impact of the ECPP on suppliers' business indicators**

Finally, we also asked upstream suppliers about their subjective evaluation of the ECPP via two questions, namely, what is your overall evaluation of the ECPP? Answers are 1. poor 2. relatively poor 3. average 4. good 5. very good, and the other question was whether you think there is room for improvement of the ECPP? There are also five options: 1. None at all 2. little room for improvement 3. some room for improvement 4. much room for improvement 5. need to be rebuilt. First, we asked the suppliers about the overall evaluation of the ECPP. According to the results presented in Figure 5.11 below, suppliers' overall assessment of the ECPP is relatively positive. This suggests that the ECPP has been successful in some aspects to the satisfaction of suppliers. It is also worth noting that more than 40 respondents

still feel "average". This implies that there are still some suppliers who may have some dissatisfaction with certain aspects of the ECPP, or who would like to see more improvements.

Secondly, we asked suppliers whether there is room for improvement on the ECPP. As shown in Figure 5.11, about 35 or so respondents believe that there is "some room for improvement" on the ECPP. This means that suppliers believe that the ECPP could be further optimized and improved in some areas to better meet their needs. This is an important piece of feedback that suggests the ECPP should actively listen to suppliers' voices to drive future improvements.




Note: The chart above shows the responses to the two questions "what is your overall evaluation of the ECPP?" and "do you think there is room for improvement of the ECPP ".

**Figure 5.11 Suppliers' opinions on the improvement of the ECPP**

### 5.3.2 Empirical tests on the impact of the ECPP on suppliers' performance

Since the detailed financial information of upstream suppliers is not available in this paper, we conduct a simple regression analysis using the questionnaire to further quantitatively analyze the impact of the ECPP on upstream suppliers. Since the date of suppliers' entry into the ECPP is different, if the ECPP has a positive impact on suppliers' operation, the longer the suppliers are on the ECPP, the more they will be affected by the ECPP, so we conducted a simple least squares regression with the suppliers' perception of the ECPP's impact on their own costs, scales, and profitability as predicated variables, and the time of being on the ECPP as the core explanatory variable. To make it clear, we redefine the predicated variable. We also define the responses of "useless" and "little" as having no significant effect, assigning a value of 0, and the responses of "general", "greater", and "greatest" as having a significant effect, assigning a value of 1. For example, for the question "whether the ECPP helps to reduce costs", we define responses that are not helpful and general as not reducing costs and assign a value of 0, and responses that are to a small degree, a large degree, and a great degree as reducing costs and assign a value of 1. Similar calculations are made for indicators such as size and profit. The core explanatory variables are calculated by subtracting the year of entry to the ECPP from 2023 and the results are shown in Table 5.2 below.

In the first three columns of Table 5.2 below, controlling province fixed effects, we find that for each additional year of entry to the ECPP, the probability that suppliers perceive the ECPP as having a dramatic fall in costs

increases by 2.9%; the probability of a significant expansion in scale increases by 3.7%, and that of a significant increase in profits increases by 2.3%, all of which are significant at the 1% level of significance. This indicates that the longer engagement with the ECPP, the greater the impact of the ECPP on the upstream suppliers and the greatest impact on the scale from the point of view of the regression coefficient. They are also consistent with the basic information of the questionnaire, the role of the ECPP on the upstream suppliers is mainly embodied in the expansion of the scale of sales.It is worth noting that the regression results show a significant increase in enterprise costs after the establishment of the centralized procurement platform, which may be due to the expansion of scale.

**Table 5.2 Regression results based on questionnaires**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Cost | Scale | Profit | Cost | Scale | Profit |
| Date to enter the ECPP | 0.052*** | 0.064*** | 0.033*** | 0.029** | 0.037*** | 0.023*** |
| | (0.020) | (0.022) | (0.010) | (0.015) | (0.017) | (0.009) |
| Supply chain finance | | | | 0.010** | 0.018** | 0.022* |
| | | | | (0.004) | (0.010) | (0.012) |
| Business nature | Yes | Yes | Yes | Yes | Yes | Yes |
| Whether Hebei Construction Group is the largest customer | Yes | Yes | Yes | Yes | Yes | Yes |
| Province fixed effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 208 | 208 | 208 | 208 | 208 | 208 |
| Adjusted $R^2$ | 0.34 | 0.39 | 0.28 | 0.36 | 0.41 | 0.29 |

Note: (1) t-values of estimated coefficients are in parentheses and standard errors are adjusted for clustering at the province level; (2) *, **, and *** denote statistical significance levels of 10%, 5%, and 1%, respectively.

This paper attempts to investigate how the ECPP affects suppliers' operations. Supply chain finance is one of important and characteristic functions of the ECPP from the establishment and operation process of Hebei Construction Group's ECPP. Financial technology and the Internet enable the cross-border connection of the supply chain participants on the ECPP, so that the supply chain financial services are steadily embedded in the supply chain ranging from transaction, logistics and government affairs, and realize the in-depth integration with the supply chain transaction and management. More importantly, supply chain finance provides solutions to the conceptual and technical bottlenecks of SME financing, and SMEs are no longer inaccessible to the credit market. Therefore, we purposely asked in the questionnaire whether suppliers enjoy supply chain financial services, and the results show that there are still close to two-thirds of suppliers who do not enjoy this service.

Therefore, taking advantage of the difference in the indicator of access to supply chain financial services, we further include the indicator of access to supply chain finance in the last three columns of Table 5.2. The results show that this indicator is basically positive and significant at the 10% level, which suggests that supply chain finance per se has a significant contributing effect on the business conditions of suppliers. Meanwhile, in Columns 4-6, the regression results of time intersect the first 3 columns with a significant decrease, indicating that supply chain finance has a more significant explanatory power for suppliers' operation, which also indicates that the role of access to the ECPP is largely attributed to the enjoyment of financial services. Therefore, the above results suggest that enjoying the financial services on the ECPP is one of the important mechanisms for the role of the ECPP.

