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Driving forces of mining outsourcing: Evidence from China

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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 the sources of information which have been used in this DBA dissertation.

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

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Abstract

The outsourcing of services by mining enterprises has become a significant global trend. In classic studies, outsourcing has been shown to improve productivity and reduce production costs. However, as a transitional economy, China has its unique characteristics regarding the driving forces of service outsourcing. By employing a case study method, one mining service outsourcing provider, and five mining enterprises' interviews and archival data, this study constructs a theory to identify the driving forces and mechanisms of mining enterprises' choice of service outsourcing and a logic relationship between variables via a diagram.

Based on the results of the case study, mining enterprises can obtain professional personnel, technology and management through outsourcing and reduce their economic costs, which further motivates them to outsource services. Secondly, outsourcing providers can reduce security risks by providing professional personnel, technology and management services. In addition, Moreover, outsourcing can transfer the safety production risk of mining enterprises to some extent and avoid the political risks of mining enterprises' senior executives. Thirdly, mining enterprises' choice of service outsourcing has heterogeneous ownership characteristics, i.e., private enterprises are more concerned about the cost-reducing effect brought by outsourcing services. State-owned enterprises, however, are more concerned about avoiding political responsibility.

Private mining enterprises must pay more attention to long-term interests such as safety production when fulfilling social responsibility has already been incorporated into enterprise strategy. At the same time, influenced by the principal–agent problem, the economic driving force of China's state-owned mining enterprises is insufficient, and thus outsourcing may be a channel for senior executives to transfer the political risks they originally should bear. Therefore, in the transitional period of China, the benefit conversion mechanism behind mining enterprises' service outsourcing is complex, including the transformation of enterprise-borne management costs into market costs and the transfer of political risks borne by individual executives into economic costs of outsourcing enterprises. This study also demonstrates that externalization and internalization of production links do not only have transaction cost problems, but also conversion problems.

From a practical point of view, regulatory authorities should not attribute mining enterprises' safety production accidents to outsourcing services and crudely impose a ban on agencies. Instead, they should encourage the development of qualified and capable outsourcing providers. At the same time, considering that outsourcing is also a channel for senior executives of mining enterprises to transfer political risks, it is also necessary for regulatory authorities to define the responsibilities of the contracting parties more precisely. From the perspective of outsourcing providers, on the one hand, enterprises need to improve production efficiency through technological innovation. On the other hand, they need to improve service flexibility through perfecting incentive mechanisms.

Keywords: mining enterprises, outsourcing, driving force, China

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1 Introduction

1.1 Research background

With the further development of industrialization in many emerging countries, such as China and India, the global mining industry has grown amazingly rapidly. Taking iron ore as an example, the global output of crude iron ore reached 3.29 billion tons in 2015, an increase of 204.6% compared with 1.08 billion tons in 2000 (NMIC, 2017). The Global Mining Development Report 2019 shows that mining has become a pillar industry in some developing countries. For example, in Congo (DRC), Equatorial Guinea, Angola, Azerbaijan, Kazakhstan, Peru, and some other countries, the mining industry's output value has accounted for more than 20% of GDP. China has a long history of exploitation of mineral resources. Particularly after the reform and opening up, the mining industry has contributed to rapid industrialisation and become the "world factory" of the manufacturing industry (He & Mou, 2020). Even in many western developed countries, the mining industry has attached great importance to the exploration and development of critical minerals such as rare earth, lithium, cobalt, nickel, and fluorite.

As a practice in the mining sector, outsourcing has become an essential trend among international mining enterprises (Mella & Pellicelli, 2012; Feng et al., 2015). Existing literature shows that outsourcing is common in many production processes of mining in Canada (Baattogtokh et al., 2018; Baattogtokh, 2016), Australia (Baattogtokh et al., 2018), sub-Saharan Africa (Obeng et al., 2015), South Africa (Kaplan, 2012), India (Khanna, 2013) and China (Zhang, 2014).

According to the existing theory, the cost reduction brought by the division

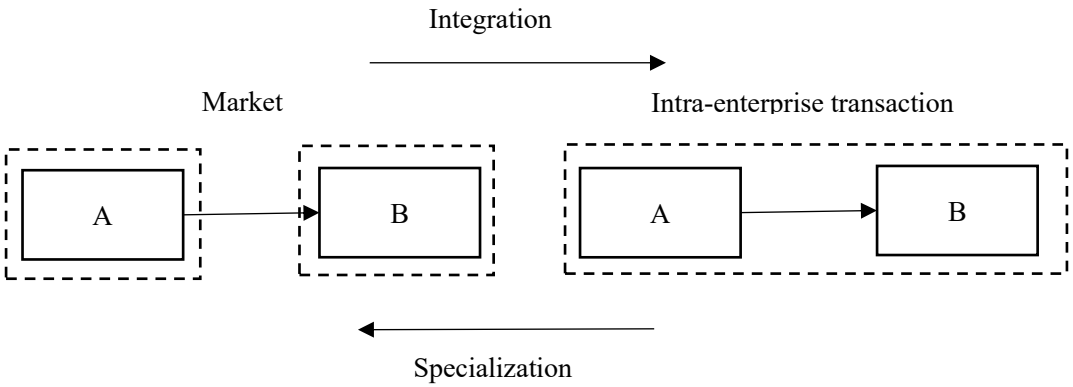
of labour is the main reason mining enterprises choose outsourcing. Smith (1887) has long pointed out that labour division can raise productivity. He held that the division of labour has the following benefits: first, it improves the quality and capability of workers; second, it saves time for task switching; third, it simplifies the work, which is beneficial to the invention and application of machines. Young (1928) believed that the increasing returns brought by the economies of the division of labour depend on roundabout production (or indirect production). The so-called "roundabout production" is a process whereby some intermediate product is produced first to improve the productivity of the final product. The division of labour defined by Smith (1887) is mainly intra-enterprise, e.g., division of labour by such functions as marketing, production, R&D, finance, and human resources. By contrast, Young (1928) focused more on the intra-industry division of labour. He pointed out that "it is impossible to understand the mechanism of increasing returns by observing the changes in the scale of individual enterprises (producers). The constant division of labour and specialization is a basic component of increasing returns. Hence, industrial management must be regarded as an interlinked whole". That is to say, when an industry is regarded as a whole, socialized division of labour is the real reason for increasing returns to scale. "Roundabout production", proposed by Young (1928), extends the intra-enterprise division of work presented by Smith (1887) to the intra-industry division of labour. Outsourcing is an example of an intra-industry division of labour at the enterprise level. Prahalad and Hamel pointed out in the article called "The Core Competence of the Corporation" that outsourcing is a management model in which enterprises dynamically allocate the functions and services of themselves and other enterprises and make full use of the external

resources to serve their internal production and operation, to reduce costs, improve efficiency, give full play to their core competitiveness and enhance their ability to respond quickly to the environment (Prahalad & Hamel, 1999). Many studies have found that outsourcing can help enterprises cut costs and focus on their core competitiveness (Arnold, 2000; Geyskens et al., 2006; Loertscher & Riordan, 2019; Quinn & Hillmer, 1995; van Laarhoven et al., 2000; Vining, 1999). For example, as a world-renowned automobile manufacturer, Toyota has outsourced 70% of its auto parts (Xiao & Gaimon, 2013).

As hefty asset enterprises, mining enterprises have the advantages of a significant investment in capital and technology, a high threshold, and a distinct operation mode, which is difficult to imitate. However, they also have the following disadvantages: heavy assets occupy many funds, which results in high opportunity costs; a large number of fixed costs and depreciation and amortization expenses may cause considerable losses in case of a change in the line of production or underuse of resources; fixed capital increases with scale expansion. Once the economic environment or customer demand changes significantly, there will be a shortage of funds. More importantly, heavy assets can serve far more than a single mine; hence, many idle assets make it difficult for mining enterprises to reap benefits from economies of scale. In practice, many heavy asset projects can hardly make up for the adverse effects caused by asset expansion, even with the rapid growth of the company scale. As a result, their fixed costs increase linearly, diminishing marginal returns. Suppose some production links requiring heavy assets are outsourced on this occasion. In that case, enterprises can significantly reduce their average fixed costs and acquire the benefits of the intra-industry division of labour. It means that apart from the intra-enterprise division of

labour, mining enterprises have another way to obtain benefits from the economies of the division of labour and enhance their competitiveness. Replace the integrated intra-enterprise division of labour with the socialized division represented by outsourcing and purchasing socialized services such as survey, design, construction, operation, sales, and environmental governance to replace intra-enterprise specialization. The relationship between integration and specialization is shown in Figure 1.1.

Figure 1.1
Integration and specialization



Note. Self-compilation

The above theories only emphasize the economic benefits of mining outsourcing. However, the factors that influence economic decisions are often complex. In China, for example, many mining companies are state-owned. Managers of state-owned enterprises are also government employees. They do not have the residual claim of enterprises, so entrepreneurs have limited enthusiasm for production (Zhou, 2000). In the case of poor management, the government often provides fiscal subsidies, tax exemptions, and additional investment and loans to rescue the loss-making State-Owned enterprises. Those policies led to the

widespread "soft budget constraint" phenomenon in state-owned enterprises (Kornai, 1980). With the government's help, the managers of state-owned enterprises are only partially financially responsible for the operation. In this case, the incentive for state-owned mining enterprises to improve economic benefits through outsourcing is insufficient. Thus, the motivation for outsourcing services may be more complicated for state-owned mining companies.

Previous studies on the influencing factors and outsourcing process control of mining enterprises have pointed out that outsourcing is an attractive choice (Baatartogtokh, 2016; Chen et al., 2015; Freytag et al., 2012; Sivakumar et al., 2015). However, these studies mainly discuss the driving forces of outsourcing from an economic perspective. However, there are many state-owned mining enterprises with insufficient economic driving force in China, and their logic of mining outsourcing may have unique characteristics of China. Based on the interview data of Chinese mining enterprises, this study explores the driving forces and mechanisms of Chinese mining enterprises' choice of outsourcing. The research questions include :(1) In China, mining enterprises replace the internal division of labour with the intra-industry division of labour. Are there other driving forces besides economic factors? (2) If there are other reasons, how does the enterprise weigh among the various driving forces? What is the mechanism of action? (3) Based on understanding the driving forces of outsourcing of Chinese mining enterprises, how should we put forward targeted regulatory strategies? This study identifies the driving force and mechanism of mining enterprises' outsourcing choices through theoretical construction based on the case study method.

1.2 Significance of the study

The outsourcing of mining enterprises in developed countries has been relatively mature. Many studies have also discussed the outsourcing of mining enterprises in these countries (Baatartogtokh et al., 2018; Baatartogtokh, 2016; Mella & Pellicelli, 2012; Sivakumar et al., 2015; Stacey, 1999; Steenkamp & Van der Lingen, 2014; Wuyts et al., 2015). Existing studies show that economic factors are the main driving force for mining enterprises to choose outsourcing. That is, outsourcing can help improve the division of labour economy and thus improve productivity (Kazmer, 2014).

However, mining outsourcing is still relatively new in China, and most existing research has not studied the theoretical and practical problems of China's outsourcing. Situational factors can influence the conclusions of previous studies. While they may be appropriate in other countries, they may only be able to paint part of China's transition period. Therefore, it is necessary to reexamine the existing theory: China is transitioning, and many state-owned mining enterprises remain. Without economic driving forces, are there other unique driving forces promoting outsourcing mining services? This research focuses on the driving factors of outsourcing mining enterprises in China. It is pioneering research based on The Chinese context, which is significant to constructing and developing theories in this field. Based on the interview data of Chinese mining enterprises, this study develops theories that can provide an essential reference for the outsourcing strategy of mining enterprises and the supervision of mining enterprises.

1.3 Structure of content

The chapters of this study are summarized in figure 1.2.

The first chapter is the introduction, which mainly describes the background and research significance of the research and the structure of this dissertation.

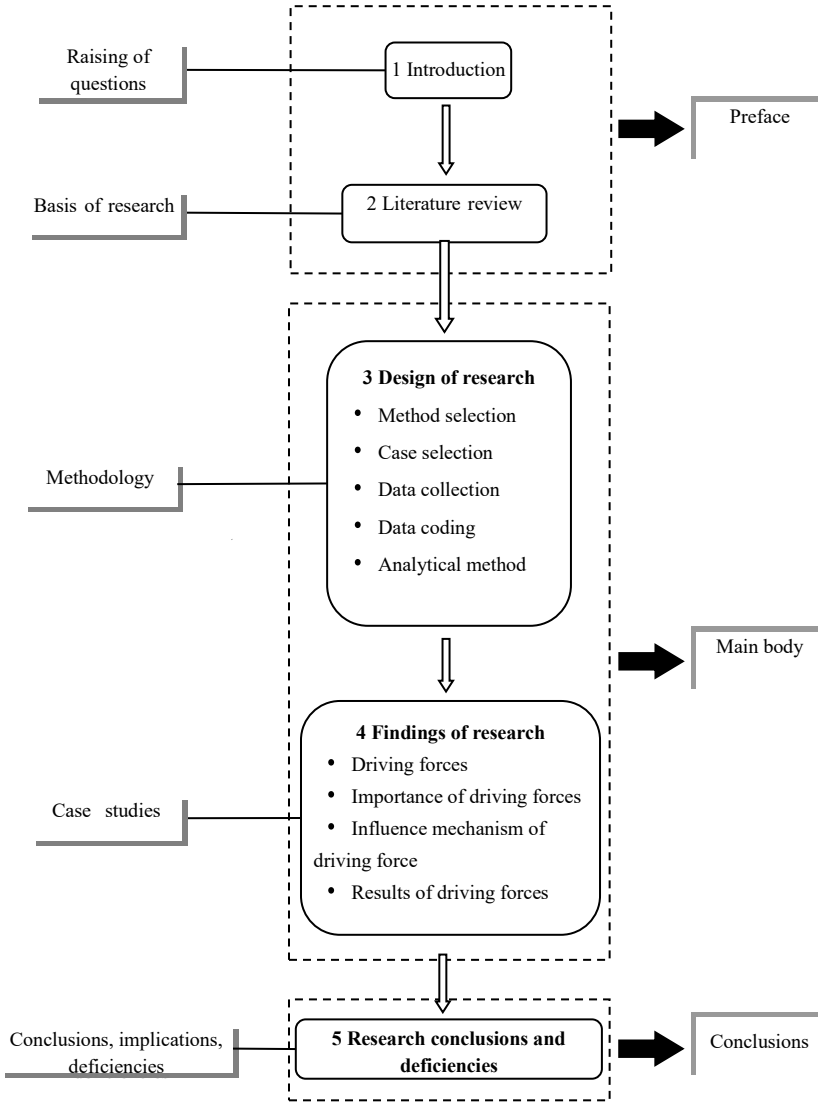
The second chapter contains the literature review, which summarizes the research on the division of labour and specialization, outsourcing in business practice, and outsourcing by mining enterprises, laying a literature basis for the study.

The third chapter describes the research design, giving the basis for selecting methods and case studies, data collection methods, data coding technology, data analysis methods, etc.

The fourth chapter gives the findings of case studies. In this chapter, we analyze the driving forces of outsourcing in detail from three aspects: access to professional services, reduction of economic costs, and avoidance of political risks, and compare the importance of different types of enterprises to each driving force. This chapter further discusses the relationship and mechanism between the main driving forces and produces a logic block diagram. Moreover, to support the theory, this chapter uses archival data to confirm different types of enterprises for choosing to outsource different considerations.

The fifth chapter gives the research conclusions, implications, and deficiencies.

Figure 1.2
Structure of this dissertation



Note. Self-compilation

2 Literature review

2.1 Research on the division of labour and specialization

2.1.1 Definition of the division of labour

Division of labour means dividing a production activity into several tasks, with each study performed by a separate person or group. These tasks are different but complementary. We must mention specialization regarding labour division, as they always come together. Specialization is a method of production whereby an individual or entity focuses on a specific task's performance to gain more excellent proficiency (Sheng, 1992). Division of labour and specialization are two different aspects of the same thing, complementing each other. The division of labour leads to specialization, and specialization relies on and further develops labour division (Kreager, 2017). Meanwhile, the division of labour is based on specialization but different from specialization. There is no division of labour if everyone is in the same profession.

As a verb phrase, "dividing the work" appeared early in primitive society. In the early stage, work was naturally divided by age and gender (Nakahashi & Feldman, 2014), such as hunting and gathering, usually divided by gender. With the development of productivity, some surplus fruits of labour emerged, triggering three great social divisions. The first great social division of labour occurred in the late primitive society; whereby nomadic herding was separated from agriculture. The second great social division of labour happened at the end of the primitive society, whereby handicraft was separated from agriculture. The third great social labour division occurred in the early slave society. At that time, the commodity exchange market was brisk, accompanied by merchants engaged in commodity exchange rather than production activities. In turn, merchants' emergence further promoted the

production and development of commodities (Stratone, 2014).

