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The Development and Innovation Research of Chinese SMEs in Post-COVID Era

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Abstract

This thesis examines the innovation capabilities of Chinese small and medium-sized enterprises (SMEs) in the post-COVID era. It specifically explores the relationship between research and development (R&D) investment, innovation performance, government policies, firm size, established time of the firms, external environment, and risk aversion. The study employs a systematic questionnaire that collects data from different SMEs to examine their innovation performance, specifically in terms of R&D spending and the influence of external factors such as government regulations. The results indicate that although financial resources are essential for promoting innovation, a strong aversion to risk greatly hinders R&D operations. The research emphasizes the need for customized government interventions to reduce financial burdens and promote innovative practices among SMEs. In addition, the study acknowledges the constraints of a limited number of participants and proposes that future investigations should embrace a wider array of sectors to strengthen the credibility of the findings. In summary, this study enhances our comprehension of the mechanisms behind innovation in SMEs in China. It also provides valuable perspectives for policymakers who seek to facilitate the sector's revival and expansion in the post-pandemic era.

Klíčová slova: MSP, COVID-19, Rozvoj, Inovace a růst.

Keywords: SMEs, COVID-19, Development, Innovation, Research and Development.

Declaration of Authorship

Prague 29.07.2024   Yuexin Pan

Acknowledgments

Contents

Introduction

The outbreak of COVID-19 in Wuhan in early 2020 was a significant public health and safety crisis, characterized by its rapid global transmission, extensive spread, and the complexity of prevention and control measures. This outbreak posed unprecedented challenges since the establishment of China. As a result, numerous factories and enterprises were unable to resume operations, leading to disruptions in the supply chain and, unfortunately, the closure, suspension, or even bankruptcy of many small and medium-sized enterprises (SMEs). SMEs play a crucial role in the modern national economy, and their significance is evident in both developed and developing countries. They form a substantial socio-economic foundation, and their sheer number is dominant within the business landscape. However, the impact of the pandemic exposed the vulnerability of SMEs, as they faced difficulties in adapting to the rapidly changing circumstances and overcoming operational obstacles. Covid pandemic has been most probably the greatest exogenous shock to the Chinese economy since 1990. According to the Director of the SMEs Bureau of the Ministry of Industry and Information Technology of the People's Republic of China, as mentioned in a press conference, by the end of 2021, the total number of SMEs in China reached 48 million, a growth of 2.7 times compared to the end of 2012. During the year 2021, an average of 24,800 new enterprises were established daily in China, which is 3.6 times the number in 2012. The average operating income profitability ratio for SMEs in the industrial sector with above-scale operations was 6.2%, an increase of 0.9 percentage points compared to the end of 2012, indicating continuous improvement in their development quality and efficiency. A plethora of new technologies, industries, business models, and modes originate from SMEs. According to the findings of the Fourth China Economic Census, SMEs account for 99.8% of all legal entities among scaled enterprises, and they contribute to 79.4% of total employment in the business sector. SMEs are rapidly growing and expanding, representing the largest and most dynamic group of enterprises, making them the driving force behind China's economic and social development. SMEs have contributed more than 50% of tax revenue, 60% of GDP, 70% of technological innovation, 80% of urban employment, and 99% of the number of enterprises, representing an important force in expanding employment, improving the livelihood of the population, and promoting entrepreneurship and innovation. However, due to their limited scale, SMEs typically encounter various

challenges. These include limited access to financing, financial constraints leading to tight capital, resulting in a lack of development momentum. Additionally, relatively lower product quality and high-tech content which makes them comparatively weaker in terms of market competition and influence. Moreover, these enterprises have relatively weak capabilities in collecting and organizing market data and information. As a result, they are unable to timely identify changes in the current economic situation, financial environment, and industrial landscape, which further undermines their ability to withstand risks. Furthermore, due to the unique level of bureaucracy in China, small and medium-sized enterprises face multiple institutional barriers to innovation. Institutional deficiencies result in a lack of innovation capacity for these enterprises. Consequently, their entire lifecycle is relatively short, and a significant number of small and medium-sized enterprises are forced to close each year.

In a typical business environment, SMEs encounter challenges in accessing financial resources. However, during an epidemic crisis, they become even more susceptible to economic shocks due to their increased risk of financial vulnerability and limited financial reserves. According to data from the Ministry of Industry and Information Technology, as of March 6, 2020, the resumption rate [1] of large-scale industrial enterprises in most industrial provinces across the country has exceeded 90%, while the resumption rate of small and medium-sized enterprises is only 52%. In terms of the expenditure structure of enterprises, the surveyed companies indicated that employee salaries, the Five Insurance and one Fund [2], rent, and loan repayments are the main sources of cash flow pressure for businesses. Hence, SMEs expected that the government could offer support in terms of working capital to prevent cash flow disruptions. Additionally, they also desired government policies for tax relief, which would assist in reducing costs for enterprises. As a result, the central and local governments swiftly and intensively implemented a series of policies to alleviate the difficulties faced by SMEs and provide timely assistance to the real economy. However, the short-term effectiveness of these policies often diverged significantly from the demands of the enterprises. The rates of tax reduction, fee waivers, preferential credit access, and cash flow relief were relatively low,

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[1] The ratio of the number of enterprises that have resumed operations to the total number of enterprises at a specific point in time. It can to evaluate the ability of businesses to withstand and recover from external disruptions such as epidemics and economic crises.

[2] China's "Five Insurances and One Fund" is a comprehensive social security framework designed to provide extensive coverage for employees. This system, mandated by the Chinese government, includes five types of insurance and a housing fund.

leading to obstacles in the resumption of work and posing challenges for businesses. According to incomplete statistics, within the short period of 26 days between January 20th and February 14th of 2020, governments at all levels issued a total of 212 emergency relief policies and promptly responded to companies' requests for assistance.

Last but not least, Western observers of the Chinese exceptionally fast long-term development concentrate too much on the performance of large corporations such as Tencent, Alibaba, BYD, Xiaomi or Baidu, claiming that it is these industry giants which play a crucial role in shaping the Chinese global development. It is somehow lost from their radar that Chinese economy is also driven by the fast development of small and medium-sized entrepreneurial firms, many of which have growth rates higher than the giants.