According to the above results, it can be found that suppliers entering the centralized procurement platform are obviously subject to positive externalities of the platform. However, it must be realized that since the data in this article comes entirely from suppliers who have joined the platform, and theoretically such positive externalities can only be obtained after joining the platform, this may lead to further differentiation within the supplier group. What kind of business methods will be adopted for market operation and competition by suppliers who have not joined the centralized procurement platform in the future requires further research in the future.

# Chapter 6 Conclusion

Through case analysis, questionnaire, and empirical research, this paper obtains several important findings as follows: first, the ECPP significantly improves the profit of Hebei Construction Group: our study finds that the establishment of the ECPP has a significant positive impact on the business performance of Hebei Construction Group. This platform significantly improved Hebei Construction Group's profit by reducing procurement costs, improving procurement efficiency, and promoting cooperation among suppliers. Second, suppliers' business performance benefits from the ECPP: we find that suppliers on the ECPP embrace significant improvements in business performance. They have higher sales, higher market share, or higher profits. The ECPP provide suppliers with broader market opportunities and higher exposure, thus helping them gain a competitive advantage in a highly competitive market. Third, supply chain financial services are one of the key mechanisms: our study reveals that supply chain financial services on the ECPP play an important role in improving suppliers' business performance. These financial services, including financing support, account period management, and risk sharing, help improve suppliers' liquidity, reduce operational risks, and promote business growth. Fourth, the application of digital technology and data analytics is the key to success: Hebei Construction Group's success comes not only from the establishment of the ECPP, but also from Hebei Construction Group’s active adoption of digital technology and data analytics to optimize procurement decision-making, supply chain management, and market forecasting. These technologies help enhance operational efficiency, reduce costs, and help Hebei Construction Group better

meet market demands.

We propose based on the above findings the following policy insights to guide Hebei Construction Group to better utilize the ECPP and related mechanisms in its future operations: First, further and proactively develop and improve the ECPP, including expanding its supplier network, strengthening its partnerships, and providing more value-added services. The further development of the ECPP will further enhance Hebei Construction Group's procurement efficiency and operating performance. Second, continue to optimize digital technology and data analytics as they play a crucial role in improving decision-making efficiency and reducing risks. Hebei Construction Group should continue to invest in and develop these areas to ensure its ability in responding to changing market demands. Third, strengthen supply chain financial support as supply chain financial services are an important part of the success of the ECPP. Hebei Construction Group should continue to provide services such as financing, account period management and risk sharing to help suppliers enhance liquidity, reduce risk and promote business growth. Fourth, continue to improve partner relationships as the establishment and maintenance of partner relationships is critical to the success of the ECPP. Hebei Construction Group should maintain active communication and interaction with suppliers and partners in order to jointly promote business development. Fifth, monitor and evaluate benefits and performance of the ECPP by establishing in place a monitoring and evaluation mechanism. Regular performance evaluation will help identify potential improvement points and opportunities.

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# Appendix Questionnaire for Suppliers in the Procurement Platform

## 1. Basic information

| | |
|---|---|
| 1.1 | When did you join the ECPP?<br>_____ |
| 1.2 | Did you have business dealings with Hebei Construction before joining the ECPP?<br>1. Yes 2. No |
| 1.3 | What is your nature?<br>1. Private 2. State-owned 3. Joint venture 4. Collective 5. Other |
| 1.4 | Where are you located?<br>_____ County/District, City, Province |
| 1.5 | Is Hebei Construction your largest customer?<br>1. Yes 2. No |

## 2. Platform related information

| | |
|---|---|
| 2.1 | What is the main purpose of joining the ECPP?<br>1. To expand scale of sales 2. To reduce cost of sales 3. To meet the needs of purchasers 4. To obtain additional services brought by the ECPP, such as supply chain finance, etc. |
| 2.2 | Is the average price of product sales after joining the ECPP, lower than before joining the ECPP?<br>1. Yes 2. No 3. Unchanged 4. No business dealings with Hebei Construction before joining the ECPP |
| 2.3 | Has the ECPP reduced your cost of sales?<br>1. Useless 2. Little 3. General 4. Greater 5. Greatest |
| 2.4 | Has the ECPP increased your scale of sales?<br>1. Useless 2. Little 3. General 4. Greater 5. Greatest |
| 2.5 | Has the ECPP increased your profit?<br>1. Useless 2. Little 3. General 4. Greater 5. Greatest |

| | |
|---|---|
| 2.6 | Have you obtained supply chain financial services from the ECPP?<br>1. Yes 2. No |
| 2.7 | How much of your overall business volume is generated from the ECPP (average per year)?<br>1. Less than 10% 2. 10-20% 3. 20-30% 4. 30-50% 5. 50-60% 6. 60% or more |
| 2.8 | Do you believe that conducting business on the ECPP is increasing competition among your industry?<br>1. Yes 2. No 3. Not sure |
| 2.9 | What is the biggest benefit brought by the ECPP?<br>1. Optimization of sales methods 2. Performance improvement 3. Financial and other services 4. Useless |
| 2.10 | What is your overall evaluation of the ECPP?<br>1. Poor 2. Relatively poor 3. Average 4. Good 5. Very good |
| 2.11 | Do you think there is room for improvement of the ECPP?<br>1. None at all 2. Little room for improvement 3. Some room for improvement 4. Much room for improvement 5. Need to be rebuilt |
| 2.12 | In your opinion, what problems still exist on the ECPP? What are your suggestions?<br>_____ |