As a noun phrase, “division of labour” can be traced back to 380 B. C. In his theory of labour division, Plato regarded labour division as specialization (Cheng & Yang, 2004). Later, Xenophon pointed out that labour division is a commonality between insects and human society and revealed the benefits of specialization to the social structure (Robson & Traniell, 2016). However, Smith (1887) first analyzed the division of labour from an economic perspective. In his book, The Wealth of Nations, Smith first proposed the concept of “division of labour,” which enabled workers to focus on specific tasks. He believed that labour division is rooted in the exchange of willingness and ability of humans and explained the superiority of the division of labour by taking the manufacturing of pins as an example. Since then, many famous economists have paid attention to the specialized division of labour. Specifically, Young explained the concept of “division of labour” regarding the degree of individual specialization, the length of the whole production chain, and the number of intermediate products. Others explained this concept based on the cooperative relationship between economic entities in the same or other sectors (Yang & Ng, 1995). In summary, the division of labour is usually analyzed from four dimensions: groups, specialization of individual members, intra-group resource sharing, and different members’ different activities (Nakahashi & Feldman, 2014; Haeussler & Sauermann, 2020).

2.1.2 Benefits of the division of labour

The synchrony of individual specialization and group activities characterizes the division of labour. The benefits of labour division have been studied for a long time in different disciplines, such as economics, sociology, and biology (de Oliveira & Campos, 2019). In primitive society, the division of labour occurred spontaneously,

with the development of productivity, the emergence of surplus products of labour, and the frequent exchange of commodities. Xenophon, a famous thinker of ancient Greece, expounded on the division of labour theory. He said that no one in the world is proficient in all skills. It shows that the division of labour is inevitable.

Different scholars have understood the benefits of the division of labour. For example, the division of labour can improve productivity and labour efficiency, boost economic growth, lower unit costs, reduce repeated learning, promote machine innovation and creation, achieve increasing returns, shorten the duration of capital formation, and make continuous roundabout production possible (Arora et al., 2009; Cheng, 2012; Jiang et al., 2019; Zhu et al., 2017). Specialized labour division has long been believed to impact productivity improvement and economic growth positively (Dobson et al., 2009; Rauh, 2014). We can see that many economists believe that productivity improvement, economic growth, and returns to scale all benefit from the division of labour (Gilles, 2019; Gilles et al., 2020).

All the benefits from labour division can be attributed to cost advantage, and comparative advantage is the core theory of the division of labour (Hearn, 2018). Further, the essence of comparative advantage is comparative cost advantage, and division of labour is a pattern of division formed by people engaging in production activities according to the law of comparative advantage. First, the labour division can improve workers' proficiency and reduce repeated learning, thus saving training costs. Because the division of labour enables workers to focus on specific tasks, they can be proficient in their tasks, and there is no need to learn about other jobs. It avoids repeated training expenses. Second, the labour division can reduce the time for task switching, thus reducing the monitoring costs (Goldsby et al., 2012). In the context of a higher degree of labour division, every worker has straightforward tasks, reducing

monitoring difficulty. As a result, the monitoring costs are relatively low. In the context of a lower degree of labour division, every worker must fulfil complex and diverse tasks, increasing the difficulty of monitoring. As a result, the monitoring costs rise. Third, the division of labour can continuously refine work tasks, with many tasks performed by machines.

On the other hand, this promotes the development of devices and reduces labour costs (Hearn, 2018). Finally, a specialized division of labour can increase returns and lower unit costs. Specialization brought about by the division of labour improves workers' proficiency and efficiency. As a result, the same number of workers can produce more products in the same period (Gilles, 2019). According to the economics of scale, the unit costs will decrease when the absolute quantity of products increases. Stigler also believed that deepening labour division, specialization, and mechanization would generally lead to a sharp rise in output, thus reducing costs.

2.1.3 Constraints on market scope and division of labour

Everything has two sides. The division of labour can undoubtedly bring many benefits, but certain constraints also bind it. Studies have shown that the market size constrained the labour division (Chandra, 2004; Chaney & Ossa, 2013; Smith, 1887; Soo, 2018). Another view holds that the division of labour is also restricted by coordination expenses (coordination costs among workers) and social knowledge level (Becker & Murphy, 1992; Sun & Lio, 2003). The division of labour is triggered by people's inclination to exchange commodities, and the potential of the division of labour needs to be brought into full play in the exchange economy. There may be some exchange in a primitive society or a self-support economy with a limited number of products. In consequence, the probability of division of labour is relatively tiny. The degree of division of labour is permanently restricted by the exchange

capacity, i.e., the market size.

According to Young's theorem, the division of labour determines the market scope, and in turn, the market scope also determines the division of labour (Sun & Lio, 2003; Youno, 1928). On the one hand, the division of labour relies on the market size. The expansion of market size will deepen the division of labour. Similarly, the increased group size will heighten labour division (Jeanson et al., 2007). On the other hand, the market size depends on the division of labour. The division of labour and specialization can improve productivity and realize economies of scale through "roundabout production". In general, labour division increases return to scale, and increasing returns to scale lowers production costs. With the decrease in production costs, product prices fall. At this time, consumers' purchasing power rises, thus further expanding the market scope. Finally, the expansion of market scope also deepens the division of labour. This is a dynamic, cumulative cycle of repeated, increasing returns (Youno, 1928). Chemical industry data also confirmed that the market scope restricts the division of labour (Arora et al., 2009).

2.1.4 Constraints on transaction costs and division of labour

From the perspective of enterprise-market dichotomy, enterprises mainly require internal labour division, and markets mostly require external labour division. The transaction cost economics (TCE) theory can be used to analyze the division of labour of enterprises or markets: labour and specialization division gives rise to transaction activities. The use (internal or external) of price mechanisms in market transactions is always accompanied by costs, i.e., transaction costs (Coase, 1995). Moreover, the transaction costs usually interact with the social division of labour and enterprise size boundaries. Yang analyzed exogenous and endogenous transaction costs. Specifically, exogenous transaction costs are directly or indirectly generated in the transaction

process. In contrast, endogenous transaction costs are the total loss in revenue caused by non-optimal decisions based on the competition for interests in the labour division (Yang & Borland, 1991; Yang & Ng, 1995).

The internal connection between enterprises and markets is that the labour market replaces the product market. The transaction efficiency of labour and products determines the boundary between enterprises and markets. To sum up, the transaction costs come from the labour division, and the level of transaction costs depends on the transaction efficiency. Endogenous transaction costs are usually produced by the self-interest decisions of transaction entities deviating from Pareto optimality.

From the contract perspective, transaction costs focus more on the correlation between transaction costs and arrangements. Based on the whole process and all links of transaction contracts, Dahlman classified transaction costs into three types: background investigation costs before contract conclusion, negotiation and communication costs during contract conclusion, and performance monitoring costs after contract conclusion (Dahlman, 1979). Cheung demonstrated the relationship between property rights exchange, contractual arrangements, and transaction costs and found that all three kinds of property rights exchange need contractual agreements. The transaction costs under different contractual arrangements are different (Cheung, 1983). Williamson built a framework covering three dimensions of "transaction frequency, uncertainty, and asset specificity" to explain transaction costs: the transaction frequency affects the choice of contract mode; the uncertainty, such as information asymmetry, accident occurrence, and risk prediction and prevention affects the transaction costs; the asset specificity is positively correlated with the transaction costs (Williamson, 1979). To sum up, the transaction costs may be generated in the whole process of contractual transactions and differ due to the

differences in contractual arrangements. Therefore, transaction costs are affected by transaction frequency, uncertainty, and asset specificity.

As for transaction costs, Zhou and Hu proposed such an equation: the net income generated by labour division = the economies of the division of labour and specialization – the increment in coordination costs caused by the division of labour. The higher the economies of the division of labour and specialization, the lower the coordination costs and the higher the net income. The labour and specialization division's economies come from the increasing returns of technological and knowledge production. At the same time, reducing coordination costs depends on increased corporate social knowledge. Only when the net income is more than 0 will the division of labour further deepen. To this end, we should focus on increasing social knowledge to gain more space to deal with the conflict between the benefits from the division of labour and the coordination costs (Zhou & Hu, 2001).

2.2 Research on outsourcing in business practice

2.2.1 Outsourcing as a corporate strategy

For decades, companies have been using outsourcing as an enterprise strategy by transferring certain activities in the value chain to independent suppliers and purchasing intermediate/finished products or services from the latter (Lahiri et al., 2022). The popularity of outsourcing lies in the diversity of benefits it can bring to enterprises, such as reduced costs, concentration on core competencies, greater flexibility, improved innovation and product quality, and enhanced competitiveness (Ambos et al., 2021; Mukherjee et al., 2013; Munjal et al., 2019). By service outsourcing, enterprises give up the mode of producing everything and opt for the governance choice of purchasing goods or services from external suppliers

(Contractor et al., 2010; Magnani et al., 2019). The existing literature mainly covers the outsourcing strategies of enterprises from the perspectives of transaction cost economics (TCE), resource-based view (RBV), and principal-agent theory.

2.1.1.1 TCE

As noted earlier, TCE can be used to explain the constraint problem of division of labour. This theory can also be used to analyze the outsourcing strategy of enterprises. Mainly focusing on corporate governance structure, TCE suggests that outsourcing is more meaningful for enterprises than internal production under certain circumstances. The former operates at a lower total cost than the latter (Ellram et al., 2008; McIvor, 2009). In other words, the TCE logic is that outsourcing can help companies improve operating results by minimising the cost of finding suppliers, signing contracts, and supervising contract performance (Barthélemy & Quélin, 2006; Gerbl et al., 2015).

As the opposite of outsourcing, many studies have discussed vertical integration. However, as for the impact of vertical integration on an enterprise's cost and performance, the existing research has not yielded consistent results. Earlier studies have shown that vertical integration raises costs (D'Aveni & Ilinitch, 1992; Harrigan, 1983, 1985b, 1985a; Hill & Hoskisson, 1987; G. R. Jones & Hill, 1988; Mahoney, 1992; Quinn et al., 1990) and have a poor performance (D'Aveni & Ilinitch, 1992; Rumelt, 1982). Therefore, researchers believe outsourcing can replace vertical integration (Harrigan, 1985b; Quinn et al., 1990).

Literature mainly discussed the underlying logic of services outsourcing based on transaction cost (Hennart, 1991) and organizational capability between two firms (Madhok, 1996) in business practice. For example, in the automotive industry, outsourcing is widespread (Dyer, 1997; Novak & Stern, 2008). In the case of mould

making, outsourcing was chosen because of suppliers' superior capabilities and despite significant transaction costs (Argyres, 1996). The more critical discussion comes from offshoring. Studies showed that offshore outsourcing increases export performance (Bertrand, 2011; Doh, 2005).

Later literature recognizes that vertical integration and outsourcing are not about who is better than whom but about the specific context (D'Aveni & Ravenscraft, 1994). Implementing vertical integration strategies must match different conditions (Harrigan, 1985b, 1986; Stuckey & White, 1993). Sometimes, technological change interacts with the intensity of competition to influence the optimal integration level (Balakrishnan & Wernerfelt, 1986). Overusing external sources to complete value chain activities could lead to opportunism and high transaction costs. It also reduces the firm's ability to absorb superficial knowledge, decreasing learning opportunities. While external sourcing is likely to increase a firm's flexibility in the short term, it also increases its path dependence on external sources. Carefully balancing vertical integration and strategic outsourcing when organizing for innovation helps firms achieve superior performance (Rothaermel et al., 2006).

2.1.1.2 RBV

RBV considers a company a collection of resources, while TCE focuses on boundary decision-making and governance mechanisms of organizations. The RBV argues that valuable, rare, inimitable, and non-substitutable (VRIN) resources are the foundation of enterprises for core competitiveness and growth (Barney, 1991; Nason & Wiklund, 2018). Outsourcing allows companies to incorporate VRIN and complementary resources from external suppliers into their operations (Barney, 1991; Holcomb & Hitt, 2007). This means that companies can create and market high-quality products or services at a lower cost by leveraging the valuable resources of

suppliers. On this basis, companies combine their resources with the resources and capabilities of suppliers into new combinations of resources and capabilities, thus enhancing their core competencies (Mukherjee et al., 2013; Strange & Humphrey, 2019).

2.1.1.3 Principal-agent theory

The principal-agent theory deals with the signing and implementing of contracts between principals and agents (Eisenhardt, 1989). By outsourcing, a company forms a principal-agent relationship with its supplier. The company outsourcing products or services is the principal, while its supplier is the agent. The former authorizes the latter to perform certain activities or processes of the value chain on their behalf. The principal-agent theory argues that the principal-agent problem appears when the principal and the agent have different goals and risk preferences. The cost of supervision and coordination may rise, thus reducing outsourcing performance, primarily due to adverse selection and moral hazards (Bahli & Rivard, 2003; Steven et al., 2014).

2.2.2 Reasons for outsourcing

Outsourcing and its influencing factors have been studied extensively (Dekker et al., 2020; Feng et al., 2019; Gunasekaran et al., 2015; Lou et al., 2020; Pournader et al., 2019; Steven et al., 2014), and the reasons of outsourcing have also been analyzed and discussed by many scholars. But, generally speaking, the reasons for outsourcing can be classified into external and internal factors.

2.2.2.1 External factors

(1) Technical reason

Complete specialization can achieve an optimal equilibrium by relying on Internet technologies (Chen, 2016). An empirical study based on Chinese manufacturing enterprises' data shows that the Internet has significantly deepened the specialized labour division (Shi & Li, 2020), and horizontally specialized companies tend to outsource services (Chen et al., 2018). Specifically, because of its extensibility and flexibility, the Internet can eliminate the constraints of geographical location and natural resources on enterprises and enable the market to extend infinitely in both time and space, thus providing technical support to overcome the time and space barriers in outsourcing. Meanwhile, the development of information technology and the Internet has drastically reduced the costs of information processing and can help enterprise policy-makers obtain as much internal and external information as possible fastest. These provide the conditions and support for outsourcing (Goldschmidt & Schmieder, 2017).

(2) Economic reason

Economic globalization drives the global flow, allocation, and reorganization of capital, information, and technology. It contributes to the integration, interdependence, competition, and interaction of production, investment, finance, and trading among different countries and regions worldwide. Consequently, the world has become a vast market (Chen, 2005). Systematic outsourcing is a trend in industrial chain development (Statsenko et al., 2018). In this context, no enterprise can succeed if it wants to "live isolated". Only by establishing strategic alliances and maintaining win-win cooperation with other enterprises through outsourcing can enterprises gain long-term competitive advantages and enjoy the fruits of globalization. Therefore, outsourcing is positively related to economic globalisation (Chen, 2005).

(3) Market reason

The rapid changes in the market environment force enterprises to adopt the outsourcing strategy. Relying on network technologies, enterprises integrate partners with different advantageous resources into a flexible, dynamic alliance with quick response. All members share resources, complement each other, and work effectively to cope with severe market challenges. Therefore, market changes positively relate to outsourcing (Chen, 2005).

2.2.2.2 Internal factors

(1) Cost saving and focus on core business

The primary purpose of outsourcing in the early stage is to improve enterprise performance by reducing costs and focusing on core business (Bustinza et al., 2010; Zhang, 2014). Outsourcing can achieve cost savings from four aspects. First, taking advantage of suppliers' economies of scale. In outsourcing, multiple customers share the production equipment. It can reduce installation and construction costs and improve the productivity of equipment, raw materials and energy, and living labour. Hence, the scale is negatively related to the charges. Second, taking advantage of suppliers' economies of scope. In outsourcing, a supplier can provide different services for other customers, achieving economies of scope and reducing costs. Third, taking advantage of suppliers' learning effect. Suppliers can fully play the learning effect in outsourcing by serving different production aspects. Finally, outsourcing enterprises can reduce transaction costs by fully using information technology and establishing a long-term stable partnership with suppliers, even though the transaction costs will increase with the deepening of outsourcing. The higher the charges, the more urgent it is for enterprises to reduce costs through outsourcing, and the higher

the degree of outsourcing (Chen, 2005).

To make full use of resources and improve their performance, most enterprises will go through the following steps in the process of outsourcing: 1) build or find out their core competitiveness and confirm that they are the best in the world to develop their core business; 2) focus their resources (e.g., human resources and properties) and managerial attention on the core competitiveness; 3) outsource non-core business. On the one hand, enterprises can concentrate their resources and capabilities on the best business to maximize internal resource returns. On the other hand, they can fully use suppliers' investment, innovation, and specialized vocational skills, which are too expensive and impossible for enterprises to copy. By developing the core competitiveness, enterprises construct substantial barriers to prevent existing or potential competitors from acquiring their interests. This way, they can protect their market share and enhance their strategic superiority (Chen, 2005).

(2) Control

The competition among modern enterprises has expanded from individual enterprises' competition to that of industry chains (Özdemir et al., 2015). To maintain long-term partnerships with upstream and downstream node enterprises, core enterprises usually outsource a portion of their related business to the node enterprises to achieve better control over them (Bergkvist & Johansson, 2007). Vitasek and Manrodt pointed out that outsourcing's primary motivator is establishing a long-term stable partnership. Therefore, the two sides in the partnership should pay more attention to the results than the transactions and try their best to balance rather than measure their interests (Vitasek & Manrodt, 2012).