1. Literature Review

COVID-19 was an unpredictable catastrophe that devastated societies and economies worldwide (Giones et al., 2020, Clark et al., 2020). During economic recessions, small firms typically shrink earlier and more severely than large firms (Davis et al., 1996). Bartik's survey of 5800 small businesses in the USA found that 43% of businesses were temporarily closed during the pandemic, which showed that Covid-19 caused severe impacts on small and medium-sized enterprises (SMEs) (Bartik et al., 2020). Similar findings were obtained by Fairlie, who conducted the first analysis of the impacts of the pandemic using nationally representative statistics and pointed out that small business activity declined sharply in the early stages (Fairlie, 2020). SMEs are highly vulnerable when facing these crises (Shepherd, 2003; Kraus et al., 2013). Many governments around the globe imposed quarantine regulations to effectively prevent the spread of the virus and safeguard public health. Simultaneously reducing the damage caused by the virus, the restrictions led to the temporary suspension of millions of SMEs (Brown and Rocha, 2020). Hence, the survival of SMEs is crucial for post-pandemic recovery, as they account for two-thirds of global employment and contribute to half of the global GDP (Albaz et al., 2020).

In response, Government assistance can alleviate the economic difficulties of SMEs and play a positive role in their development (Bartik et al., 2020). In Razumovskaia's research (Razumovskaia et al., 2020), the effectiveness of government support measures was empirically evaluated, indicating that the assistance provided by the Russian

government effectively supported SMEs. Moreover, if more comprehensive measures were implemented, the adverse effects of COVID-19 could be mitigated. To encourage innovation among SMEs, the Chinese government has promulgated the R&D tax credit policy. This policy allows a tax deduction of 150% of the actual income for eligible R&D activities (Zhu et al., 2011). Doh and Kim(2014) found in their study that government financial support significantly promotes technological innovation among regional SMEs in South Korea. Additionally, Foreman-Peck(2013) claims that government support influences innovation among SMEs, which in turn influences their performance. In other words, evaluating the indirect impact hypothesis indicates that government support affects SME performance by fostering innovation. Conversely, if SMEs lack innovation, their profits may be lower, and they could face the risk of bankruptcy under certain external circumstances. Feranita, Nugraha, and Sukoco(2019) explored West Java, Indonesia's SME manufacturing sector. The conclusion reached was that innovation has a positive effect on business performance. According to the research framework, innovation can explain fluctuations in business performance. If left unfettered, low innovation and poor business performance will impede the growth of SMEs (Feranita et al., 2019). A sample collected of 284 SMEs from the subsectors of food and beverages, textiles and clothing, and wood was concluded that innovative SMEs tend to perform better than non-innovative SMEs after controlling for firm characteristics. Therefore, policymakers should formulate policies to support SMEs in their innovation activities so as to improve firm performance and competitiveness (Le et al., 2023).

Faced with the long-term impact of the pandemic, many SMEs are focusing their survival strategies on the innovation domain (Danilin, 2020). In a world characterized by recurring crises, innovation has become essential for all modern businesses that wish to survive (Adam & Alarifi, 2021). To thrive in a turbulent and uncertain market environment, SMEs must shift their focus and priorities toward innovation and embrace new initiatives. This means making essential and innovative changes to adapt to the evolving business landscape (Le Nguyen & Kock, 2011). Rothwell and Smith's research have shown that many SMEs participate in innovation activities across various industries, which could be a key factor in their success. These research findings also confirm that SMEs generally possess innovative capabilities (Rothwell, 1991; Smith, 1991). Using integrated methodology, Caballero demonstrated that innovation is the primary resource that aids business recovery during the pandemic (Caballero, 2021). According to Van Auken's multivariate regression analysis on 185 small and medium-sized enterprises in

Ardakan, Iran, the results show that during the COVID-19 crisis, adopting innovation as a core organizational value helps SMEs maintain competitiveness (Van Auken et al,. 2021).

Innovation indeed comes in various forms, and among them, research and development (R&D) investment plays a crucial role in promoting enterprise innovation. Innovation depends on the efforts and investments made in research and development activities (Bertrand, 2009),   higher levels of commitment to research and development can indeed foster more innovation (Van Auken et al,. 2021). Innovation is an important indicator of increased productivity in SMEs. Investment in R&D increases firms' productivity levels, and increased productivity in turn helps firms to invest more in R&D, further stimulating innovation (Xu, 2009). Creating a virtuous circle of innovation. However, according to OECD research, while R&D is part of innovation, emphasizing R&D inputs alone is insufficient to generate innovation (OECD, 2010). There is a shift from the "Managed Economy" which focus on R&D, to the "Entrepreneurial Economy" in which, entrepreneurship is one of the foundations of innovation (Thurik, 2009; Audretsch and Thurik, 2004; OECD, 2010). Hence, both R&D and non-R&D types of innovation are necessary if economic growth outcomes will be obtained. The authors use the Barcelona Summit of the European Union as an example of an objective that emphasizes increasing the proportion of investment in research and development while ignoring the central role of the practical application and utilization of research in economic growth and well-being. New forms of action to support entrepreneurship and SMEs should be considered more broadly. Policymakers must acknowledge the entire process of R&D investment and innovation, including the dissemination and application of research, as well as the importance of the non-technology economy. This suggests that government policies should place a greater emphasis on promoting the innovative capabilities of firms and knowledge transfer in order to facilitate the entire innovation process. To facilitate the recovery of economic growth, policymakers must adjust to the new realities and diversify their measures to support entrepreneurship, SME innovation and development (OECD 2010).

1.1 The connection between Entrepreneurial spirit and Innovation

Joseph Schumpeter is known for his theory of innovation and entrepreneurship, two pathbreaking, contributions to the assessment of economic performance. His emphasis on innovation as the main driver of economic development has profoundly

impacted economics and the study of innovation. Schumpeter defined innovation as the introduction of new products, new methods of production, new markets, and new forms of organization, a new production method that opens up new markets and the reorganization of industry. According to his work, innovators, or those with inventive ideas and an entrepreneurial spirit, were the driving force behind innovation. Therefore, entrepreneurs play a crucial role in economic development. Through their innovative and entrepreneurial endeavors, they introduced new products, services, production methods, and business models, disrupted existing economic structures and practices, and facilitated the reconfiguration of resources and the transformation of the economy, thereby fostering economic change and progress.

Innovation, according to Schumpeter, initiates phases of economic development. This process is described as an "innovation storm" in which innovative trends arise and stimulate economic growth and development by disrupting existing economic structures and equilibriums. Entrepreneurs play a crucial role in this innovation tempest. They are the engine of innovation, fueling the evolution of the economy by continuously introducing new ideas and methods. Entrepreneurs' risk-taking and decision-making abilities enable them to triumph in a competitive market, thereby contributing to the expansion of the entire economy.

Schumpeter's deliberations were later expanded by Drucker(2014), who defined innovation as a specific entrepreneurial tool, an activity that opens new ways of creating wealth from resources. In contrast, Kirzner views entrepreneurs as discoverers who are able to be quick and astute enough to search out and capitalize on undiscovered profit opportunities in the market. Kirzner views entrepreneurs as market adjusters, not market disruptors (Kirzner, 1973).

Schumpeterian growth models imply that R&D investment is counter-cyclical in the business cycle, in that it may increase during economic downturns and recessions and decrease during economic expansions. The reason for this is that research and development increases in the presence of underutilized resources created by the fall in factor prices caused by the economic crisis, as these idle resources provide opportunities for innovation and the cost of investment in development is reduced, and these innovations assist the firm's economic recovery (Schumpeter, 1934). By contrast, the procyclicality of R&D and innovation were proven by (Campello et al. 2010), who conducted a survey of 39 countries' senior managers on their efficacy under financial constraints. The results showed that a high proportion of small businesses were influenced,

indicating that procyclical R&D and innovation during the GFC crisis were due to the credit constraints that existed at the time. The same result was proved in Aghion's study that during a recession if firms have limited financing capacity, it leads to an increase in R&D investment in the procyclicality as innovation. (Aghion et al. 2012)

Audretsch et al. (2023) also emphasized the importance of innovation on SMEs growth and competitiveness, where innovation is one of the vital ways to help enterprises to gain a market advantage. Moreover, he especially focused on the importance of collaboration strategies. The resources for SMEs remain limited (De Massiset et al., 2017; Audretsch et al., 2023), which also limits investment in internal knowledge, leaving localized and international collaboration with a variety of external partners an attractive source of innovation. Hence, through the collaboration network, SMEs could share resources and knowledge. Even though extracting value from external knowledge collaborations for SMEs is challenging because they have limited absorptive capacity and generally operate in narrow domains in the sense of distribution, research, target markets, or technologies, it can also compensate for the limited resources of SMEs and enhance their innovation capacity. The literature on open innovation in SMEs has investigated the connections between the size of a firm and its ability to innovate as well as the sources of knowledge for innovation and growth (Kraus et al., 2021; Audretsch et al., 2023). Firms of different sizes have diverse experience, skills, technologies, and innovative capabilities (Ribeiro-Soriano, 2017; Audretsch et al., 2023) to search and absorb external knowledge (Nieto & Santamaria, 2007; Audretsch et al., 2023).

He studied those external factors such as the types of collaborators and geographical proximity predict innovation performance in SMEs, and different type of partners such as national government, suppliers, or customers impact differently on SMEs, including market demands, size of population, and access to finance, etc. Besides, in-house R&D intensity also reflects a firm's investment in and ability to innovate, thus affecting innovation performance.

2. Methodology

This study attempts to explore the factors affecting the innovation capabilities of small and medium-sized enterprises in the context of China. Based on this research goal, the research method will be explained in this chapter. It should be emphasized that the purpose of this study is not to establish theoretical verification and conclusions, but to

answer specific research questions. The subsequent sections primarily focus on the methodologies implemented in this study and provide an in-depth outline of the entire research design. This embodies our approach towards conducting research, formulating hypotheses, strategic planning of the research process, techniques of data collection, methods of choosing the sample size, different approaches to data analysis, potential limitations, and ethical aspects to consider. In order that the data obtained through the questionnaire can be used for further statistical analysis, this study will be coded. The coding method of specific variables will be explained in detail below.

2.1. Research Philosophy

The following method has been applied in solving the above objectives:
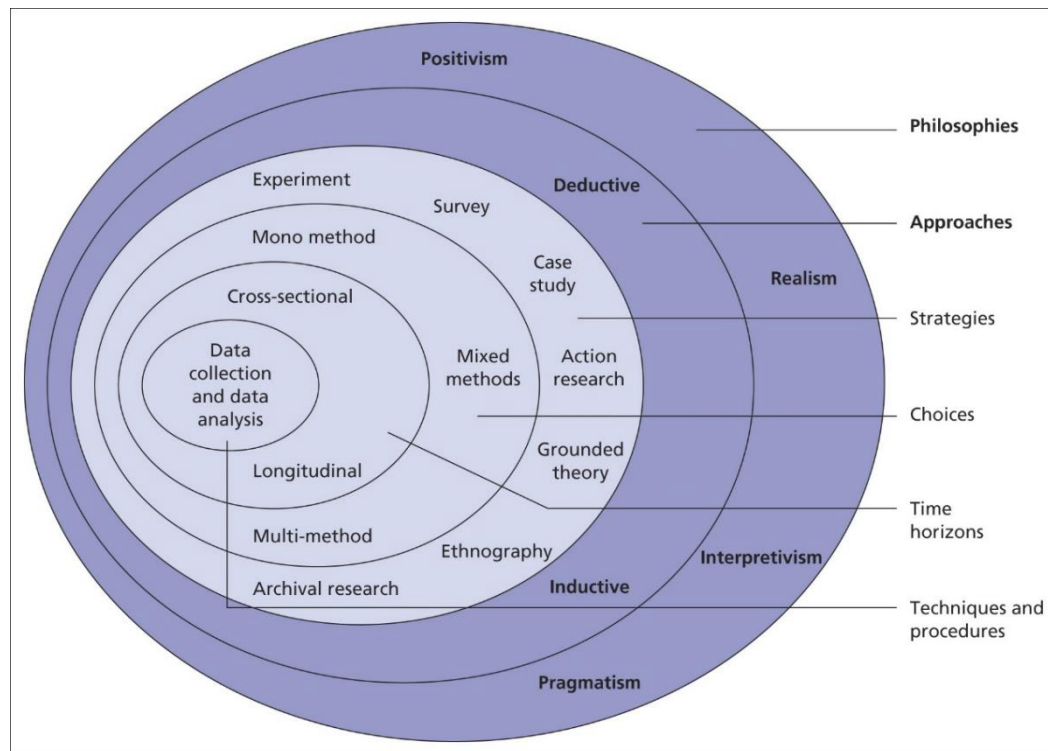
Source: Research Onion (Saunders, Lewis, & Thornhill, 2007)