2.2.3 Impact of outsourcing on enterprise performance

2.2.3.1 Positive effect on business performance

Driven by the improvement of transaction efficiency, specialization, and labour division, economic activities have risen continuously. At this time, outsourcing emerged, helping enterprises achieve increasing returns. However, a dramatic transformation of American manufacturing occurred at the end of the twentieth century, away from vertical integration and outsourcing (Whitford, 2005). As a result, even integration-oriented enterprises have to weigh whether to self-operate or outsource their business (Loertscher & Riordan, 2019).

Outsourcing can help enterprises pay more attention to their core competencies and optimize their internal processes (Dekker et al., 2020), reducing costs and enhancing competitiveness. Managers can focus their knowledge and experience on core competencies by reducing the number of responsible functions. In this sense, outsourcing changes from a cost-saving method to a strategic decision to improve enterprises' key competencies, accompanied by competitive advantages or potential. Besides, outsourcing is a relatively flexible mechanism (Scherrer-Rathje et al., 2014), allowing enterprises to adapt to the dynamic changes in the environment by adjusting outsourcing activities. Therefore, outsourcing can be a feasible solution for restricted companies to expand their boundaries. Jones found that pharmaceutical companies must become part of the global knowledge network to remain competitive. Most pharmaceutical companies prefer to buy knowledge from other companies rather than invest directly in biotechnology. More and more drug R&D activities have been acquired (Jones, 2000).

As for the mechanism of the impact of outsourcing on enterprise performance, studies have shown that outsourcing affects enterprise performance mainly by its effect on enterprise competence (Appiah-Adu et al., 2016; Bustinza et al., 2010). The most critical impact of outsourcing on enterprises is that it enables enterprises to

better adapt to the market conditions and gain a competitive advantage. With the ability to adapt to market conditions, the enterprise can reduce uncertainty and develop sustainable competitive advantages, thus improving its performance.

2.2.3.2 Negative effect on business performance

Not all studies show that outsourcing positively affects business performance (Bhalla et al., 2008; Lahiri et al., 2022; Mol et al., 2005). The cause lies in the risks brought by transaction costs. It is crucial for enterprises opting for outsourcing to consider the potential transaction costs in outsourcing (Foss & Foss, 2005; Mukherjee et al., 2013). The transaction costs occurring in outsourcing may considerably exceed the benefits obtained from resource integration. Such costs include the fronted costs of finding and signing contracts with suppliers with VRIN resources, such as searching, evaluation, negotiation, and making detailed contracts with suppliers, as well as contract supervision and performance costs. Moreover, outsourcing may add to the complexity of production activities, increasing costs (Lahiri et al., 2022).

2.3 Research on outsourcing of mining enterprises

2.3.1 Preconditions, types, and degree of outsourcing of mining enterprises

2.3.1.1 Preconditions for outsourcing

The main reason for outsourcing in the mining industry is to focus on core competencies, improve productivity or service quality, and reduce operating costs (Igarashi et al., 2013). One of the advantages of outsourcing is that it helps enterprises concentrate their resources on core competitiveness and obtain better attributes and skills than those of other enterprises, thereby gaining competitive benefits or potential for competitive advantages. The main reasons for outsourcing are the transaction cost

theory and efficiency. All organizations, especially commodity organizations such as mining companies, strive to minimize production and transaction costs. Enterprises sometimes outsource a function, transforming the fixed-cost business into a variable-cost business. Hence, outsourcing is essential for strategic change (Freytag et al., 2012).

In recent years, there have been more mining enterprises outsourcing services—however, several preconditions for outsourcing need to be met. Overall speaking, mining enterprises can meet these preconditions. First, mining enterprises in a challenging position urgently need to seek the advantage of cost reduction. As mentioned above, mining enterprises are hefty asset enterprises. However, heavy assets do not necessarily represent economies of scale.

On the contrary, the profits of enterprises may decrease with the expansion of scale. First, it is difficult for mining enterprises to achieve economies of scale. Therefore, mining enterprises often tend to outsource services. Second, each link of the mining engineering is separable. Moreover, mining is a very particular industry in which each project is independent of geology, labour conditions, seasons, commodity prices, etc. (Baatartogtokh et al., 2018). Hence, subcontracting and overall outsourcing are both feasible. Finally, with technology development, the mining industry has changed its technology mode from manual technologies relying on labour to automation technologies. As a result, mining and mining-related professional services have become increasingly technology-intensive, providing conditions for mining outsourcing (Holcomb & Hitt, 2007).

2.3.1.2 Types of outsourcing

Outsourcing has become a major trend in international mining enterprises because good outsourcing can reduce costs and improve productivity, profit margin,

and performance. The outsourcing of mining enterprises can be classified as follows. First, according to the sequence of mining operations, there are drilling contracting, blasting contracting, mining contracting, loading contracting, and transportation contracting. The advantage of such classification lies in professional operations, and the disadvantage lies in high cost and great difficulty in production management. Second, mining and tunnelling are contracting according to the type of mining operations. The advantage of such classification lies in the ease of production management. The disadvantage lies in interactions, which increases management's difficulty and is not conducive to reducing the loss and dilution ratios. Third, subcontracting can be conducted according to section division, i.e., operation areas. The advantage of such classification lies in the adjustability based on the actual mining situation. The disadvantage is that specialization is impossible. Each section is a separate production system, which is not conducive to unified management (Feng et al., 2015).

2.3.1.3 Degree in outsourcing

In the past, the mining industry showed a low tendency to outsource. Mining has always been well-protected, unlike the manufacturing and retail industries. However, the fierce competition forces mining enterprises to innovate their business models. There are signs that some mining companies today are moving towards a loose network of service and equipment suppliers (Baatartogtokh, 2018). Outsourcing can occur anywhere in the supply chain, including upstream, downstream, and organizational processes, especially the links where materials, information, or funds cannot flow virtually (Wuyts et al., 2015). Generally speaking, an enterprise tends to outsource its non-core business and develop its core business into a competitive edge. Mining activities are outsourced more often than mineral processing and waste

management activities in the whole mining industry. Mineral processing is a profit-making tool that needs a significant investment. Usually, outsourcing suppliers do not have such abilities (Baatartogtokh et al., 2018). Mining usually covers the following links: drilling, blasting, loading, transportation, and tunnelling, among which drilling and blasting are outsourced most frequently; equipment performance inspection and compliance monitoring; storage, maintenance, and transportation. Recently, some mining enterprises have also outsourced financial management, marketing, environmental management, employee management, and activities related to corporate social responsibility (Sivakumar et al., 2015).

A study based on Canadian data shows that outsourcing has become typical for primary and large mining enterprises. About 89.7% of mining companies outsource or have outsourced services (Baatartogtokh et al., 2018). Enterprises outsource services through engineering design, procurement, construction, maintenance, and even outsourced mining operations such as drilling and blasting (Sivakumar et al., 2015). Due to a lack of high-quality suppliers in some regions of the world, the mining outsourcing industry's competition is becoming increasingly fierce (Baatartogtokh, 2018).

2.3.2 Current situation of outsourcing of mining enterprises

Outsourcing is becoming increasingly common in the mining industry. Some scholars even predict that mining enterprises may experience "extreme outsourcing," that is, all production and economic processes are outsourced through a stable and flexible network on a global scale (Mella & Pellicelli, 2012). For example, an international company located in Australia only supplied explosives to mining enterprises in the past. But now, it provides blasting and other services using its equipment and technology. As a result, mining enterprises no longer need to purchase

blasting equipment or hire experienced personnel for blasting operations. As a result, mining enterprises can divest assets, obtain a higher return on investments, reduce operating costs, and access specialized technology (Baatartogtokh et al., 2018).

Many studies on mining outsourcing focus on outsourcing decisions—the reasons for choosing to outsource, the process of outsourcing, and the critical factors to the success of outsourcing (Baatartogtokh, 2018). Based on considering the economic benefits, environmental benefits, and risk factors, Sivakumar et al. proposed the selection process of outsourcing suppliers suitable for green mining. In addition, they discussed various business models of mining outsourcing (Sivakumar et al., 2015). Stacey et al. studied the advantages and disadvantages of increasing specialized outsourcing in the mining industry (Stacey, 1999). Kirk discussed the operations and risks related to contractual mining in a study on strategic outsourcing management preferences (Kirk, 2000). Besides, there are also many studies on the critical factors to the success of outsourcing. Lin et al. found that managers in the mining industry attach great importance to outsourcing suppliers' professional competence and the complementarity in knowledge between suppliers and mining enterprises (Lin et al., 2016). Steenkamp and van der Lingen built a framework for mining outsourcing decision-making to help enterprises decide whether to outsource and further identify the critical factors to outsourcing's success (Steenkamp & Van der Lingen, 2014). Modak et al. also developed a framework used to evaluate the performance of outsourcing decisions based on the balanced scorecard (BSC) and fuzzy analytic hierarchy process (FAHP) (Modak et al., 2017). Another study discussed the factors influencing effective outsourcing decision-making in the sub-Saharan African mining industry and found that concluding contracts is essential to outsourcing (Obeng et al., 2015).

Traditionally, outsourcing was not common in the mining industry. The mining industry has been protected for a long time, unlike other sectors in which competition is fierce. However, in the face of increasingly severe challenges and intense competition in the whole mining industry in recent years, mining enterprises are outsourcing services through engineering design, procurement, construction, and maintenance to gain competitive advantages. Especially for commodity-based businesses, such as mining, outsourcing has become a potential solution to save costs and retain high-quality talents. The mining industry involves a wide range of activities, including soft activities such as financing, planning, marketing, and labour relations, physical activities such as exploration, excavation, production, material handling, processing, and refining, as well as the management of all these activities (Steenkamp & van der Lingen, 2014). South Africa has developed technologically advanced and globally competitive mining equipment and professional services as a world-famous mining country. In terms of trade, importing mining equipment and relevant services is significant to South Africa and has achieved huge benefits and great success (Kaplan, 2012).

Outsourcing has become common for foreign mining enterprises, but it started late in China. Mining outsourcing has been long studied in foreign countries. The findings show that mining outsourcing can significantly reduce costs and risks with high-cost performance. In India, for example, state-owned coal mining organizations have outsourced mining operations to private institutions, aiming to improve the efficiency of mining operations, lower operating costs, reduce waste, and improve mining operations' sustainability (Khanna, 2013). In many countries, mining enterprises tend to expand production through private participation. They urgently need to reduce costs, improve capital project management, employee management,

and environmental impact, enhance corporate social responsibility, and cope with the global economic crisis. The benefits of outsourcing are reducing operating costs and improving productivity and efficiency, acquiring up-to-date technologies, and ultimately increasing profits (Sivakumar et al., 2015).

Chinese mining enterprises often outsource links-based services while integrated mining service providers are developing. For example, Guangdong Hongda Blasting Co., Ltd. is an integrated mining solution provider. On the one hand, it provides various engineering services in mines' full life cycle, such as mining scheme optimization, infrastructure construction, mining, dressing, and environmental improvement. On the other hand, it provides value-added services such as mining investment consulting, investment and financing scheme design, capital financing, and overall operation and management based on integrating resources in the mining industry. Thus, Hongda contributes to constructing low-cost, green, intelligent mines (Zhang, 2014).

2.4 Summary

In the era of outsourcing, it is easy to forget that outsourcing only reflects labour division. Outsourcing is an example of an inter-enterprise vertical division of labour. The upstream sector comprises specialized input suppliers, and downstream enterprises can choose to produce the inputs by themselves or buy them from upstream enterprises. Outsourcing has become an essential strategic tool for maintaining enterprises' competitiveness in the highly specialized, geographically dispersed, networked global economic environment.

The division of labour and outsourcing has been extensively studied in the existing literature, which references this study. The studies on the outsourcing of mining enterprises usually focus on outsourcing determinants, outsourcing processes,

and critical factors to outsourcing. The mainstream research methods include case studies, investigation, mathematical modelling, and financial data analysis. However, it should be noted that the studies on outsourcing of mining enterprises are less than those of other industries, and there is a lack of deep understanding of the impact of outsourcing on the behaviours of mining enterprises, especially on enterprise costs. In addition, the existing research on outsourcing focuses on its economic impact but rarely mentions the effect of other aspects. And this is the focus of this study.

3 Methodology

3.1 Method selection

In practice, the case study method usually includes eight links from start to end, some of which come from the grounded theory. The primary purpose of grounded theory is to refine some concepts with the help of cases and explain their relationship. Therefore, it is necessary to constantly screen and collect case data and integrate, compare and analyze it to find theories in new fields (Strauss, 1987). Yin believed that a case study is a primary theoretical research method. He mainly emphasized the case study design and explained the “replication logic” by describing and classifying the design methods. To realize the “replication logic,” we should attach great importance to the case study design’s two dimensions of reliability and validity (Yin, 1994). Mile and Huberman held that a case study represents positivism. They believed that although the case study method’s data is qualitative, we can make them visible through graphs and tables and effectively avoid original data corruption by coding. Besides, triangulation and observation methods are also used by some scholars to conduct case studies (Miles & Huberman, 1984).

The case study method includes eight steps: hypothesis formation, start, case selection, research tools and program design, entering the site, data analysis, literature comparison, and end. Table 3.1 summarizes the process of building a theory through case studies.

Table 3.1

The process of building a theory through case studies

	Step	Content
1	Initiation	· Define the research question · Attempt to use pre-conjectured related constructs
2	Case selection	· Do not presuppose theories or assumptions · Identify a specific population · Conduct theoretical sampling
3	Research tools and program design	· Use a variety of data-collection methods · Use a combination of qualitative and quantitative data · Include multiple researchers
4	Entry into the field	· Ensure that data collection and analysis overlap, including the collation of field notes. · Ensure that data collection methods are flexible and adaptive.
5	Data analysis	· Perform case analysis · Use a variety of different approaches to find cross-case patterns
6	Hypothesis formation	· For each construct using evidence iteration · Apply replication logic across cases, not sampling logic · Look for reasons behind variable relationships
7	Literature comparison	· Compared with contradictory literature · Compared with similar literature
8	Conclusion of the study	· Ensure the study is as theoretically saturated as possible

Note. Reprinted from "Theory building from cases: Opportunities and challenges", by Eisenhardt, K. M., & Graebner, M. E., 2007, *Academy of Management Journal, 50*(1), 25–32. Copyright 2007 by Academy of Management.

3.2 Case selection

The case study approach follows a "replication" logic, which treats a series of cases as a series of experiments, each of which may or may not support the hypothesis (Yin, 1994). Each case is like an experiment, and multiple cases are like multiple experiments. In multi-case studies, the relationships between variables are repeatedly verified by cases to enhance the credibility of their validity. Case studies should be carried out as far as possible without any idealized theories or hypotheses to be tested since the presupposition of theoretical views or propositions can bias researchers or limit the discovery of new conclusions (Eisenhardt & Graebner, 2007). Therefore, this study first defines the research questions and identifies some potentially essential variables based on the literature but tries to avoid considering the specific relationship

between variables and theories in the research process. We can design studies according to the number of cases and distinguish between types of case studies, including single-case and multiple-case studies (Yin, 1994). To further understand the internal mechanism, a multi-case design will be adopted in this study. Case studies adopt the theoretical sampling method. That is, cases are selected for academic needs rather than statistical needs. To observe the problems of interest, we tend to choose cases of extreme situations and extreme types (Eisenhardt & Graebner, 2007).

This research discusses the driving forces behind the choice of mining enterprises to outsource services. This research considered the outsourcing situation (self-operated before or always outsourcing), ownership structure, scale, mineral species, and region when selecting the case enterprises. The following are the reasons why these aspects were considered:

Some enterprises choose to self-operate first, then notice that service outsourcing has more advantages, so they abandon self-operation in some production links and choose service outsourcing. These enterprises deeply understand the advantages and disadvantages of self-operation and outsourcing. On the other hand, some enterprises choose outsourcing from the beginning, and they usually have their reasons. Therefore, this research chooses two different enterprises, which can identify the differences between the two types of enterprises and summarize their commonalities.

Different ownership structures may bring other decision-making and investment concepts, affecting the enterprise's service outsourcing strategy. For example, private enterprises may focus more on achieving high profits, while state-owned enterprises may focus more on safe production. Therefore, understanding the service outsourcing strategies of mining enterprises with different ownership structures also helps us better understand the reasons for outsourcing.

Scale is an essential factor influencing outsourcing behaviour. For example, large mining enterprises may have perfect management mechanisms and sufficient resources. In contrast, small and medium-sized mining enterprises may have more flexible business models, and thus, there may be differences in the driving force of service outsourcing. Therefore, we considered the sample enterprises' scale to understand better the choices and reasons of large and small enterprises in terms of service outsourcing.

Different types of mines may bring different mining environments and technical requirements, thus affecting the enterprise's service outsourcing strategy. For example, gold mines may be more complex than iron mines, requiring more external technical services.

Different regions may have different cultures and local regulations, affecting the enterprise's service outsourcing strategy. For example, in some areas, the government may provide more support and resources, thus encouraging enterprises to outsource services, while in other regions, there may not be the same support. Therefore, understanding the service outsourcing strategies of mining enterprises in different regions helps us better understand the reasons for outsourcing. We chose case enterprises from other areas to explore why mining enterprises in different regions decide to outsource services.