https://projekter.aau.dk/projekter/files/253621160/Thesis.pdf

Figure 1: Research onion graph

The structure of this study is depicted in the above onion diagram. Regarding the research philosophy, the study is grounded in Pragmatism: the subjective perceptions of the respondents partially influence the study outcomes, while objective statistical facts also contribute significantly to the data sources. Pragmatism advocates the rational use of

both world interpretations and empirical studies, incorporating diverse methods of validation (Clarke & Visser, 2018). Based on this onion diagram, researchers can determine the choice of methods for each layer in conjunction with the research objectives. For example, in the selection of time horizons, this study uses Cross-sectional data. Specific elaborations are shown below.

Furthermore, this study should be classified as an exploratory study: it attempts to analyze how SMEs' innovative capabilities are influenced and determined in a Chinese context. This research is not aimed at establishing theoretical validation and conclusions, rather it is designed to address specific research questions.

2.2. Hypothesis Development

Next, it was necessary to justify several hypotheses based on a literature review provided by deductive reasoning: investigating these hypotheses was an important part of this study.

The progression of corporate innovation performance is significantly fueled by research and development (R&D). This comprises the formulation of novel products and services, refining business operations, and pioneering new technologies. The impact of R&D spending on innovation performance has been consistently validated in previous studies, demonstrating a positive correlation (Fu et.al, 2018). For instance, Seenaiah and Rath (2018) suggest that companies that invest heavily in R&D are better positioned to enhance their existing products or create new ones. Not only that, but they also have more ability and resources to improve the production process, thereby reducing the overall cost and improving efficiency and quality. In addition, Yiu et.al (2019) emphasized the positive effect of R&D investment on the technical capabilities and knowledge management of enterprises. Based on the investment in R&D activities, employees and middle managers in enterprises can learn new technologies, acquire new knowledge, and improve their ability to solve problems. In support of these assertions, Artz et.al (2010) conducted a quantitative analysis on a sample of 272 companies in 35 industries over the past 19 years to study the relationship between companies' investment in R&D and their innovation outcomes. The study considered two innovation outcomes simultaneously: invention and innovation, the development of a product or service through an idea.

The study shows that investment in R&D does lead to more innovation and further improves firm performance as patents provide protection for new products. Also, Zhu et.al (2019) offers some counterarguments; the study seems to show that the relationship

between R&D investment and innovation performance is not linear. Depending on a range of factors, additional investment does not necessarily improve innovation performance. Factors such as market conditions, R&D quality, firm size, and industry also play a crucial role in determining the effectiveness of R&D investments (Aghion, Bloom, Blundell, Griffith, and Howitt, 2005). Based on the above findings, the following hypothesis was developed:

Hypothesis 1: There is a positive correlation between R&D investment and innovation performance.

It is generally accepted that government incentives and policies have the potential to enhance firms' innovation performance. As an evidence, Jiang et al. (2022) studied the impact of digital finance on the innovation performance of companies listed on China's SME Board and ChiNext Board from 2011 to 2018. Their findings suggest that government subsidies do affect the innovation performance of these firms. Make a positive contribution. Chundakkadan and Sasidharan (2023) emphasized the positive value of government subsidies for relaxing corporate budgets based on the background of the epidemic, and therefore believed that this may promote corporate innovation activities. Xu (2022) conducts a sample of geothermal, wind, and solar companies to investigate whether the above initiatives can enhance firm innovation and evaluates its mechanism.

The findings indicate that government subsidies act as a direct boost to the innovative performance of renewable energy firms, with research and development (R&D) investment serving as an intermediary factor. In a contrasting study, Zhu et.al (2019) examined five years of data related to innovation in China. Through multiple regression analysis, they discovered that both government subsidies and main investment can enhance performance. However, they also found that government subsidies may crowd out innovation investment. Absorptive capacity exerts a positive influence on the connection between R&D and innovation performance, but government investment impacts this relationship negatively.

This view, however, is contradicted by Hall et.al (2014). developed empirical evidence on secondary data at the European firm level: there is a positive relationship between financing constraints and R&D investment. Further, given that the financial crisis has led to problems in accessing credit on which innovation activities depend, the study suggests providing more flexible financing instruments to facilitate firms' investment in R&D activities. Based on these results, it's plausible to infer that government support measures/subsidies could stimulate corporate research and

development (R&D) investment. Additionally, a favorable correlation between R&D investment and innovation performance appears to be evident. This leads to the formation of the following two hypotheses:

Hypothesis 2: Government aid policies/subsidies have a positive impact on corporate R&D investment.

Next, a series of researchers focused on the relationship between firm size and innovation performance. Although most researchers agree that the increased internal communication costs brought about by larger organizations hinder innovation, there is no consensus among researchers. The general view is that corporate decision-making processes and innovation processes are influenced by internal bargaining as well as goals and aspirations that guide corporate behavior: for SMEs, internal coordination and communication costs are low, resulting in a high proportion of innovation investment. This notion is supported by Stock et al. (2002) it shows that under conditions of high level of competition, firms are more motivated to innovate. However, based on the judgment that large firms may take advantage of more abundant resources, some researchers argue that large firms are more actively involved in innovation; both large and small firms have their own strengths and weaknesses in the innovation process (Maffini Gomes et al., 2009). Additionally, Muhammad et.al (2022) investigated the impact of company size on the link between corporate governance and R&D investment, using a generalized method of moments (GMM) estimator and data from U.S. publicly traded pharmaceutical firms from 2009 to 2018. Their findings suggest that bigger firms are more likely to boost R&D investment compared to smaller firms. By integrating these diverse perspectives, we can formulate a hypothesis suggesting that a growth in firm size may decrease the ratio of the firm's R&D investment, consequently leading to a decrease in innovation performance.

Hypothesis 3: Firm size is negatively correlated with firm R&D investment.

Based on the widely accepted theory of the firm life cycle, many researchers have determined that the age of firms is strongly related to their investment in innovation. For example, Corder et al. (2016) examines the link between firm innovation and firm growth across age groups using a broad sample from the Spanish Community Innovation Survey conducted between 2004 and 2012. Their research suggests that engaging young firms in riskier innovations can lead to significant performance gains (if successful) or substantial losses (if unsuccessful). Similarly, Czarnitzki and Kraft (2004) demonstrate that established firms may not invest as heavily in R&D as new firms, which allocate more resources to R&D than established firms. Therefore, it is reasonable to assume that an

increase in firm age will reduce the proportion of firm R&D investment, thereby reducing innovation performance.

Hypothesis 4: The establishment time of a firm is negatively correlated with its R&D investment.

Beyond that, as evidence, Zhu et.al (2019) attempted to explore the facilitators and constraints of SME innovation in China. A study involving 188 Chinese manufacturing Small and Medium Enterprises (SMEs) was conducted to investigate the relationship between 10 factors that influence innovation performance. The results reveal a positive linkage between external environmental factors, which include economic outlook and growth forecasts, and the innovation performance of SMEs. Further, Zahra (2000) investigated the technology strategy (TS) of a sample of firms in the computer software industry. It emphasizes that new ventures not only face the pressures that all young companies face (such as a shortage of funds), but also have to keep up with rapid technological change, so the influence of the external environment is crucial. Ultimately, this empirical study demonstrates that positive perceptions of the external environment drive firms to adopt more positive TSs and thus have a positive relationship with new venture performance (NVP). Contrary to expectations and literature claims, some environmental variables (such as the intensity of competition) are not related to innovation (Hadjimanolis, 2000). Combining these differentiated views, we can try to hypothesize that a firm's positive perception of the external environment will reduce the proportion of firms' R&D investment, thereby reducing innovation performance.

Hypothesis 5: A firm's positive perception of the external environment is positively correlated with its R&D investment.

Finally, a range of researchers argue that widespread risk aversion among SMEs drives firms to adopt more conservative strategies in R&D. For example, based on questionnaires conducted during personal interviews with business owners or managers, SMEs, especially family businesses, may exhibit a higher degree of risk aversion, which hinders their innovative potential (Hadjimanolis, 2000). To some extent, this characteristic is reflected in their careful investment in research and development. Besides, Li et.al (2021) provides a unique perspective that in SMEs, influenced by closely related stakeholders, leaders and their successors are often risk-averse. They tend to focus on short-term development and reduce investment in the company's R&D activities. Therefore, it is reasonable to assume that corporate risk aversion will reduce the proportion of corporate R&D investment, thereby reducing innovation performance.

Hypothesis 6: A firm's risk aversion is negatively correlated with its R&D investment.

2.3. Research Strategy

A crucial component of the study is the research strategy, intimately tied to the accomplishment of research objectives and the adoption of research methodologies. This study predominantly adopts a quantitative approach to investigate the research question, involving the gathering of numerical data via an online questionnaire method, which is the principal strategy used. The study relies mainly on primary data, sourced from the responses of surveyed Chinese SME employees to the questionnaire. Due to specific reasons, the study zeroes in on Chinese SMEs with a maximum of 200 employees and an annual revenue not exceeding RMB 50 million. Most of these companies are not listed companies and are not obliged to publish financial data. Secondary data on the cybersecurity risks of Chinese SMEs obtained through authoritative surveys is insufficient and may be at risk of being outdated. Therefore, relying solely on secondary research cannot obtain sufficiently accurate data, and the timeliness will also decrease. However, it's important to underscore that alongside primary data, the study also amasses secondary data regarding the supply chain collaboration of Chinese SMEs to glean a comprehensive understanding of the industry. These data were used to support further analysis of conclusions based on primary research.

Considering the time frame, the time series survey method utilized in this paper is quite intricate, necessitating a substantial amount of time to monitor participants and document varying data. Consequently, its significance is somewhat restricted. For this reason, our study employs a cross-sectional approach, amassing data at a singular point in time. Cross-sectional surveys, in comparison, require less time and accommodate larger sample sizes, and they do not require tracking of respondents and data over time, making them more convenient than time-series surveys. In other words, cross-sectional surveys are more suitable for the research of this paper.

2.4. Data Collection Methods

As mentioned above, it is quantitatively measured through an online questionnaire. Ball (2019) posits that employing an online questionnaire method can enhance efficiency, save time, and reduce costs relative to other alternative techniques, including similar interviews. Moreover, the online approach allows for reaching a broader demographic

than in-person surveys. Regmi et al. (2017) also observed that online surveys not only eradicate potential regional discrepancies, but also enable more efficient data gathering. Researchers can amass significant volumes of data and facilitate quantitative analysis swiftly via online questionnaires. The findings from the study provide a sound foundation and augment the dependability of the results. For instance, online surveys, unlike interviews, eliminate the need for telephonic or in-person interactions, thus contributing to a larger sample size. As for the secondary data involved, we mainly rely on corporate financial statements, industry surveys, peer review studies, WTO data, and official statistics. These data sources are varied, encompassing both qualitative aspects like corporate strategies and quantifiable information such as financial data of companies.

On July 1, 2023, the researcher of this study began to investigate: it first searched for "small and medium-sized keywords such as "enterprise", "innovative activities", "policy support". For these labels, I selected Chinese SMEs with no more than 200 employees and no more than 50 million RMB in annual revenue. Next, I published a post explaining the ultimate purpose of the survey and sent emails to the public contact email addresses of the companies to recruit participants (SME managers) who were willing to help. After obtaining the consent of the respondents, for these samples, the designed questionnaires were sent to the participants. The study sent the take home questionnaire via private message; and provided a week to answer the questionnaire. Ultimately, 400 questionnaires were emailed to these researchers. Compared to alternative methods (eg: face-to-face interviews), sending questionnaires online enables the collection of larger amounts of data in a shorter time (Vehovar & Manfreda, 2017). Most of the respondents did not reply to the email; after excluding invalid samples, a total of 87 valid samples were collected and were therefore included in the primary research.