Although the case companies selected in this study have diversified characteristics, the production process of these mining companies is similar, mainly including drilling, blasting, mining, transport, etc. More importantly, these companies are in similar economic and technological environments, and their decision-making logic is consistent. This study focuses on the discussion of the service outsourcing decision-making behaviour and process of mining companies, and these cases can

provide us with a complete perspective on the selection of service outsourcing in the mining industry rather than being limited to a specific factor. Therefore, the diversity of case samples in this study does not adversely affect the central theme of this study but instead helps us better understand the driving forces of mining companies to choose service outsourcing.

Regarding the number of cases, when the theory is saturated, the new cases should be stopped. Although there is no ideal case number, considering that too few can hardly generate complex theories and too many can make data processing difficult due to complexity. Generally, 4-10 cases are ideal (Eisenhardt & Graebner, 2007). In this study, five mining companies (B1-B6) were selected as samples, which meet the number of case standards. In addition, to better understand the outsourcing industry in the mining industry, we initially included the outsourcing company B6 in the research. Table 3.2 gives the essential characteristics of the sample companies.

Table 3.2

Summary of characteristics of surveyed enterprises

Characteristic	B1	B2	B3	B4	B5	B6
Outsourcing	Outsourcing from beginning	Outsourcing after internal operation	Outsourcing from beginning	Outsourcing after the internal operation	Outsourcing after internal operation	Service provider
Ownership structure	Private	State-owned	Mixed ownership	Private	State-owned	Mixed ownership
Gross output value (100 million yuan)	20	15	55	200	15	—
Main minerals	Iron	Iron	Gold	Iron	Copper	
Region	Central China	Northeast	East China	Northeast	South China	South China

Note. The data in the table are compiled from archival sources

The first case selected for this research is B1. Located in central China, B1 has a proven reserve of 370 million tons, with six mining areas established to implement

open-pit and underground stereoscopic mining. Founded on March 5, 2004, with a registered capital of 300 million yuan, the company currently has three land mining areas, two open-pit mining areas, three beneficiation plants, one iron concentrate plant, two gravel processing plants (producing 2 million tons per year) and one mechanical sand processing plant (put into production in September 2019). It has an annual production capacity of 1 million tons of iron concentrate and 10 million tons of various sand and gravel aggregates, with an annual output value of about 2 billion yuan.

The second case is B2. Located in northeast China, B2 is a private enterprise founded in 2004, also a joint venture for iron concentrate production. With an annual ore production of 4 million tons, the mining scale is about 15 million tons of mining and stripping, and the annual output value is about 1.5 billion yuan. The mine originally had its stripping production team, but the self-management was ineffective, so the stripping process was eventually outsourced to the service provider.

The third case is B3. B3 is a mixed-ownership enterprise with two production systems: gold mine and copper mine. With nine production plants and an annual ore production of 2.7 million tons, the annual output value is about 5 billion yuan. Unlike A and B mines, B3 has been outsourcing its stripping process since the beginning. Due to years of continuous mining, the stripping volume of B3 is decreasing, so the scale of outsourcing is also declining.

The fourth case is B4. B4 is one of China's largest and oldest iron mining companies, with nine iron mines, eight beneficiation plants, one sintering plant, two pelletizing plants, and two auxiliary mines. It is the industry leader in the largest iron ore resource control, production scale, lowest production cost, and comprehensive technology and management. Its annual production capacity reaches 60 million tons,

with an annual output value of about 20 billion yuan. B4 did not start outsourcing some of its production processes until 2014.

The fifth case is B5, an old state-owned enterprise established in 1958. B5 is an open-pit multi-metal ore deposit, with the upper part of the main ore body as brown iron ore, with a reserve of 20 million tons, and the lower part as a sizeable copper-sulfur ore body, with an account of more than 28 million tons, accompanied by a variety of rare metals and precious metals such as tungsten, bismuth, molybdenum, gold and silver. Since the upper iron ore has been mined out, copper-sulfur ore is mainly mined at present, with an annual output of 3.6 million tons and an annual output value of about 2 billion yuan. Before 2009, B5 had its engineering team for mining stripping. However, since 2009, the enterprise began to outsource the stripping process to service providers, and the scope of outsourcing stripping has gradually expanded.

The sixth case is B6, established in 1988, the first listed mine blasting integrated service company (stock code SZ002683) in China, one of the most advanced blasting technology, mining stripping capacity and complete mine engineering service providers in China. It has a grade I qualification for mine engineering general contracting, a grade I license for blasting operation units, and a production license qualification for civilian explosives. B6 focuses on three core businesses of large and medium-sized open-pit mines, underground mines and on-site mixed explosives, providing global mine customers with innovative integrated solutions for the mining industry. The business scope of B6 includes preliminary research consultation, optimization design of mining development plan, mine infrastructure, engineering blasting, civilian blasting production, ore selection, mine re-greening, tailings pond construction and overall operation and management of mines, as well as value-added

services such as mining development consultation and investment and financing plan design and optimization. B6 currently operates over 100 mining projects under construction, with construction areas spread over more than 30 provinces, municipalities and autonomous regions in China and countries along the Belt and Road Initiative. The annual output value of the plate exceeds 8 billion yuan, which has a profound understanding of mining service outsourcing in China.

As shown in Table 3.3, the outsourcing scale of mining enterprises such as B1-B5 has been outsourced over the years. Due to the different units used in the outsourcing service contracts of different enterprises, some are measured by the amount, while others are measured by the volume of earthwork outsourced. Some enterprises sign outsourcing contracts annually, while others may sign contracts once in a few years. It can be seen from Table 3.3 that the outsourcing scale of the case enterprises is quite different, and the time for signing outsourcing contracts is quite scattered, which helps us to examine whether the theory developed is consistent in different scales and at other points in time.

As for the number of case studies, no more case is required when the theory is saturated. There is no ideal number of cases. It would be difficult to produce complex theories when there are too few cases, while dealing with the complexity of data when too many cases are considered. Therefore, 4-10 cases are generally enough (Eisenhardt & Graebner, 2007). In this study, we have selected one service provider and five mining enterprises, so the number of cases is sufficient.

Moreover, these six enterprises have turned out to be sufficient for the theoretical development of this study. Therefore, this study is finally based on the case studies related to B1 - B6. Table 3.3 gives the essential characteristics of the sample enterprises.

Table 3.3

Outsourcing by enterprises in case studies

Year	B1 (RMB 10,000)	B2 (RMB 10,000)	B3(10,000 m^3)	B4 (RMB 10,000)	B5 (10,000 m^3)
2006	19196.57				
2007	11105.92				
2008					
2009					425.20
2010	89770.71				1041.83
2011					
2012			3611.96		
2013	19627.33		3340.27		595.56
2014			3520.51	99976	668.94
2015			3116.60	35080	2206.33
2016		1600	3836.59	42805	
2017		1600	3157.63	64657	
2018		1600	3081.86	95032.14	
2019		1720	2339.47	168565.86	2625.04
2020		1950	2645.02	127851.69	
2021		1720	2518.84	144103.83	
2022				235230.93	2600.00

Note. The data in the table are compiled from archival sources

3.3 Data collection

This research draws data from interviews and archival sources. These sources encompass subjective and objective data, which provide detailed information about the reasons for outsourcing mining enterprises and offer useful grounds for further investigations into the drivers of mining enterprises' outsourcing. Generally, the mining process of a surface mine includes multiple processes, such as drilling, blasting, scooping, transportation, rock-breaking, ore-breaking and so on. A mine does not outsource all the processes to a single service provider but often outsources different processes to different service providers. Considering data availability and comparability among sample enterprises, we focus on studying the outsourcing of the blasting and rock-breaking processes.

We conducted in-depth interviews with top managers of the selected enterprises according to the pre-designed outline for the interview. To analyze the credibility of the obtained data, researchers need to apply triangulation strategies to examine the research data from different sources (Denzin & Lincoln, 2011). To this end, we interviewed the decision makers who personally participated in the initial negotiation for outsourcing contracts and the managers directly related to outsourcing activities of these enterprises, including deputy mine managers in charge of safety production, heads in charge of production sites, etc. (Table 3.4).

Table 3.4
Summary of characteristics of surveyed enterprises

Characteristic	B1	B2	B3	B4	B5	B6
Outsourcing	Service provider	Outsourcing after the internal operation	Outsourcing from beginning	Outsourcing from beginning	Outsourcing after the internal operation	Outsourcing after the internal operation
Ownership structure	Mixed ownership	Private	Private	Mixed ownership	State-owned	State-owned
Production scale (10,000 tonnes)	—	400		270	6000	360
Main minerals		Iron	Iron	Gold	Iron	Copper
Region	South China	Northeast	Central China	East China	Northeast	South China

Note: Due to different statistical scopes of service outsourcing contracts among different enterprises, some are calculated according to the amount, while some are calculated according to the excavation volume. This table mainly shows the changes in service outsourcing of the case enterprises over the years, so the different statistical scopes will not distort the meaning to be expressed.

To obtain data for analysis. We conducted household interviews, that is, interviews with sample enterprises. Each interview lasted one hour on average, and some respondents were interviewed more than once. The interview includes two aspects. One is the background of the interviewed enterprise. The other is the driving

force of outsourcing and the impact of outsourcing, etc. The second part of the interview questions is semi-structured. In addition, the interview process should be ethical; interviewees should know the basic information about the study and agree to be interviewed, and the interview records should be recorded and used. This study guarantees that the privacy of the research objects and interviewees will not be disclosed. To reduce the omission of information, unless objected to by respondents, we recorded the whole interview, sorted it into words, and obtained a manuscript of more than 130,000 words. Besides the interviews, we also collected archives and data from each sample enterprise, including the detailed introduction of the enterprise, originals of some outsourcing contracts, information on outsourcing over the years, safety incidents, and the resulting punishment of responsible personnel etc.

This study sorted out and analyzed the data collected during the research process and established a database to improve the reliability and validity of the data. Data and research analysis are usually superimposed on case studies and carried out simultaneously. When collecting data, we conduct an extensive search based on the research object and topic and then conduct a specific in-depth collection. During the research process, the depth and breadth of data collection will be adjusted at any time. Data analysis is the key to case studies. With the deepening and concreteness of data collection, data analysis will become more in-depth and specific. The conclusions obtained in the early stage will be tested and modified accordingly. Although the data obtained from case studies do not have strict and standardized procedures like empirical studies, the reliability and validity of case studies will be improved through continuous inspection and modification.

Table 3.5

List of interviewees

Enterprise code	Interviewee code	Interviewee information
B1	A1	The deputy mine manager for production is responsible for coordinating the production activities of the outsourcing service providers.
B2	A2-A3	The Party secretary is the enterprise's direct controller and top manager, while the deputy general manager is in charge of production, directly interacts with service providers, and coordinates the production activities of the service providers.
B3	A4-A6	The interviewed members of the start-up team participated in the initial decision-making for outsourcing; the deputy factory manager for production and the head of the production department were responsible for coordinating the production activities of the outsourcing service providers.
B4	A7-A13	The head of the technology department is responsible for making decisions on outsourcing. The sub-mine manager, the deputy mine manager for production, and the director of the production technology office are responsible for coordinating the production activities of the outsourcing service providers.
B4	A14-A17	The former chairman (and Party secretary) made the initial decisions and handled outsourcing. Now he has retired, so he can express his true intentions without worrying about the pressure from colleagues. The general manager is the current decision-maker for outsourcing, and the deputy general manager, deputy mine manager for production, and others are responsible for coordinating the production activities of the outsourcing service providers.
B6	A18-A19	The chairman and the deputy general manager are the decision-makers of various outsourcing contracts.

Note. The content in the table is derived from interview records

3.4 Data encoding

This study encodes the data from different sources with a typical content analysis program (Yan & Gray, 1994). We assign the data to professional services, economic cost reduction, and risk avoidance. Table 3.6 gives an example of data encoding for this study.

We also create subcategories for data under the main categories. For example, professional personnel, professional technology, and professional management are subcategories under the professional services category. We conduct triangulation to verify the data from different sources for each subcategory to enhance the study's

validity. For example, we demonstrate the data on the sub-category of professional personnel for outsourcing. Besides the professional personnel mentioned by A10, many other sources gave similar views, so we adopt A10's view.

I worked with my assistant to complete data coding. First, we jointly developed a coding scheme and used it to analyze a case study. We then encoded five other case studies. One of us completed the encoding, while the other checked the encoding process and its results (Lincoln & Guba, 1985; Yan & Gray, 1994).

Table 3.6
Professional personnel

Dimension	Construct	Typical quotes
Professional personnel	Professionals	A10: Outsourcing is more efficient...Our workers need to be trained before they can work, while outsourced workers have already been trained, and their skills are excellent. A18: Outsourcing is more professional...Explosive outsourcing has achieved full automation and intelligentization of design, perforation, loading and warning, for which skilled personnel is required.
	Personnel quality	A8: The service provider has a strong management team. A16: In outsourcing, the service provider has more employees with better education, specialized knowledge, and richer experience. A17: The service provider's team is highly qualified and responsible. By outsourcing, our technical personnel are subject to fewer requirements and become more flexible. The service provider deals with the more significant part regarding recruitment and training.
	Owner's lack of workers	A2: We lack blasting personnel and technology. We chose outsourcing mainly because the service provider has professional personnel and technology. A5: We don't have professional teams like these, so we have to rely on the professional service of the service provider... It is crucial to have professionals do the professional work. With professional problems solved, I can carry out large-scale mining. A14: It is important to have professionals do the professional work... As the owner, we lack a management team with insufficient capability, and it isn't easy to find personnel with suitable technical experience and working knowledge in a short time, so outsourcing is necessary.

Note. The content in the table is derived from interview records

3.5 Analytical methods

From the case studies, data analysis is the key to constructing a theory (Miles &

Huberman, 1984). In this study, we processed and analyzed the collected text and data, summarized the contents related to the subject of research directly from the abundant survey data (Strauss, 1987), and comprehensively identified the driving forces of mining enterprises to choose outsourcing and the importance of these driving forces affecting outsourcing.

In the data analysis, we fully considered all the nuances in the data, encoded them into important contents and dimensions, and then gradually formed the theories (Li & Li, 2006). The analysis of this study was gradually deepened between outsourcing and the factors affecting outsourcing. According to sampling theory, we verified existing theories and developed new theories by collecting further data. Continuous comparison and fluid movement between data and theory gradually produced conceptual results (Isabella, 1990). For example, we continue to analyze whether similar relationships exist in other cases when there is a relationship between access to professional services and outsourcing choices. In the following case analysis, we compared the results obtained from the case studies and found that the conclusions were similar, and no new theory appeared, which meant theoretical saturation. We finally reached a deterministic conclusion on the correlation between professional services and outsourcing choices. To establish new theories, we also paid special attention to ranking different driving factors by importance for enterprises with different characteristics in the analysis.

4 Research results

In the early days, miners in China were run by their owners. Coal mines, in particular, cannot be outsourced according to safety rules. However, after the 1990s, there were fewer and fewer miners engaged in mining, and some mines encountered recruitment difficulties, so they began to choose to outsource (Liu et al., 2015). In China, mining outsourcing mainly focuses on drilling, blasting, mining and loading, transportation, and drainage, while mineral processing is rarely outsourced as the core business of mining enterprises. This chapter uses the multi-case study method to develop the middle-level theory, which explains the driving forces and mechanism of outsourcing in Chinese mining enterprises.

4.1 The driving force behind the outsourcing of the case enterprise

4.1.1 The driving force of B1

B1 was established in March 2004. After its establishment, B1 organized its engineering team to carry out the small-scale surface soil stripping construction. The construction machinery and equipment were mainly Hitachi 240 excavators (bucket capacity of 1.2m^3) with 8-ton self-unloading dump trucks. The model was relatively small, and the construction efficiency was low with high cost. The archived documents showed that B1's self-operated excavation and transportation construction cost was high, reaching 6 yuan/ton.

Studies have shown that outsourcing services helps to reduce costs (Freytag et al., 2012; Chen Fei, 2005). After the mining enterprises outsource part of the production links, the labour costs, fixed asset investment, management fees and other costs related to the outsourcing link are borne by the outsourcing enterprises, and the owner only needs to pay the outsourcing party for the corresponding service fee. The

service cost paid is usually much lower than that generated by self-operation, so the enterprise's total cost will be significantly reduced after outsourcing (Khanna, 2013). In December 2005, after realizing that the cost of self-operation was high and the professionalism was insufficient, B1 began to outsource several production links. As A1 said: "Our own cost was too high, then we heard that outsourcing was much cheaper than doing it ourselves, and it was better than we did ourselves, so we checked a few outsourcing companies and just outsourced them". For any other motivation, A1 said: "At that time the reason was very simple, did not think so much. If there are other reasons, it is because our technical ability is limited, and the technology of the service outsourcing provider is good. Better technical equipment is conducive to reducing costs, so it is still the cost".

From the documents provided by A1, we can see the methods service outsourcing providers use to achieve cost reduction. The service outsourcing company optimized the overall mining design and applied reinforced mining technology to meet the design scale of the mine production in advance. Initially, the mine's design production capacity was 1.2 million tons/year, with a service life of 12 years. However, optimising the mining design and application of reinforced mining increased the production capacity to 2.4 million tons/year, and the mine's service life was shortened to 5 years.