2.5. Sampling method

Discovering and addressing the innovation performance of Chinese SMEs, as mentioned above, and the underlying influencing factors are the main research questions of this study. Therefore, the population of this study is Chinese SMEs. For this population, it uses simple random sampling to code all respondents who wish to participate and randomly draws 150 samples. Many respondents did not respond to the email, and after discarding invalid samples, a total of 87 valid samples were gathered, which were subsequently included in the primary research. The samples were collected in Hefei city, located in Anhui Province, which is situated in the central region of China. The city has

a Gross Domestic Product (GDP) of 1.27 trillion yuan and a GDP growth rate of 5.8% in 2023, as reported by the Bureau of Statistics of Anhui Province.

2.6. Questionnaire Design

Further, it's important to delineate the questionnaire design. The comprehensive questionnaire content is incorporated in the final appendix. Specifically, the questionnaire is segmented into three sections with a total of 16 questions. Respondents are expected to complete the questionnaire within 15 minutes.

As pointed out by Ketchen et al. (2019), simple random sampling ensures that each member of the study population possesses an equal probability of being chosen, thereby rendering the sample an unbiased representation of the entire population. Through these questions, this paper will obtain information on the status quo of the enterprise, thus providing a basis for further analysis. The objective of this section is to expedite the completion of the questionnaire by the respondents. It only contains six closed questions, aimed at minimizing response time and encouraging the respondents to thoughtfully answer questions in the subsequent sections. It should be emphasized that enterprise size is involved in the verification of the research hypothesis mentioned above, while other variables such as industry are included in the regression analysis as control variables.

The second part consists of 2 questions aimed at understanding the innovation activities of the interviewed companies and thus measuring their innovation performance. The crux of this section encompasses the number of patents filed in the past year and the R&D budget. Justifying this design, these indicators are commonly utilized: an example is the study by Ponta et al. (2021) that evaluated the impact of digital finance on firm innovation performance using the number of patents filed.

The third part constitutes a significant segment of the questionnaire as it seeks to gauge the crucial factors and hurdles impacting the innovation performance of companies. Based on the previous literature review and hypotheses, this questionnaire designs several main factors, including whether it is affected by the recovery plan/policy, the extent to which it alleviates financial distress, and ownership characteristics.

2.7. Data Analysis Method

The research methodology of this paper mainly involves data visualization, descriptive statistics, and regression analysis. Before its utilization in later descriptive statistics, the gathered data is first summarized and filtered. Primarily, this study centers

on the innovation performance of companies and the key drivers of this performance. Employing descriptive statistics, the general level of the sample is represented using graphs. A thorough analysis, encompassing their variance, mean, and other statistical indicators, is conducted. The outcomes obtained are used to address the first research question.

This study carries out a regression analysis on firms. In accordance with Golfinopoulos and Arhonditsis (2002), the goal of implementing multiple regression analysis is to express the relationship between correlated variables through mathematical formulas. The purpose of this regression is to determine the precise relationship between the latent factors derived from the literature review and hypothesis development section and the innovation performance of Chinese SMEs. Among these factors, the number of patents filed by companies in the past year, an indicator of innovation performance variables, is considered the dependent variable. The independent variables include the four factors mentioned in the hypothesis, the year of establishment, the type of ownership, whether to participate in the recovery plan, and the size of the enterprise. Regression model results will be used to explain the correlation between these variables, thereby validating the research hypothesis.

2.8. Ethical Considerations

Ethical considerations require special attention. Prior to initiating this online survey, the researchers attached an informed consent form to each questionnaire, implying that the respondents participated voluntarily and agreed to support the research. Furthermore, during this survey, the researchers understood the necessity to protect the privacy of each respondent, refraining from disclosing any personal information and ensuring anonymity. Therefore, in the design of the questionnaire, this study tried to avoid asking for specific information related to the personal privacy of the respondents, such as the specific value of annual income, but instead provided a range of relevant data for the respondents to choose. This will effectively protect the personal information and privacy of respondents. Data collected through the questionnaire will be anonymized and recoded. These data will not be disclosed online or on other computers but will be securely stored on personal computers. Upon the successful conclusion of this survey, all collected data will be promptly erased to prevent leakage and safeguard the privacy of each interviewee.

3. Chinese SMEs Phenomenon and Policy Comparison

3.1 Characteristics of the Development of SMEs in China

Unlike large-scale enterprises, the special operational flexibility, diverse structural nature, wide distribution, and specialized production of SMEs reflect their importance in economic development.

Firstly, the operational flexibility of SMEs is directly reflected in their higher decision-making efficiency. The flexibility in operations is a distinct advantage of SMEs compared to large enterprises. Due to the limitations in scale, SMEs have relatively fewer personnel, capital, and sales resources. Thus, they also require lower levels of technological expertise. This enables them to react more rapidly to the market and complete the entire process from production to sales faster. In addition, the organizational structure of SMEs is relatively simple and efficient. Without conflicts between ownership and operational rights, the management team is able to easily grasp the business model and direction of the company and make decisions that are beneficial to the development of the business. Due to the simplified organizational structure, decisions can be quickly transmitted to the various departments and implemented promptly, thus significantly increasing productivity. Moreover, with a limited workforce, SME managers are capable of communicating directly with their employees to fully understand what their needs are and to develop appropriate incentives to increase their sense of belonging. This flexibility and communication advantage results in a higher degree of adaptability and innovative capacity for SMEs.

Secondly, there is a diversity of structures. After decades of reform and opening up, private enterprises in China have gradually developed. In the 1990s, township enterprises emerged in the Jiangsu and Zhejiang regions. In fact, various types of township enterprises can be considered as small and medium-sized enterprises, collectively driving the economic development of township enterprises. In addition to township enterprises, there has been a gradual diversification of SMEs in China. These include privately owned enterprises under individual or family ownership, state-owned enterprises wholly or partially owned by the government, and mixed ownership enterprises with joint investment by the government, foreign investors, and individuals.

This diversification promotes economic development and industrial diversification. In particular, Chinese SMEs often adopt a highly concentrated and family-style ownership capital structure. The ownership structure under the distinctive type of family-style

management protects confidentiality and trusted relationships within the family business, but at the same time, it restricts the governance and development of the company and could lead to the autocracy of individual family decisions. However, the transformation of corporate ownership requires a clear property rights system and corporate governance mechanism to address the problems in family-style management, and hence to help achieve sustainable and stable corporate growth. Thirdly, there is a wide geographical distribution of SMEs. The distribution of SMEs in China presents a few characteristics. Firstly, the most developed region in terms of SME distribution is the eastern part, as it has a more developed urban agglomeration and industrial base, which attracts a large number of SMEs for further development and investment; the central region, on the other hand, is the most widely distributed region. As the middle zone, the district is transported conveniently and also has a diversified industrial base in agriculture, manufacturing, and services, which provides opportunities for SMEs to develop; the western region is relatively less developed, due to its vast territory and relatively slower economic expansion, as well as the imbalance in the distribution of resources, which may limit the growth of SMEs in the region. Secondly, with regard to industrial layout, SMEs cover a broader range of industries, reflecting their dynamism and relevance in different industrial sectors.

Except for some sectors with high technology and capital requirements, SMEs cover large areas of competition, comprising primary, secondary, and tertiary industries. According to the data from the 2018 Economic Census, from the perspective of the proportion of SMEs by the shares on the number of all firms within each industrial sector, 96.7% of SMEs in mining, 98.5% of SMEs in manufacturing, 98.2% of SMEs in public utilities, 98.8% of SMEs in wholesale and retail, and 98.3% of SMEs in accommodation and catering. In addition, Chinese SMEs are relatively equally distributed in industries including chemicals, machinery, and metals. This adequately reveals that the current social distribution of Chinese SMEs is widespread and deeply involved in all social sectors of the national economy. Lastly is the specialization of SME productivity. By being limited in size, SMEs have a greater gap in output, labor, capital, and finance per firm than large enterprises. But higher labor per value added and lower capital and loans per value added, which makes also their wage rates lower. However, this does not imply that SMEs are unable to survive and thrive in a highly competitive market. Instead, SMEs can be more focused on efficiently allocating resources by utilizing their limited resources flexibly and devoting them all to various areas to find opportunities for survival and

growth in a giant market. It is not surprising that the profit rates in the well-managed SMEs could be much higher than in many large corporations. So do the investment rates per value added.

In 2012, the government first proposed in the "Opinions of the State Council on Further Supporting the Healthy Development of Small and Micro-sized Enterprises" of the encouragement of small and micro-sized enterprises to pursue the path of " Specialization, Refinement, Differentiation, Innovation " and collaborate with large enterprises for coordinated development. Among them, "Little Giants" refer to specialized and sophisticated enterprises that produce new and unique products with a strong focus on core components, key materials, advanced processes, and industrial technological foundations, demonstrating outstanding main business operations, competitiveness, and growth prospects. Along with the progress of scientific and technological development and the acceleration of socialized mass production, Chinese "small giant" enterprises have shown extraordinary dynamism throughout a decade. Firstly, in terms of specialization, SMEs adopt specialized technologies or techniques to manufacture products with specialization and market expertise. This implies that SMEs are equipped with the expertise and technical skills in a particular field or industry and are able to produce products that correspond to specialized demands. Secondly, in terms of refinement, SMEs achieve lean production by adopting advanced and appropriate technologies to enhance production efficiency and product quality. Additionally, they establish meticulous and efficient management systems and processes, focusing on streamlining operations, reducing waste, and improving productivity. By embracing a culture of continuous improvement, SMEs are able to achieve higher levels of refinement in their operations and deliver value to their customers. Moreover, in terms of differentiation, SMEs manufacture products with regional characteristics or special features through the adoption of unique crafts, technologies, formulations or special raw materials. This reflects the differentiation of SMEs in product development and orientation to address the demands of specific markets through the generation of unique product features. In the last aspect of novelization, SMEs rely on independent innovation, the transformation of scientific and technological achievements, or the re-innovation method to develop and produce high-tech products with independent intellectual property rights. This demonstrates the expertise of SMEs in technological innovation and their ability to develop products with advanced and innovative features. As SMEs usually have a specialized background and expertise in a particular field or industry, they are capable of

obtaining a deeper comprehension of market demands, refining their production processes, and providing high-quality products and services in line with market demands. The specialized capabilities of SMEs in a particular field or industry are not only of greater assistance to the production process but can also exert a greater influence in the market. Regarding the factors of the actual product itself, different production scales and production methods lead to product differentiation. SMEs can compete with large enterprises in the market with more competitive products by continuously improving product quality and production efficiency through lean production methods. In addition, being relatively small in size, SMEs are more flexible and capable of adapting more swiftly to changes in market demand and making quick adjustments and innovations.

3.2. Existing Problems in the Development of Chinese SMEs

As the backbone of the Chinese economy, SMEs remain plagued by numerous problems in their development, such as social services, financial constraints, entrepreneurial innovation, and management capabilities. As far as the issue of social services is concerned, China currently has a significant number of widely distributed SMEs covering a wide range of industries. However, the social and public service system for SMEs has not been improved. In the developed country of the United States, for example, the Small Business Administration （SBA） was established at an early stage to provide unified management of SMEs nationwide and to provide comprehensive public services vertically. At the state level, government policy to support SMEs is a long-term and systematic strategy, and the government is expected to provide services such as technical support and informative advice in accordance with the requirements of SME development. Yet, over time, the Chinese social service system has been dominated by large enterprises, as SMEs face limitations in financial, technical, and manpower support, resulting in insufficient resources to invest in social services. Moreover, effective bi-directional communication between SMEs and service organizations is difficult due to the low hierarchy, unitary functions, and miscoordination of service organizations.

Secondly, financial constraints have always been the major issue for the survival and development of most SMEs, mainly reflected in the limited access to finance, high financing costs, and high credit risks, etc. Conventional financing avenues, such as commercial bank loans, require higher access criteria for SMEs and often require higher collateral requirements. SMEs tend to pay higher interest rates or loan fees due to the

business scale and the relatively short-term operation. The constraints of business size frequently imply also a lack of reliable information on financial status, which causes investors and financial institutions to have difficulties in assessing their credit risk, therefore large commercial banks or venture capital institutions are more inclined to invest capital in enterprises with greater potential and faster growth rates. However, as there is a gap between the overall qualifications and overall level of competence of SMEs themselves compared to large enterprises, it is hard for investors to obtain support, resulting in financing difficulties. So far as the Chinese capital and market elements are concerned, the Chinese Growth Enterprise Market (GEM) has not yet entered the early stages of development and is relatively weak in scale to provide a complete financing platform for all types of SMEs. In addition, due to the relatively high barriers to entry in other industries, SMEs are also not able to issue shares or bonds by their own means to aid in raising capital.