Furthermore, through the measures of "separate blasting and separate mining", the entire mining area was divided into upper and lower ore bodies, affluent ore areas, poor ore areas, ore-rock boundary zones, and interlayer distribution zones, each with corresponding blasting and loading standards. Under the premise of ensuring the blasting effect, the ore zone was appropriately enlarged with explosives to ensure the block size and pile shape of the blasting ore. The ore-rock mixed zone was carried out

with separate blasting and mining, increasing 3% of the iron ore recovery rate and a decrease of 3% of the waste stone incorporation rate, achieving remarkable savings in resources.

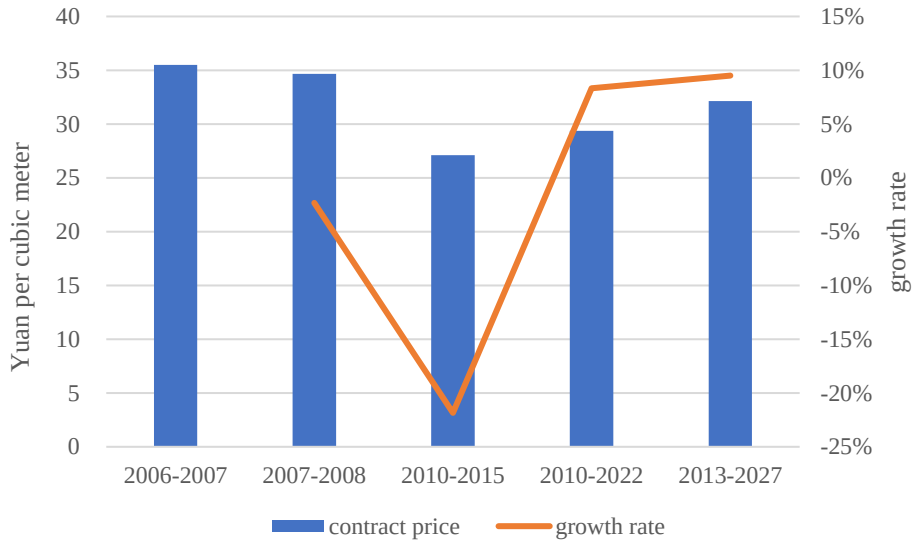
An on-ground station was also built to realize integrated mixing and blasting construction, saving costs. After two years of construction in the mine, a mixing and emulsifying explosives production line was constructed locally, ensuring the safety of blasting operations and reducing the construction cost of blasting. In addition, acceptable pricing was implemented in the sub-contracting of mining and transport to save mining and transport costs.

The mining and transport construction unit price was fine-priced according to each 10m step (the unit price increased by about 0.1-0.2 yuan/ton for each step down), significantly reducing the average unit cost expenditure and the average unit price of mining and transport sub-contracting was about 4.7 yuan/ton, which was significantly lower than the previous B1 self-operated cost (6 yuan/ton).

Thanks to the efforts of the service outsourcing company, B1's construction costs have been significantly reduced compared to the initial period between 2006 and 2007. Therefore, the service outsourcing contract price signed by B1 and the service outsourcing company has also trended downwards (Figure 4.1).

Figure 4.1

B1's yearly outsourcing contract price situation



Note. Data were obtained from interview records

Upon realizing the economic benefits of outsourcing, B1 outsourced the entire mining process, including drilling, blasting, excavation, transportation, pushing and discharging, sprinkling, and road maintenance.

4.1.2 The driving force of B2

As a private iron ore enterprise, B2 had a weak professional force. Therefore, B2, established in 2011, mainly employed experienced operation technicians from large state-owned enterprises. In the early stage, B2 completed all production links through self-operation. However, due to the limitation of inadequate technical capabilities, the cost of the enterprise remained high. Subsequently, to obtain more professional services and compress costs, B2 gradually outsourced some production links, such as blasting links, in 2016. After outsourcing the blasting link, the service provider established a project department, and both parties cooperated well. Unlike B1, B2's choice of service outsourcing was not only to reduce costs but also to emphasize

obtaining professional services and ensuring safe production.

4.1.2.1 Cost reduction

B2's primary reason for selecting service outsourcing is to reduce costs, as A2 stated: "There are great advantages from a cost standpoint with outsourcing". A3 also commented: "The choice of outsourcing is also with the intent of controlling costs. We bid out our services and, in the bid process, we look to control costs and drive down prices". Furthermore, this cost advantage achieved through service outsourcing is brought about by professional services. As A2 stated: "The service providers have a more professional technical and management team, so there are some advantages in terms of cost control and pricing, where they can give us discounts".

4.1.2.2 Professional service

Enterprises providing outsourcing services possess more professional knowledge and have a more accurate grasp of personnel requirements, and the employees they recruit are more professional. Obtaining professional services is why many enterprises outsource some of their production processes. In practice, one of the critical factors driving mining companies to outsource is to get skilled technology and professional knowledge (Peterson, 2001). Generally speaking, outsourcing companies must have excellent technology before the owners can outsource the relevant production processes to the contractors. Outsourcing firms' specialization, technical advantages, and equipment advantages must be what owners lack and need and are also vital to the strategic development of outsourcing firms (Modak et al., 2017). Obtaining professional technology is another reason why B2 chooses to outsource services. As a necessary production process in mining, blasting requires high technology. As A2 said: "Professional blasting requires qualifications, but we don't have qualifications.

Our blasting technical strength is insufficient, and no such technical personnel exists. So, outsourcing has great advantages for us. Our blasting personnel strength and technical strength is not enough, so outsourcing is considered because outsourcing companies have professional personnel and technology". A3 also pointed out: "If all the production processes are done by ourselves, our management personnel and technical level will not reach the standard. We do not have excellent technology regarding blasting design, review, and on-site disposal, so we outsource these processes.... If we take it on ourselves, our management personnel are not up to the task. So, professional things should be done by professionals".

The professional technology brought by outsourcing services can guarantee safe production, as blasting is very dangerous. As A2 said: "Blasting is a high-risk work process, and it is appropriate for the owner to entrust this process to a professional construction team".

With the state's increasingly strict environmental protection supervision policies, open-pit mining is gradually turning to underground mining. A3 pointed out: "The province documents stipulate that all mines will not be allowed to open-pit mining in the future. Our staff, such as management teams, drivers, etc., are only suitable for open-pit mining. Underground mining requires higher technical requirements and higher requirements for employees' abilities. From a professional point of view, our team's ability is insufficient. Finding suitable personnel in the short term is difficult even if we re-recruit. So, from the point of view of the development of the enterprise, more production processes will be outsourced". This means that the more stringent regulatory policies lead to B2's greater reliance on the technical capabilities of outsourcing firms.

4.1.2.3 Safe production

The safety of the Chinese mining industry has been under tremendous pressure. According to statistics, the average number of people killed in mining accidents in China from 2000 to 2010 was 4870 per year, while that of the United States during the same period was only 33. At the peak in 2002, 6995 people died in China, while 27 died in the United States, 259 times that of the latter. Because of this, the Chinese government has increased its supervision of safety production at the administrative level. China's safety production in the mining industry is facing a serious situation. Therefore, the related provisions concerning labour protection and safety production are included in the laws such as the Criminal Law, Mineral Resources Law, Trade Union Law and Labour Law issued by China successively. On this basis, the Mine Safety Law and the Safety Production Law were promulgated in 1992 and 2002, respectively, and the responsibility for safety production accidents was elevated to a legal level. The Criminal Law Amendment (Eleventh) passed in 2020 made major adjustments to the relevant safety production regulations and added two new offences: organizing others to engage in hazardous and hazardous operations. Under strict safety production supervision, B2 is considering improving the safety production level.

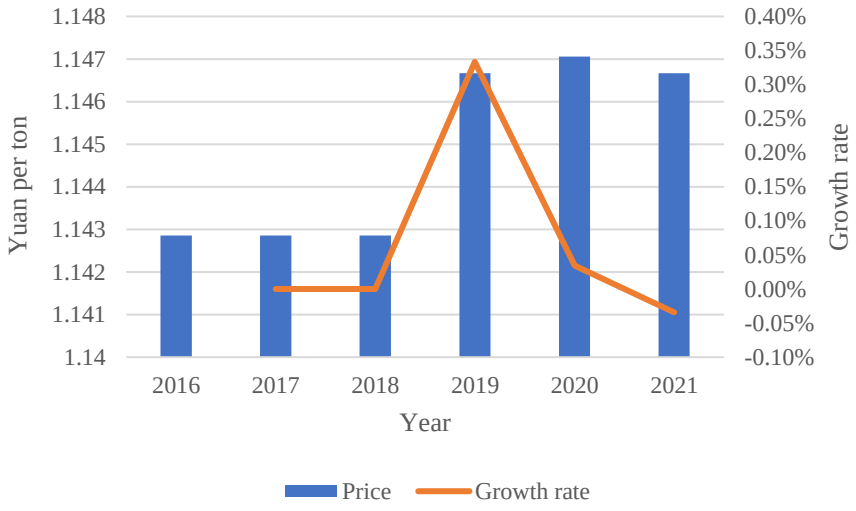
As a relatively flexible mechanism, outsourcing allows enterprises to adjust their outsourcing activities to cope with and adapt to environmental changes (Scherrer-Rathje et al., 2014). In China, service outsourcing has become essential for B2 to enhance safety production capacity. A3 said: "Faced with safety production, new requirements exist, including accountability for problems. Blasting is a high-risk operation. It is appropriate for the owner to leave this link to a professional construction team to deal with".

Through service outsourcing, B2 has achieved better cost, technology and safety

production results. Firstly, from the cost point of view, as A3 said: "If we organize blasting ourselves, the cost may be 20 yuan. If we leave it to a professional outsourcing team, the cost may be two yuan. So outsourcing is a win-win decision". Since then, the service provider has continuously improved the blasting operation process, gradually improved the blasting management technology, and has taken several cost-saving measures. In practice, the service provider's professional technicians track the quality of drilling, loading and filling, networking and detonating, and alarm inspection in the blasting site and provide feedback and analysis on the blasting effect in time. The service provider also compiles the internal ledger based on the first-hand data of blasting operations, regularly analyzes the blasting effect and economic gains and losses, and then systematically improves the data in blasting work to guarantee blasting safety and a basis for cost control. Data show that the blasting cost was 1.143 yuan/ton when blasting began to be outsourced in 2016, and it was 1.147 yuan/ton in 2021, only 0.35% higher in 5 years (as shown in Figure 4.2). In this process, as A2 said, outsourcing companies have unique ability to reduce costs after outsourcing. The cost control has been very good for so many years, and we are very satisfied.

Figure 4.2

Outsourcing price of blasting process service of B2



Note. Data were obtained from interview records

A2 remarked on the acquisition of technology, "We have gained a lot in terms of technological power through cooperation with outsourcing companies. It can be said that the services we have obtained in terms of technology are priceless".

A2 and A3 both mentioned the benefits of outsourcing to enterprises regarding safety production. A2 pointed out that "the risk of blasting is particularly great. After outsourcing, our enterprise is only responsible for management, and the outsourcing party bears the direct responsibility so that the enterprise can avoid certain safety risks". In fact, before outsourcing to service providers, B2 organized production by itself, and its construction personnel were local villagers with a lack of necessary job skills and low safety awareness. Three mechanical injury accidents occurred one year and nine months before the outsourcing, resulting in fractures of the legs and arms of construction personnel. After outsourcing, the outsourcing service provider formulated detailed control measures for drilling, blasting, mining and transportation to ensure the safety performance of the machinery and equipment used in

construction, to check the safety hidden dangers in the mining construction environment, to strengthen the safety training and education for employees, to strictly regulate the wearing of labour protection equipment, and to continuously improve the safety awareness and job skills of personnel. According to the archive data, since the outsourcing project in December 2005, except for two traffic accidents in the transportation team, no safety production responsibility accident has occurred in B2's construction. The two traffic accidents were properly handled through consultation, and the outsourcing service provider conducted special safety education work.

4.1.3 The driving force of B3

B3, a gold-copper mine in eastern China, currently employs 3,000 employees and consists of two major production systems, gold and copper mines, and nine production plants. Zijinshan Gold-Copper Mine has developed from an annual gold output of 8.5 kg in 1992 to an annual gold output of 16,227 kilograms in 2010, an increase of 1,908 times. Its leading economic and technical indicators have reached internationally advanced levels, creating a number of national firsts such as the maximum amount of gold available, the highest gold output, the largest selection scale, the best economic benefits and the fastest development speed, making it the only world-class large gold mine in China. B3 has accumulated 305 tons of gold metal resources and more than 3 million tons of copper metal. Its main products include mineral gold, electrolytic copper, copper concentrate and sulfur concentrate.

Unlike the private enterprises of B1 and B2, B3 is a mixed ownership enterprise: it is held by the county's state-owned assets commission, but its corporate governance mechanism is relatively perfect, and it has the advantages of system mechanism and market-oriented operation and management. This means that B3 has some characteristics of private enterprises in some aspects and some characteristics of state-

owned enterprises. All along, B3 has outsourced multiple production links in the mining process, such as blasting, excavation and transportation, to service providers. Similar to B1 and B2, B3's outsourcing drivers include cost reduction, obtaining professional services and ensuring safe production. However, it still has its characteristics, such as B3 emphasizes flexibility and the importance of safety production more than the private B1 and B2.

4.1.3.1 Cost reduction

The cost constraint was the initial reason for B3's decision to outsource multiple production links. B3 is a county-level state-owned enterprise. In the 1990s, the county where B3 is located belonged to the national poverty-stricken counties, with a population of more than 400,000 and an annual fiscal revenue of only 50 million yuan, making the economic situation very difficult and even relying on borrowing money to pay wages. At the beginning of B3's startup, it wasn't easy to operate without enough funds. The archives provided by B3 showed that at the beginning of the startup, B3 lacked funds, and its general manager had to run to the bank three times to get a loan of 50,000 yuan. Under this situation, B3 did not have enough funds to invest, so it decided to outsource some of the production links that it could not manage independently to maintain its flexibility and save costs. As A4 said: “The advantage of outsourcing is that I don't have the funds to invest in this area... So, there is an advantage in terms of cost”. A5 also pointed out: “After outsourcing, there is less investment in machinery. For example, excavators cost 200,000 to 300,000, and mining trucks cost more than 700,000. But if it is outsourced, the equipment investment will be reduced. For the procurement of large-scale mechanical equipment, the procurement process of outsourcing companies is faster. Moreover, outsourcing companies are more familiar with it, have resource-wide procurement

channels, and can get more favourable prices. If we go to purchase, we don't have the resources and channels, so the price will naturally be higher”.

4.1.3.2 Professional service

Similar to B1 and B2, B3 considered acquiring professional services a vital factor of service outsourcing. As A4 stated, "From the aspect of engineering technology, if we want to build it quickly and put it into production, outsourcing is probably necessary, and the expansion speed may not be so fast”. A5 said, "We don't have these professional teams ourselves, so we need to rely on the professional capabilities of outsourcing parties. With professional people handling professional matters, the problems of professionalism can be solved. I can carry out large-scale mining”. In addition, A6 also pointed out that service outsourcing is conducive to the application of new technologies and is also an essential reason for choosing service outsourcing: "Outsourcing will promote the application of new technologies, which is also beneficial to the owner”.

4.1.3.3 Increase flexibility

Outsourcing services help reduce enterprises' capital and equipment investment, achieve light asset operation, improve the flexibility of corporate finance, and thus reduce enterprise costs (Scherrer-Rathje et al., 2014; Sivakumar et al., 2015). Outsourcing is helpful to simplify management and has the advantage of professional management (Freytag et al., 2012). In China, many mining enterprises are state-owned, and their management, examination and incentive mechanisms are subject to many restrictions. In contrast, the outsourcers are primarily private enterprises with more flexible management mechanisms and professional management models, which can drive the host enterprises to carry out flat management and streamline the

organizational setup (wang, 2009). B3 acknowledged that the financial returns from light assets are important reasons for choosing outsourcing. A5 said, “In terms of management, the owner will be more relaxed after outsourcing and personnel management are saved. After outsourcing, our management will be more relaxed, and the outsourcing party will bear a larger part of recruitment and training regarding personnel. If we operate ourselves, the labour cost will be much higher”. A6 also pointed out, "We don't have so many professional personnel and technologies. For professional construction units, their sustainability is higher. The cost is also lower than when we operate ourselves. We are a listed company, and the regulations are becoming stricter, and the requirements are higher. At the same time, outsourcing is more flexible and can solve many practical problems, and the related investment is often lower than when we operate ourselves”.

4.1.3.4 Safe production

Under the strict safety production supervision policy, B3 emphasizes improving its safety production level through service outsourcing. As A6 said, “The safety input of the outsourcing team went up correspondingly, which is beneficial to the overall safety production”. A5 also said, “After outsourcing, I reduced the safety pressure”. Service outsourcing also helps to reduce the risks caused by B3's safety production. A4 said, “For outsourcing, the owner is the main management responsibility, and the outsourcing party is directly responsible”.

B3 mentioned the political responsibility caused by safety production. A5 said, “From the perspective of political responsibility, we should take reducing safety risks as the first driving force to choose service outsourcing. If the safety is not guaranteed, I don't want to use you even if the price is lower”. Under the special circumstances in China, the identity of state-owned enterprise agents is quite special. Most of them

have dual identities: one is a government official, and the other is a professional manager or, even more importantly, a political official (Kato & Long, 2011; Yang et al., 2013; Zheng et al., 2012; Chen et al., 2015). Empirical research found that many government employees are also directly produced by state-owned enterprise executives, which indicates that state-owned enterprise executives have the identity of political officials (Zheng et al., 2012). To reduce the occurrence of safety production accidents, the central government has implemented a strict accountability system for local governments on safety production, and the promotion, assessment and veto of officials responsible for safety production accidents are all borne by these officials. A5 also mentioned that managers will be promoted if safety production is done well: “If one can manage safety well, he should also be able to manage other work. Therefore, if one can manage safety work well, his future development should have a higher promotion. Before the deputy general manager is promoted, he is asked to manage safety. If he manages well, he will be further promoted to general manager. In addition, the head of the production must also manage safety. If the safety awareness is in place, it should be promoted first”.

4.1.4 The driving force of B4

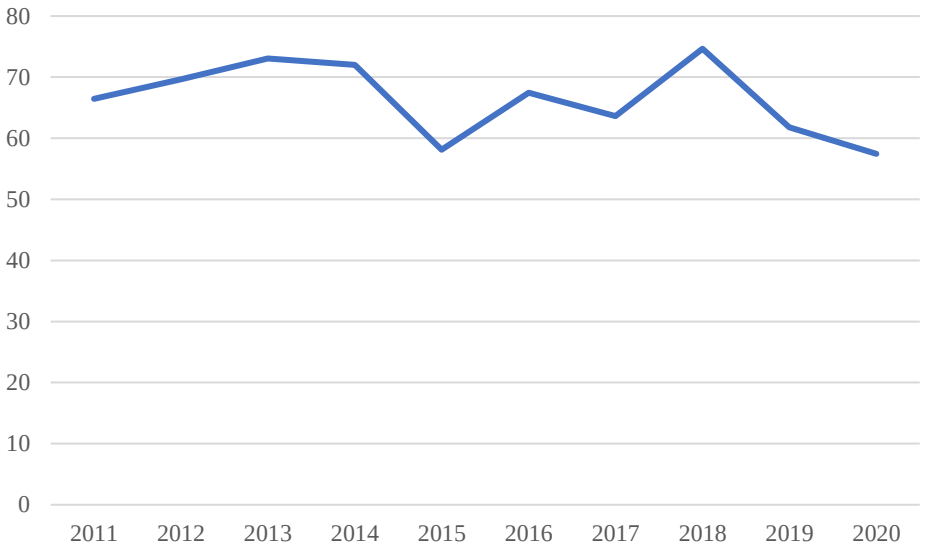
As one of China's largest and oldest iron ore mining companies, B4 has a very high position in the industry and is a well-known state-owned enterprise. According to the interview situation, B4 is similar to B3, and the driving force for outsourcing is also concentrated in several aspects, such as cost reduction, obtaining professional services, increasing flexibility and safety production.

4.1.4.1 Cost Reduction

B4 mentioned that they chose outsourcing for cost control considerations. For

example, A9 said: "Our management is not good. You will not see the profit without outsourcing. After outsourcing, we don't need so many people. It is more flexible". A13 also said: "After outsourcing, I do not invest in labour. There is no labour cost". We obtained B4's cost data for one ton of iron ore from 2011 to 2020. Interestingly, after 2014, when B4 outsourced the drilling, blasting, mining, and pushing processes, the cost per ton of iron ore seemed to have a sure decline, but the magnitude was not significant (as shown in Figure 4.3). This means that B4's production costs have dropped to some extent through service outsourcing, but the decline is limited.

Figure 4.3
Annual cost per ton of iron ore of B4



Note. Data were obtained from interview records

4.1.4.2 Professional service

During long-term operations, B4 has cultivated a strong technical team and amassed a wealth of mining experience. Therefore, unlike B1, B2 and B3, outsourcing service providers sourcing service providers' techno as strong as those of previous. As A7 said, "Our technology is leading in the country, and there are excellent talents in

the industry". However, B4 still acknowledges that improving its technical level is an essential reason for its choice of outsourcing services. A7 said, "Through outsourcing, our technical level has improved. Including industry awards, patents, etc., we have. Our personnel and equipment have not increased, but efficiency has increased. Due to specialization, the technical level of blasting has improved". A13 also said, "Outsourcing is a good way to introduce new technology because it is a joint venture between two or more companies. Each one must have its technical strengths, so, through outsourcing, the technologies of each party will be integrated, which will lead to an improvement in technology". In addition, some people have also mentioned the professional management brought about by service outsourcing. A8 said, "The managers of the outsourcing party are very efficient".

Regarding the performance of service outsourcing, A9 said, "From a technical point of view, our blasting level and quality have been gradually improved, which is much higher than the previous technical level". A12 also pointed out, "Through outsourcing, our blasting technology has been improved to some extent".

4.1.4.3 Increase flexibility

Similarly, to other enterprises, B4's selection of outsourcing services contributes to reduced fixed asset investment and increased flexibility. As A8 said, "The spare parts cost of large equipment is high, and the management is complicated, the management cost is also high, such as depreciation, maintenance, etc... Outsourcing does not need to consider these". A10 also said, "Compared with self-operation, I don't need equipment... I don't have the equipment to repair. The advantage is that the cost is very low. I implemented the outsourcing model in the newly opened mines, with very little initial investment, no large equipment, no depreciation. Compared with self-operation, many posts can be reduced when outsourcing. This flexibility

brings the benefit of very low cost". A13 also said, "After outsourcing, I do not make equipment investments and operate with light assets. Light asset operation costs are lower because if it is a heavy asset operation, there is depreciation of equipment and labour costs. No matter how much you do, this fixed thing has depreciation and labour costs".

In comparison with B3, B4 emphasizes the importance of flexibility for its choice to outsource services. B4, from the old industrial base in Northeast China, is one of the regions with the longest implementation of the planned economy and the most far-reaching impact of the planned economy in China. Due to the long-term planned economy background, there are severe block problems segmentation in the Chinese mining industry (Kang et al., 2011). Especially in the front-end design part, the mining technologies for different minerals are incompatible. However, with the development of technology, it is urgent to change the block segmentation problem. Outsourcing companies are more flexible in terms of systems and operations, so after outsourcing some of the production links, the outsourcing party can flexibly solve problems in personnel incentives, organizational management, material procurement, etc., reducing costs (Modak et al., 2017; Scherrer-Rathje et al., 2014; Wang, 2009). In this case, B4 hopes to enhance its operational flexibility through outsourcing.

As A7 said: "Our technology is leading in the country, and there are also excellent talents in the industry. However, the incentive mechanism of the outsourcing party is better and can better play the enthusiasm of talents". A8 said: "On the management level, the outsourcing party implements performance management. This points management system mobilizes people's enthusiasm in an all-round way. Every employee's self-management ability is strong. They know their work content and how to do their job well. But in state-owned enterprises, it can't be done absolutely". A11

pointed out: "The reward mechanism and incentive mechanism of the outsourcing party are more flexible. Through the flexible market operation mechanism of the outsourcing party, the vitality of cost reduction is stimulated—our cost reduction benefits from the flexible operation mechanism. We are state-owned enterprises and need to bear some social responsibilities, such as hiring re-employed soldiers. The personnel of the outsourcing party are more professional. The operation efficiency is higher". A15 also said: "The outsourcing party has stronger adjustment ability, people and equipment are more flexible, more efficient, and the results are more obvious". In addition, A9 also pointed out: "We are state-owned enterprises, personnel costs are high, after outsourcing we don't need to use so many people, more flexible". A11 also said: "After outsourcing, personnel are streamlined and the efficiency of the entire operation is improved".

4.1.4.4 Safe production

Compared to B1-B3, B4 is the one that pays the most attention to safety production. A8 said: "It is essential to peel off this thing and outsource it. The most important purpose is safety. People's safety, environmental protection inspection, the outsourcing party is helping us to do the work". A12 also said: "I feel that the biggest benefit of outsourcing is, to be honest, the risk sharing is different. The mining enterprise is most afraid of safety production and major safety accidents—especially blasting, which is more of a concern by the state. The risk was on the owner's side before. Now, through outsourcing, our actual risk is much smaller". A9 said more directly: "Blasting is a high-risk industry. The purpose of peeling it off is to reduce the risk. Transfer the risk to someone else. If there is a problem, it has nothing to do with me. It has been outsourced". When asked which driving factor was most important for B4, A8 answered: "Safety is critical. After peeling off this link, the safety risk is

reduced, and the frequency of safety risk occurrence is greatly reduced. If you ask me why service outsourcing is chosen, the first is safety".

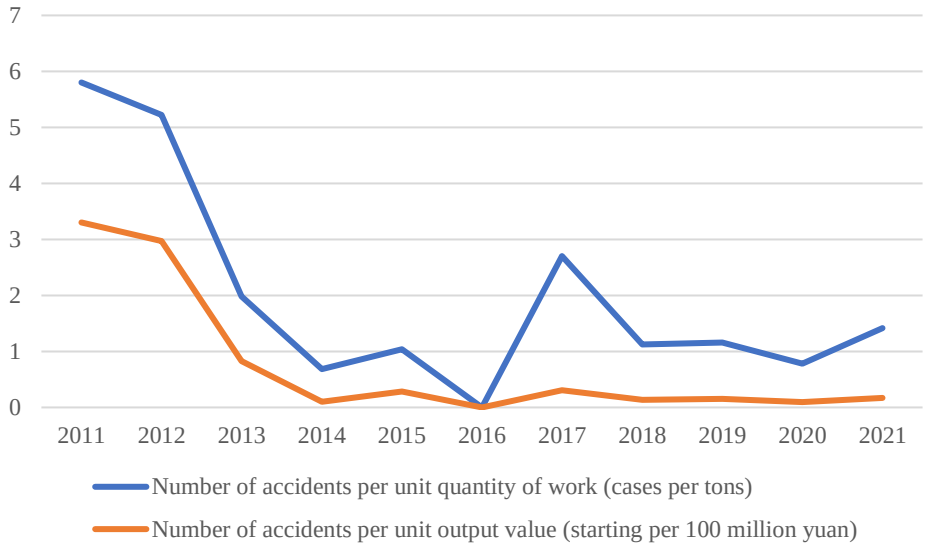
B4 also mentioned the political responsibility of safety production. A13 said: "If there is a safety production accident, we have to bear political responsibility. The black hat cannot protect. So why outsource? We just find someone to blame for the dead". For example, in 2018, B4's safety production accident, resulting in 1 death, led to the company. The iron ore mining chief, party secretary, production deputy mining chief, mining chief, party branch secretary, deputy mining chief, etc., were given serious disciplinary action, which means that the promotion of these six people will be affected by a huge unfavourable factor in the future.

Service outsourcing has indeed brought more safety production benefits to B4. We obtained the accident data of B4 in the past ten years. As shown in Figure 4.4, since the choice of service outsourcing in 2014, the number of B4 unit accidents has dropped significantly. Before 2013, the number of accidents per unit engineering volume or unit engineering amount decreased yearly, but still at a high level. Since the choice of service outsourcing in 2014, except for the rebound of the number of accidents per unit engineering volume in 2017, the number of safety production accidents of B4 has been low.

The occurrence of a safety production accident implies that B4's senior executives are to be held accountable and dealt with. Following the selection of outsourcing services, on the one hand, the number of safety accidents decreased, while on the other hand, due to the outsourcing service provider assuming the production responsibilities, the number of B4's managerial personnel being held accountable for safety production accidents has also been steadily decreasing (as shown in Figure 4.5).

Figure 4.4

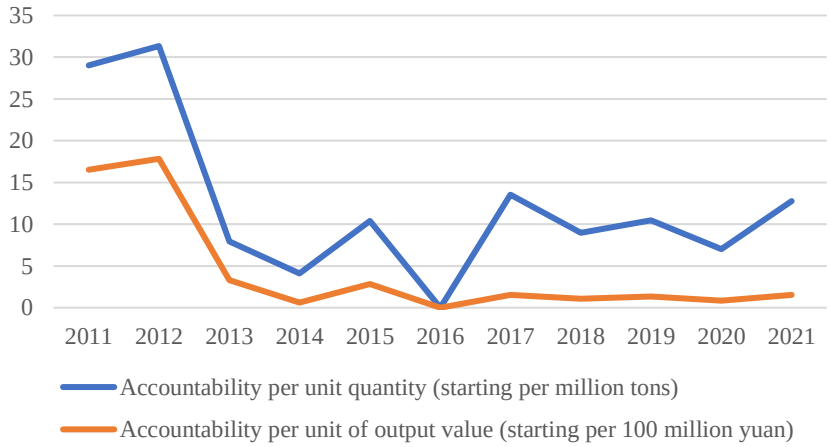
Safety accidents in each year of B4



Note. The data in the figure are compiled from archival sources

Figure 4.5

Managers held accountable for safety incidents by year.



Note. The data in the figure are compiled from archival sources

4.1.5 The driving force of B5

B5 is a state-owned enterprise located in South China. Established in 1958, B5 has been a large-scale copper mine since the Tang and Song Dynasties and has officially been put into production since 1966. By 1975, a large-scale open-air iron

ore mine was established with a designed annual mining capacity of 2.3 million tons. B5 has built a complete mining system with more than 2,300 employees. As an old state-owned enterprise established in 1958, B5 has chosen the same driving force of outsourcing services as B4, which mainly focuses on cost reduction, obtaining professional services, increasing flexibility, and strengthening safety production.

4.1.5.1 Cost Reduction

Outsourcing brings about a decrease in labour costs for B5. First, as A15 said: "It is much simpler to manage after outsourcing and the training and configuration of personnel are all handed to the outsourcing company, resulting in a lower cost". A17 said: "Without outsourcing, it would be easy to cause problems like idle personnel and difficulties in deployment, etc. After outsourcing, the labour cost is reduced and the personnel needed is at least halved".

From the perspective of division of labour, service outsourcing can bring about economies of scale in the industry (Youno, 1928). Our interviewees also pointed out that the outsourcing party can get lower procurement costs through large-scale procurement as A18, a service provider of B5, said: "Outsourcing party may be cheaper than the owner party in purchasing, because the outsourcing party may purchase thousands or even tens of thousands at a time, so the cost of outsourcing is lower". A19 also said: "In the past, the owner party was a state-owned enterprise, taking care of many relationships, so the cost was somewhat artificially high. But the outsourcing party can ignore those faces and save costs through the market".

4.1.5.2 Professional service

Outsourcing companies may be able to recruit more specialized personnel than owners, who require training for the hired personnel. It is due to the outsourcing firm

recruiting professionals that they have a high-quality professional personnel team. A16 said: "After outsourcing, the employees of the outsourcing companies are highly educated, more talented, more knowledgeable and more experienced". A17 said: "The outsourcing team has high quality and responsibility... After outsourcing, our technical personnel requirements are reduced, making personnel more flexible. Regarding personnel recruitment and training, the outsourcing party will bear a greater part". In contrast, B5's professional strength is relatively weak, so they chose to outsource some processes. A14 said: "Professional people should do professional work... Our owner's management team cannot find people with technical experience and business level suitable in the short term, so we need to outsource".

Outsourcing also helps to promote technological innovation (Freytag et al., 2012). B5 emphasized the application of new technologies brought by outsourcing, such as A17, which said: "The outsourcing party has greater investment in science and technology and is more professional. These technological investments are all shared with the owner, enhancing the owner's technological ability".

4.1.5.3 Increase flexibility

B5 also mentioned the managerial flexibility brought by service outsourcing, as A17 said: "Outsourcing has advantages in team allocation, flexibility, and equipment configuration...Their personnel management and elimination mechanisms are worth learning from". Regarding fixed asset investment, service outsourcing also brings stronger flexibility, as A15 said: "After outsourcing, the investment in equipment is greatly reduced. This can be seen by comparing the data. Outsourcing has a stronger ability to adjust, and people and equipment are more flexible, efficient, and effective. A18 also said: "Investment in self-operation is high, that is, fixed asset investment is relatively large". We can see that the pursuit of flexibility is also an essential reason

for B5 to choose service outsourcing.

4.1.5.4 Safe production

As a state-owned enterprise, B5 is also highly aware of the importance of safe production. A15 said, “Safety is a critical issue for us. After outsourcing, investment and personnel are in place, the outsourcing company's employees have higher academic qualifications, and the talent introduction is better, including doctors and masters, all of whom are capable and willing to work. Furthermore, the efficiency of the outsourcing party is higher than ours, and more funds are invested in improving the level of safe production”. A17 also mentioned the political responsibility of safe production: “We need to take responsibility for safety... The owner has to consider not only the economic aspects but also other political and social responsibilities”. A18 also said, “After outsourcing, if there is a safe production accident, the owner is only liable as an accessory, including imprisonment, fines and other matters, which are the outsourcing party’s business. B5 is a state-owned enterprise, so it cannot do as private enterprises do. If they have a serious safe production accident, the political life of their senior executives will end”.

4.2 Comparative analysis of driving forces

Through the analysis above, we have comprehensively understood the driving forces behind mining enterprises' choice of outsourcing services. With the increasing number of case enterprises, the driving forces of the case enterprises are becoming consistent, and the theory is saturated. The above analysis shows that reducing costs, obtaining professional services, increasing flexibility and improving safety production levels are the main reasons mining enterprises choose outsourcing services. Interestingly, the driving forces for different types of enterprises to choose

outsourcing services are not completely the same. For private enterprises B1 and B2, the main driving force for outsourcing is to obtain professional services and reduce costs. However, for the mixed ownership enterprise B3, there is also a need to increase flexibility and improve safety production levels. B4 and B5, as traditional state-owned enterprises, have strong economic and technical strength. They chose outsourcing services mainly to increase their management flexibility and improve their safety production level. It should be noted that B4 and B5 both emphasized the political risks brought by safety production, and they believed that outsourcing services would help transfer safety production risks to service providers and thus reduce the political risks of senior executives.

We let the interviewees of the case enterprises score the importance of different reasons. The overall score of each enterprise is shown in Table 4.1. We can see that B1 and B2, as private enterprises, are more concerned about the professional and economic benefits of outsourcing services. However, both of these two companies are not concerned about political risks. As A3 said:

We have never had to deal with people for safety accidents. If there is a safety production accident, we always solve it with money.

We can also observe that while both B1 and B2 are private enterprises, B1's driving force is merely cost reduction. In contrast, B2's driving force includes cost reduction, professional services, and safe production. Although B1 considers professional services important in the comprehensive scoring, this was after learning that other enterprises pay attention to this driver. Conversely, B2 specifically mentioned the importance of professional services during the interview and reiterated its importance to the enterprise during scoring. Therefore, it can be seen that, compared to B1, professional services are more critical for B2. The reason for this

difference lies in the fact that B1 only owns one production mine, while B2 owns multiple. This implies that B1 only needs to ensure high economic benefits for one mine through service outsourcing, while B2 can also learn through service outsourcing, "learning by doing," to gain technical improvements from professional services and safe production technologies.

For B3, a hybrid-ownership enterprise, although they are concerned about the professional personnel and flexibility brought by outsourcing, their requirements for professional technology, management and cost reduction are not so high. In fact, the reason why the enterprise chose outsourcing is that the initial investment of the enterprise is too large, and if it is organized and produced by itself, the enterprise does not have the ability to bear the huge fixed asset investment. So, the enterprise established a strategic alliance with another enterprise providing outsourcing services to outsource part of the production process.

However, different from B4 and B5, state-owned enterprises, whose own technology level is already very high in some aspects, the most important appeal of outsourcing is not to obtain professional personnel or technology or even to save economic costs. As A7 said, our technology is leading in the country and there are also very excellent talents in the industry. However, the incentive mechanism of the outsourcing party is better, which can effectively play the enthusiasm of talents.

Since the executives of state-owned enterprises are also employees of the government, for state-owned enterprises, if there is a safety production accident, a veto will lead to the promotion of the executives being blocked. For example, the Shandong Qixia mine disaster led to the accountability of 45 relevant personnel, including not only the executives of Shandong Wucai Dragon Investment Co., Ltd., where the mine disaster occurred but also the secretary of the Qixia Municipal

Committee, Yao Xiuxia, the deputy secretary of the municipal committee and the mayor, Zhu Tao, etc. This means that for mining executives, they should not only consider the economic cost of the enterprise, but also consider the political risk they bear. In practice, corporate executives will be held accountable when the number of safety accidents or deaths reaches a certain number, in addition to government officials. Therefore, for state-owned enterprises, one of the most important reasons for choosing outsourcing services is better professional management, such as reducing social responsibility, better incentive systems, etc.

An intriguing phenomenon is that, unlike private and mixed-ownership enterprises, state-owned enterprises (SOEs) emphasise reducing safety risks and regard it as an essential goal of service outsourcing. This implies that, while the service outsourcing drivers for mixed-ownership enterprise B3 and SOEs B4 and B5 appear to align superficially, they fundamentally differ: B3's focus on safe production primarily aims at complying with national laws and regulations for safe production, while B4 and B5 not only adhere to legal and regulatory requirements but also significantly consider transferring the risks associated with safe production to the service outsourcing companies. Just as the former chairman of B4 said when deciding to outsource part of B4's production process: we are just looking for a "dead substitute" - outsourcing means that if a safety production accident occurs, B4's executives only need to bear management responsibility, not direct production responsibility. Therefore, the outsourcing service provider became the so-called "dead substitute".

Table 4.1

Distribution of importance of driving forces to enterprises

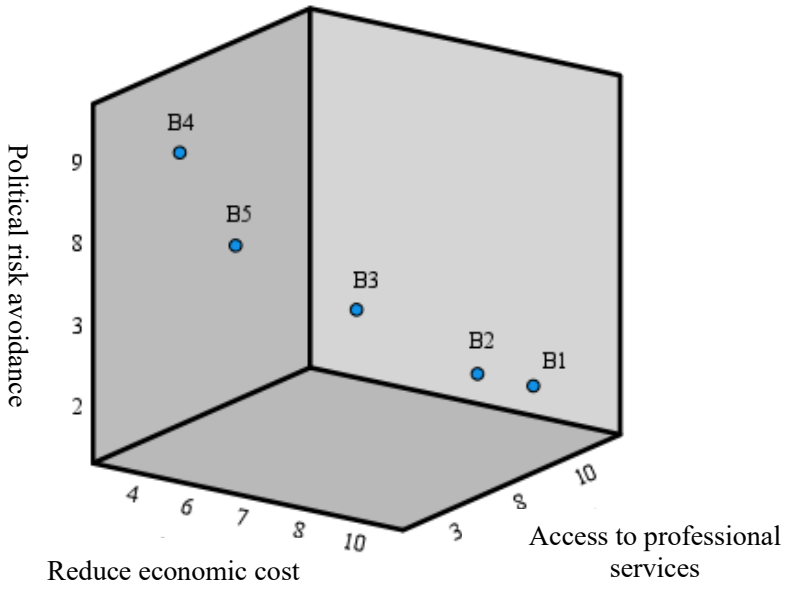
Ownership	Private		Mixed ownership	State-owned	
Enterprise code	B1	B2	B3	B5	B6
Access to professional services	High	High	High	Medium	Medium
Professional personnel	High	High	High	Low	Low
Professional technology	High	High	Medium	Low	Low
Professional management	High	High	Medium	High	High
Reduce economic costs	High	High	Medium	Medium	Medium
Reduce direct costs	High	High	Medium	Low	Medium
Improve flexibility	High	High	High	High	High
Avoid political risks	Low	Low	Low	High	High
Reduce safety risks	Medium	Medium	Medium	High	High

Note. Compiled on the basis of analysis of interview records

Figure 4.6 shows more intuitively the objective of sample enterprises when choosing outsourcing. From the figure, B1 and B2 pay more attention to obtaining professional services and reducing economic costs. In comparison, B4 and B5 pay more attention to avoiding the political risks of executives by reducing safety risks, though they also obtain professional services through outsourcing. With a mixed ownership structure, B3 is between B1 and B2 and B4 and B5. Though it also pays attention to reducing safety risks, it has no especially high demand for avoiding political risks.

Figure 4.6

Distribution of purposes of sample enterprises choosing outsourcing



Note. Compiled on the basis of analysis of interview records

4.3 Analysis of influence mechanism of driving force

4.3.1 Relationship between professional services and cost reduction

Outsourcing companies can bring specialized personnel, technology and professional management to the owner company (Gilles, 2019). Outsourcing companies can create more profits through technological and management innovation while driving up the owner company's technical and management level. The relationship between outsourcing and technological and management innovation is mutually beneficial, as outsourcing promotes technological and management innovation, while technological and management innovation promotes the development of outsourcing (Modak et al., 2017; Scherrer-Rathje et al., 2014). The interviewees also pointed out that the outsourcing party has more professional technology, which helps to reduce costs and thus induces the owner to choose to

outsource, as A5 said: "We do not have so many professional personnel and technology, and for professional construction units, their sustainability is higher, and the costs are lower than if we operate on our own". A7 said: "Through outsourcing, technology has improved, efficiency has improved so that costs can be reduced". A8 said: "The outsourcing team has built a smart mine, which has played a great role in quality, production, efficiency, safety, environmental protection, etc., and has reduced costs. Our concentrate cost was more than six hundred per ton before, but through all these years of effort, now it is over four hundred per ton. Through the outsourcing party's porous granular emulsion blasting technology, the cost of explosives production has been reduced". A11 said: "The efficiency of the outsourcing party's equipment is more than 30% higher than ours. Their equipment is updated in time, and there is no problem of high failure rate due to old equipment". A14 said: "Our technical level does not reach the standard. If we organize blasting ourselves, the cost may be twenty yuan, but if we outsource to a professional team, their cost may be only two yuan". As the outsourcing party, A18, said: "Outsourcing helps the application of new technology, and the application of new technology leads to lower and lower costs. Outsourcing parties are more professional in maintenance and maintenance than the owner parties, which reduces operating costs".

Professional management also helps to reduce costs, as A11 said: "From the management point of view, after outsourcing, the management level and personnel are more concise, and the operation efficiency is high. There are obvious cost benefits, whether it is from the advantage of specialization or the innovation of the enterprise management model. Just looking at the data, the outsourcing cost has decreased in recent years, saving us tens of millions of dollars yearly". A12 said: "Outsourcing has achieved professional management. Now, we can manage it well, and the input is

getting less and less. If we manage it ourselves, we may not be able to manage it all in place". A15 said: "After outsourcing, the team's enthusiasm is higher and the cost is lower".

In conclusion, the above analysis shows that professional technology, professional management, light asset operation and flexible management can reduce maintenance costs, material costs, labour costs, procurement costs, and improve productivity and reduce financial pressure, thus reducing the overall costs of enterprises and further promoting mining enterprises to choose to outsource.

4.3.2 Professional service and avoidance of political risk

As a transitional country, China is in a special economic and social environment--influenced by factors such as insufficient investment in safety production (Tang & Guo, 2006), unclear property rights (Tan & Tang, 2006) and government-enterprise collusion (Nie & Jiang, 2011), mine disasters frequently hit mining enterprises, and there is generally a phenomenon of concealment and omissions (Yang et al., 2022). As a central-authoritarian state, administrative accountability is essential to state governance (Li & Wang, 2020a, 2020b). From the perspective of society, people from all walks of life are also calling for the active participation of stakeholders in the mining industry to solve safety production problems (Saleh & Cummings, 2011). The Chinese government has adopted a set of mine safety production index systems to cope with the grim safety production situation, the primary purpose of which is to shift the focus of local officials' evaluation from the growth model centred on GDP to the new thinking of achieving a balance between economic development and social stability in local governance. This index system is a prudent strategy to solve the responsibility defects in the previous safety production supervision system. To strengthen the central government's supervision of local safety management, China

has taken the following measures to regulate mining safety: first, by closing small mines and imposing stricter legal requirements on operating mines; second, by introducing new index and reporting systems to monitor mining safety; third, by introducing criminal penalties specifically for covering up accidents to punish inappropriate behaviour (Yang et al., 2022). Our interviews show that service outsourcing helps reduce safety production risks for owner enterprises. The first reason outsourcing helps reduce safety risks is that outsourcing parties have more professional personnel, as A2 said: "Blasting is a high-risk operation. For the owner, it's appropriate to hand this link over to a professional construction team". A13 said: "Outsourcing is beneficial for safety. Our outsourcers are blasting companies, which are more professional from a professional point of view, so it is better for safety to hand over professional work to professionals". A17 said: "After outsourcing, part of the safety pressure is shared by the outsourcing party. Their level is higher, the safety risk is reduced, the probability of safety accidents is smaller, and the pressure of safety accidents on the owner is reduced".

The second reason outsourcing helps reduce safety risks is that outsourcing parties have professional technology. As A12 said: "After outsourcing, some new technology was used, which was safer and more efficient".

The third reason why outsourcing helps reduce safety risks is that outsourcing parties have professional supervision and management, as A10 said: "There have been no problems in terms of safety between the owner and the outsourcing party because they are stricter than we require for safety, and their internal supervision is stringent".

Both owner-enterprises and outsourcing enterprises believe that service outsourcing can help reduce the safety risks of mining enterprises, so an essential purpose of service outsourcing is to minimise the safety risks of owners. As A5 said,

“After outsourcing, I reduced safety pressure”. A6 said, “The safety input of the outsourcing team went up correspondingly, which must be beneficial to the overall safety of production”. A8 said, “We need to outsource, which is for safety. People's safety and environmental inspection, the outsourcing party is helping us with the work”. A9 said, “After outsourcing, there were no major accidents”. A16 said, “After outsourcing, there was increased strength and less safety pressure. With double assurance from the owner and outsourcing party, safety was strengthened”.

The above analysis indicates that professional services from outsourcing providers, including professional personnel, technology, and management, can help reduce safety risks and determine the choice of service outsourcing for mining enterprises. In addition, service outsourcing can also help transfer safety production risks of mining enterprises and, to some extent, avoid the political risks of senior executives of mining enterprises, thus resulting in the choice of service outsourcing by mining enterprises.

4.3.3 Integrated model for drivers for outsourcing

Outsourcing has become an integral part of the strategic decisions made by global companies to reduce costs and improve productivity and quality. After obtaining cost advantages, enterprises will find that outsourcing can also bring strategic benefits to enterprises, such as product quality improvement and market share expansion, significantly when the tactical transactional relationship between the two sides of the transaction is transformed into a strategic partnership relationship (Tate et al., 2009). This strategic partnership is partly based on the division of labour and specialization: Studies have shown that outsourcing can be supported by specialized technologies (Baatartogtokh et al., 2018; Lin et al., 2016). Based on previous studies, our case study is further developed. The results show that owners

can obtain professional personnel, technology, and management through outsourcing, thus inducing mining enterprises to outsource part of the production process. Moreover, owners may be more inclined to outsource if talent shortage problems and management disadvantages exist.

After outsourcing services, mining enterprises hand over part of their business units to the external market so that enterprises can reduce investment in machinery, technology, and other aspects. In this way, part or all of the fixed costs can be borne by external service providers, and enterprises only need to bear variable costs and part of fixed costs (Razzaquean & Chen, 1998; Kakabadse & Kakabadse, 2000; Kelleher, 1990; Kremic et al., 2006; Liu & Tyagi, 2017), so it does not have to undertake technological accumulation in corresponding production links. Then outsourcing can make enterprises make full use of external service providers such as fixed assets specificity of assets, do not need to maintain infrastructure, internal search only needs to pay a certain cost and negotiation cost, etc., so that we can to reduce the idle and waste of resources and better develop their own core business, optimize the structure of enterprise cost, and improve financial flexibility (Freytag et al., 2012; Tsay et al., 2018). Studies on outsourcing in the medical sector also showed that to cope with demand uncertainty and financial risks, and hospitals would change their original resource procurement methods to adopt outsourcing, equipment leasing and contract workers to improve cost structure flexibility (Holzhacker et al., 2015). The results of our case study indicate that mining companies choose to outsource services because of reduced maintenance costs, material costs, labour costs, procurement costs, increased productivity, reduced financial pressures, and reduced social responsibility. The case study also shows that the technical expertise, professional management, asset-light operation, and flexible management obtained from outsourcing are the

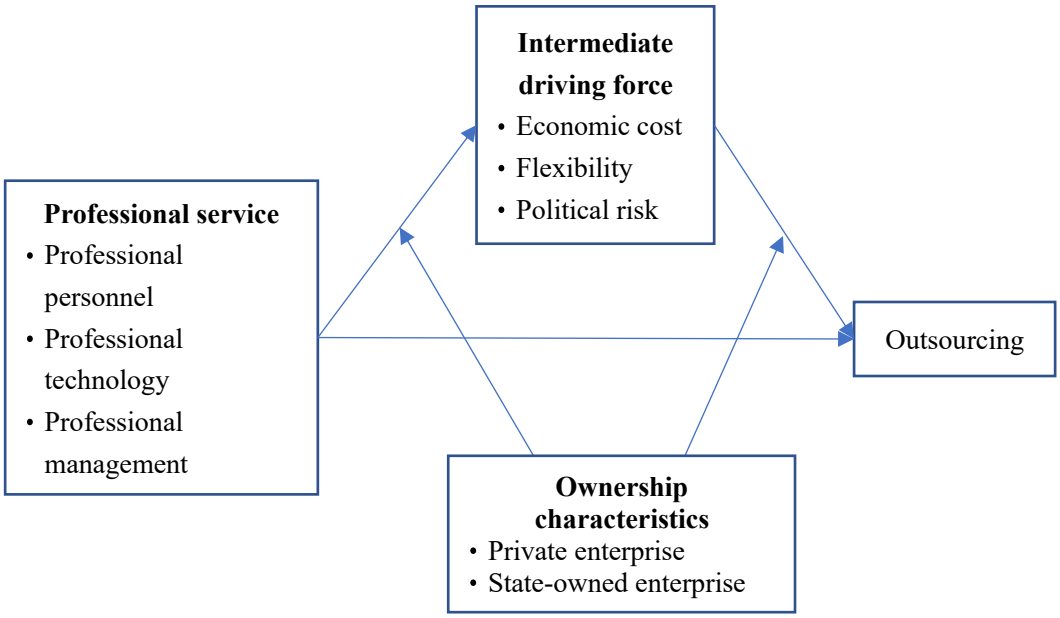
reasons for achieving the above cost-cutting effects. In other words, outsourcing is a way for enterprises to realize the combination of production and transaction costs as low as possible to achieve higher efficiency (Geyskens et al., 2006).

From the above analysis, specialization, technology, and economy are all essential driving forces for mining enterprises to choose to outsource. However, as described above, the factors influencing strategic decisions are diverse. In the transition period in China, the government has adopted an increasingly strict accountability mechanism for safety, and safety has been placed in the most important position for the promotion of corporate executives, especially the “one vote veto” system for the executives of state-owned enterprises. Local governments also attach great importance to the administrative accountability of mining safety accidents (Li & Wang, 2020a, 2020b). For mining executives, safety responsibilities carry a lot of political risks. From the motivation of political promotion, senior executives are incentivized to escape punishment (Xu & Yan, 2011). Studies also show a problem of concealment in official statistics of mining safety accident data (Yang et al., 2022). In this case, enterprises will choose outsourcing if outsourcing can help state-owned enterprises’ executives avoid political responsibility.

Our case study also shows that professional services brought by outsourcing providers, including professional personnel, technology, and management, can help reduce security risks. Outsourcing also transfers the safety risk to economic costs so that the executives can avoid the political risk. In this process, the ownership characteristics of enterprises modulate the effect of driving factors on the choice of outsourcing. The driving forces for obtaining professional services and reducing economic costs are vital for private enterprises. In contrast, state-owned enterprises' driving force for avoiding political risks is stronger. As a typical example, B1 does not

present any political risks associated with security production. As A1 stated, “Once any security production accident occurs, we always solve it by money, never by punishing people”. The results of the case analysis are intuitively shown in Figure 4.7.

Figure 4.7
Theoretical logic of outsourcing selection of mining enterprises



Note. Compiled on the basis of analysis of interview records

4.4 Summary

In this chapter, we have made an in-depth analysis of the sample enterprises with collected interview data and archived data and identified the factors that drive mining enterprises to choose outsourcing and their internal mechanisms. The research presented in this chapter shows that outsourcing helps obtain professional services, including professional personnel, technology, and management. Therefore, it is conducive to reducing costs and further drives mining enterprises to opt for outsourcing. Professional services also help reduce and transfer safety risks in

production and avoid political risks for executives. Private enterprises pay more attention to the effect of economic cost reduction brought by outsourcing, while state-owned enterprises pay more attention to avoiding political responsibilities. The research based on the archived data also shows heterogeneity characteristics in outsourcing performance depending on the ownership structure of mining enterprises.

5 Conclusions, applications, and deficiencies

5.1 Conclusions and discussion

5.1.1 Conclusions

Economic and social development has incorporated different industries into a large division of labour system, including the mining industry. In practice, service outsourcing has become an essential strategic tool for many mining enterprises to ensure corporate competitiveness (B. Baatartogtokh et al., 2018; Mella & Pellicelli, 2012). Existing literature has analyzed the theory of service outsourcing from the perspective of TCE, RBV and agency theory, and from external factors such as technology, economics, and market, as well as internal factors such as cost savings, focusing on core business and enhancing control power. As a strategic choice in China, service outsourcing is also accepted by more and more mining enterprises. The existing literature on service outsourcing in the mining industry mainly focuses on the mining industry in developed countries in the West. Based on China's unique institutional environment, this study collected interview data from six enterprises using a case study approach to develop a theory and an in-depth understanding of Chinese mining enterprises' driving forces and intrinsic mechanisms for choosing service outsourcing. This study found that:

Firstly, obtaining professional services, including personnel, technology, and management, and reducing the maintenance costs, material costs, labour costs, and procurement costs of the owner, as well as improving productivity and reducing financial pressure, have been widely distributed in the existing literature on service outsourcing (Ambos et al., 2021; Mukherjee et al., 2013; Munjal et al., 2019). This study, based on the Chinese context and using Chinese mining enterprises for

research, shows that the conclusions of previous research are still applicable to the mining industry in China. In addition, this study also indicates that for private enterprises, due to their limited capabilities, it is essential to obtain professional services from outside and reduce costs for economic benefits. Differently, state-owned enterprises generally have better personnel and technological reserves, so getting professional services is less important. The above findings show that under the special institutional environment of China, there is heterogeneity in the importance of professional services and cost reduction for enterprises with different ownership characteristics, which is an essential supplement to the existing literature.

Secondly, increasing flexibility through incentive mechanisms and fixed asset investment is an essential driver for state-owned mining enterprises to choose service outsourcing. Still, it is not so evident for private enterprises. Existing studies have indicated that increasing flexibility is an essential driver for firms to select service outsourcing (Freytag et al., 2012; Rothaermel et al., 2006; Tsay et al., 2018) and discussed the problem of rigidity in the management mechanism of Chinese state-owned enterprises (Li et al., 2014; K. J. Lin et al., 2020; Stan et al., 2014), but they did not recognize that service outsourcing may be an essential means for Chinese state-owned enterprises to get rid of inefficiency, which this research has supplemented.

Thirdly, the specialized services brought by service outsourcing help reduce safety risks. Mine safety production is a serious problem facing China and a global issue (Nie & Jiang, 2011). For a long time, China has greatly reduced the number of personnel casualties caused by mine safety production problems (Nie Huihua et al., 2020) through various efforts. This research has also shown that under the strict safety production supervision of the Chinese government, improving safety production level

has become one of the critical drivers for many mining enterprises to choose service outsourcing. As a remarkable finding, this research has shown that for state-owned enterprises, executives are not only enterprise managers but also government officials. If a safety production accident occurs, the executives of state-owned mining enterprises have to bear political responsibility, which adversely affects their political prospects. Under the influence of the principal-agent problem, state-owned mining enterprises outsource some dangerous production links to transfer safety production risks and avoid political risks. Existing studies on service outsourcing mainly come from mature developed country markets, focusing on technology, flexibility and cost. This research takes the mining industry in China's transition period as the research object, providing us with an example of the inefficiency of state-owned enterprises. Classic studies have shown that the efficiency of state-owned enterprises is lower than that of private enterprises (J. Y. Lin et al., 1998; Mueller, 2003; A. R. Vining & Boardman, 1992). This research shows that service outsourcing to increase economic benefits has become a tool for executives of state-owned enterprises to avoid political responsibility. Therefore, this research also helps us understand the inner logic of the behaviour of Chinese state-owned enterprises and supplements the literature on the reform of state-owned enterprises.

5.1.2 Discussion

As economic and social development progresses, safety production has become an extreme concern to society, so attaching importance to safety production is one aspect of fulfilling social responsibility. The fulfilment of social responsibility has been incorporated into enterprise strategic management (Cornelius et al., 2008; Meznar et al., 1990). For mining enterprises, safety production issues are not only limited to responding to regulation but also related to whether to pay attention to the

long-term interests of the enterprises. Our research results indicate that compared with state-owned enterprises, private enterprises are more concerned about short-term technological and cost benefits while neglecting the importance of safety production. For this issue, existing literature discussions are relatively few. However, for the increasingly mature economic entity of China, the practices of private mining enterprises need to adapt to the changes in the overall policy environment and increase their attention to long-term interests such as safety production.

Our research results show that under the special institutional background of China, the driving force of mining enterprises to choose service outsourcing has heterogeneous characteristics in terms of ownership. Private enterprises are more concerned about the effects of reducing economic costs brought by service outsourcing, while state-owned enterprises are more concerned about avoiding political responsibility. The reason why mining enterprises choose service outsourcing may be technology and economy. Still, it may also be a channel for mining executives to transfer the political risks that individuals should have borne – safety production responsibility includes management responsibility and production responsibility. Therefore, if the process prone to safety production accidents is outsourced, the outsourcing enterprise bears the production responsibility, and the mining enterprise only needs to bear the management responsibility. Thus, the political responsibility of the mining executives will be greatly reduced. In practice, the main body of service outsourcing for mining enterprises is private enterprises, and entrepreneurs or executives do not have political risk problems (Wang & Lu, 2015) or even evade criminal responsibility through legal agency. This means that for state-owned mining enterprises, service outsourcing not only brings economic benefits to enterprises by reducing costs and improving labour productivity but also transfers the political risks

of executives. Of course, service outsourcing itself requires costs, so service outsourcing is still a "revolving door" for executives of state-owned enterprises to transfer their political risks into the economic costs of enterprises. This means that in the transition period of China, the benefit conversion mechanism behind service outsourcing of mining enterprises is complicated, which includes the conversion of management costs to be borne by enterprises into market costs, as well as the transfer of political risks to be borne by executives to economic costs of outsourcing enterprises.

Furthermore, from the perspective of transaction cost economics, the key for an enterprise to choose self-operation or outsourcing lies in whether the cost of choosing an authoritative mechanism is higher or the cost of selecting a price mechanism is higher (Coase, 1995). From the perspective of the division of labour, the reason an enterprise chooses to outsource is the comparison of transaction costs between the internal and external divisions of labour (Yang & Borland, 1991; Yang & Ng, 1995). Existing studies on TCE merely propose the issue of cost comparison. Nevertheless, as shown by the results of this study, if the mining enterprise itself undertakes certain production links, the executive personnel of the enterprise will bear the high cost incurred by the political responsibility. However, after outsourcing, the mining enterprise and the outsourced service enterprise only need to bear economic costs. Therefore, between internalization and externalization, there is the issue of high or low transaction costs and the transformation of different types of costs. Hence, this study supplements the literature related to transaction cost theory, which helps us understand the cost transformation mechanism between different ways of production by organizations.

We must also recognize that the above theoretical findings were derived under

China's unique institutional environment. As a socialist country undergoing transition, China's legal system often cannot guarantee the smooth operation of economic activities, presenting a pattern where "politics determine economics" (Naseemullah, 2023; Wang & Lo, 2022). Under such circumstances, Chinese government agencies often intervene in market transactions and business operations for political interests, inevitably affecting enterprises' outsourcing decisions. From the perspective of enterprises, executives in state-owned enterprises, as "officials" within companies, also make decisions that defy economic laws due to political considerations. This study's findings have highlighted the issue of state-owned enterprise executives transferring political responsibilities to service outsourcing companies. However, we should still acknowledge that the mechanisms influencing the outsourcing decisions of state-owned enterprises are complex. For example, resolving employment is an essential function of Chinese state-owned enterprises (Hsu & Fan, 2022), indicating that employing more workers holds significant political significance for these executives. Outsourcing, which implies divestment or even dismissal of some employees, can generate unfavourable political repercussions and possibly lead to a decline in the status of these executives. Therefore, these executives may be more cautious in making outsourcing decisions. This illustrates that, against the backdrop of this unique institutional environment, it is necessary to further expand upon this study to gain a deeper understanding of outsourcing decisions made by Chinese enterprises.

5.2 Policy implications

5.2.1 Implications for policymaking

For a long time, outsourcing services have been considered an essential cause of safety production accidents in mining enterprises. In reality, some unqualified units or

individuals borrow the qualifications of other construction units to undertake coal mine construction projects. Some qualified construction units borrow each other's qualifications to undertake construction projects, resulting in many serious safety accidents due to the weak safety awareness and unstandardized production operations of outsourcing companies, such as the chaos of project outsourcing management and the lack of implementation of the primary responsibility of safety production by the involved enterprises in the Qixia Mine disaster. Therefore, outsourcing services have always been a strictly regulated field. After the Qixia Mine disaster, the National Mine Safety Supervision Bureau of China issued Several Regulations on Strengthening the Safety Management of Underground Metal and Non-metal Mines Outsourcing Projects, requiring that no more than two large and medium-sized mines and one small-scale mine shall be permitted to undertake the mining and excavation projects. The subcontracting of mining projects shall be strictly prohibited. Metal and non-metal underground mines are encouraged to establish their mining construction teams and gradually cancel the external subcontracting of mining projects. However, our research shows that outsourcing services can not only help to improve the productivity and economic efficiency of enterprises but also help to reduce safety production risks. Therefore, it is not advisable to require mining enterprises not to outsource, which is a lazy government of prohibition and substitution. For regulatory authorities, it may be more valuable to strengthen the regulation of the industry in a targeted manner according to the particularity of outsourcing services.

Of course, our research also shows that outsourcing services are channels for mining executives to avoid political responsibility due to safety production responsibility, that is, political risk transfer. This practice contradicts the national safety production supervision policy and leads to the loss of state-owned assets.

Regulatory authorities may be able to define the responsibility allocation between the owner and the outsourcing party.

In addition, regarding the inefficiency of Chinese state-owned enterprises, existing research has suggested the introduction of non-state-owned capital for restructuring, that is to say, what is commonly referred to as privatization or mixed ownership reform (Wu & Zhang, 2014). Privatization can improve the performance of state-owned enterprises mainly due to the entrance of non-state-owned capital, which changes the operational objectives of state-owned enterprises and thus changes the behaviour of enterprises. Taking state-owned mining enterprises as an example, they pursue both profit and political objectives. As our analysis has pointed out, the multiple objectives may likely generate contradictions; therefore, privatization transforms the multiple objectives of state-owned enterprises into a single objective of economic efficiency and profit, changing the response to both administrative signals and price signals to only responding to price signals, thus improving the performance of enterprises. Our study also shows that B3 is more profit-oriented as a mixed-ownership enterprise. Therefore, in our view, to improve the performance of state-owned enterprises, we must vigorously promote the reform of mixed ownership of state-owned enterprises.

It is worth noting that the ultimate goal of state-owned enterprise reform is to improve productivity. Currently, China's state-owned enterprise reform focuses on the mix of ownership, hoping to improve the behavior of state-owned enterprises by introducing private capital. However, our research shows that the same goal of improving productivity can also be achieved by outsourcing part of the production process. Service outsourcing means that the enterprise transfers part of the operating rights to the service outsourcing provider, that is to say, realizing the mix of operating

rights. Therefore, this research implies that another way outside of mixed ownership can also be found to enhance the productivity of state-owned enterprises, namely, the mix of operating systems.

5.2.2 Implications for business operators

This research suggests that outsourcing services could be beneficial to mining enterprises in terms of obtaining professional technology, management and personnel, thus reducing economic costs. Therefore, outsourcing part of the production processes to service providers is of great economic value for mining enterprises. More importantly, this study provides a series of operational strategies to meet the needs of mining outsourcing companies.

First, efficiency can be improved through technological innovation. Technological innovation is a crucial way to improve the production efficiency of mining enterprises. Mining outsourcing companies should recognize the importance of technological innovation and make it the core of their business development. They should take active measures to promote technological innovation, strengthen technological transformation, and push the progress of technological innovation to enhance the production efficiency of mining enterprises. This includes using suitable technical equipment and new production methods, such as adopting equipment of appropriate scale according to the actual conditions of the mine, reconstructing the transportation route, optimizing the mining program to shorten the construction period, optimizing ore grade and ore block partitioning, etc.

Second, the flexibility of services can be improved by improving the incentive mechanism. Outsourcing can make up for the rigidity of the incentive mechanism of state-owned enterprises. Therefore, mining outsourcing companies should attach importance to the flexibility of the incentive mechanism and design a flexible

incentive mechanism to improve the production efficiency of mining enterprises. One is to continue to carry forward the financial incentive mode for project managers, to mobilize the enthusiasm of project managers through a dividend system; two is to implement a scientific assessment mechanism, to establish a reasonable performance assessment system, to give a scientific assessment and incentive; three is to pay attention to the construction of corporate culture, to create an excellent corporate culture atmosphere, to make employees more active and efficient; four is to organize regular training, to let employees continuously enhance their skills, to update their knowledge, to improve production efficiency constantly; five is to improve the incentive mechanism of technology, to allow employees actively participate in technological innovation, to give reasonable technical incentive to scientific and technological personnel, so that they are motivated to promote technological innovation and to improve production efficiency.

5.3 Deficiencies

There are still some deficiencies in this study. Firstly, Due to the impact of COVID-19, some companies that planned to interview failed to go, which affected the quality of this study to a certain extent. Secondly, There are numerous factors influencing outsourcing decisions. Further research is warranted to incorporate elements, such as contract duration, which this study has not considered. Thirdly, This study is qualitative, and a large sample of data needs to be collected in the future to test the theory developed in this study empirically. The shortcomings of the above two aspects will be the direction of my further improvement in the future.

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Appendix: Outline of entrepreneur interview questionnaire

(1) which production links of your company are outsourced

(2) What is your company's consideration (driving force) for outsourcing these production links?

1) Safety: administrative supervision, legal provisions

2) Cost

3) Technology

4) Others

(3) Which of the following factors driving outsourcing is the most important

1) security

2) Cost cutting

3) Technical constraints

4) other

(4) What impact does the liability traceability of work safety accidents bring you?

1) Promotion

2) Salary

3) Criminal responsibility

4) Political responsibility

5) Financial responsibility

(5) The impact of service outsourcing on identifying liability for work safety accidents? How does this influence outsourcing decisions?

(6) What do you think about China's safety responsibility supervision system needs improvement?