The third issue is entrepreneurial innovation. Chinese SMEs are constrained from innovating partly by the existing multiple institutional-level barriers. The current institutional environment is facing certain problems such as inadequate protection of intellectual property rights, which is the core of SME start-ups, and when issues such as the inability to defend rights against infringement are not addressed, this can significantly limit the innovative power of enterprises; another common barrier concerns cumbersome market entry thresholds, which have affected the entry and development of some high-tech start-ups due to complex administrative approval procedures.

Finally, the issue of management capacity. Given the relatively small size of products and capital and the limited market share of Chinese SMEs at present, they are often operated by individuals or families in the start-up phase. At this stage, being managed by individuals or families saves innovation and costs, and allows SMEs to demonstrate their enterprising spirit and dynamism. However, with the development of enterprises, individual and family business patterns cannot match the enterprise's needs. Firstly, in terms of decision-making mechanisms, the primitive individual or family business tends towards rigidity in decision-making. Managers usually lack the ability to formulate policies that are conducive to the survival and growth of the business. The second place, the lack of contemporary financial systems may lead to confusion in financial management, which in turn will lead to loss of funds. SMEs need to set up a modern financial system to manage their finances effectively. Thirdly, in terms of supervision mechanisms, the individual or family business model makes it difficult to form a complete

supervision system. Managers must count on self-supervision through their own qualifications to ensure that the development of the enterprise is not adversely affected.

3.3. Status Report on Policy Support for SMEs in China

The various constraints faced by Chinese SMEs have limited their development. Consequently, to enhance the development and innovation of enterprises, the government has formulated a series of policies and measures to guide and support the development of SMEs and to aid the survival and growth of SMEs in the private sector. The Law of the People's Republic of China on the Promotion of Small and Medium-sized Enterprises, promulgated in 2003, is the first law in China to address the promotion of SMEs, clearly illustrating the vital aspect of their contribution to economic and social development. The promotion of the solution is mainly reflected in the following principles: firstly, to maintain the safety and legitimate rights and interests of SMEs; secondly, to continue strengthening the support and assistance for SMEs; thirdly, SMEs should be guided and supported to conduct technological innovation in various products. The Act clearly states that it is necessary to continuously improve the scientific and technological capabilities of existing SMEs, encourage and support the development of science and technology-based SMEs, and accelerate the transformation of their own scientific and technological achievements into socio-economic capabilities.

The secondary aspect is financial and tax support. China has established policies such as accelerated depreciation, R&D cost deduction, and tax incentives for high-tech enterprises to encourage SMEs to promote innovation in technology, products, management models, and business models in line with market demands. Embodied in investment, such as for innovative investment projects, increased support, and the provision of microcredit guarantees for enterprises, which would help address the issue of unemployment. Furthermore, there is an increase in investment in the construction of technological innovation funds, specifically targeting areas such as developing and utilizing new energy in agriculture, agricultural technological innovation, and services. Additionally, relevant technical institutions are being established to provide corresponding human resources and technical services for the technological innovation work of SMEs. The policies reflected in the taxation aspect relate to the reform of the collection of VAT to reduce the tax burden on SMEs as much as possible and to enhance the ability to achieve profitability, followed by the reform of the corporate income tax, which unifies the tax burden on foreign and domestic enterprises and enables SMEs to

enjoy other tax benefits arising from product development potentially. Under the severe impacts of COVID, the Ministry of Finance of the People's Republic of China and the State Tax Administration have jointly stated that the implementation period of tax incentives has been extended to 2023 for the depreciation deduction incentives. For catering, retail, tourism, transportation passenger services, and other special industries with difficulties, increase support such as phased tax relief and partial deferment of social security payments to promote stable employment and consumption recovery; and exempt public transportation services from VAT in 2022.

The third is financing support. The government has provided some major policy assistance in the most common financing problems faced by SMEs. The Chinese government has set up a few special funds for the economic growth of SMEs in various administrative regions, including special funds for the construction of economic development projects for SMEs, special funds for the construction of service systems for SMEs, special funds for the investment of high-tech SMEs in product and technological innovation, and special funds for the development and investment of SMEs in accessing international markets. This provides a better set of financial supports for the economic development of SMEs. Apart from the special funds, and start-up fund assistance, the government has expanded the financing channels for SMEs by establishing SME bonds and GEM bonds. For the stable development of growing SMEs, the government has increased its credit support by establishing a credit rating system to provide greater credit support to SMEs with potential and development prospects, including in the form of loan guarantees and credit enhancement. It has helped SMEs access a wider range of financial resources and reduce their financing risks, contributing to sustained growth. For SMEs with cash flow constraints, repayment by installments can be explored. The Government encourages financial institutions to provide SMEs with repayment loans in installments to ease their short-term financial pressure and create a better business environment for them.

The fourth is support in social services. Policy support for social services for SMEs is a systematic project. Apart from providing support in various aspects, such as legal and financial support, the government should also actively foster and support SMEs' participation in social services to obtain services conveniently. In this process, local governments have assumed an important proactive and guiding role, strengthening their role in supervising, managing, and guiding market mechanisms, continuously optimizing the allocation of social service resources, establishing various chambers of commerce,

associations, and service groups, and promoting the development of the service structure of SMEs in a more diversified and deeper direction. In the 14th Five-Year Plan for the Development of Small and Medium Enterprises released by the government in 2021, a series of initiatives have been taken in social services. Firstly, a horizontal and vertical pooling service system has been established, with horizontal pooling of government public services, market-based services, and social public service resources to form an integrated service system. At the same time, a networked, intelligent, and ecological service system has been established between the national, provincial, municipal, and county levels for better service delivery. Secondly, continuing to push forward the reform of the "streamline the government, delegate power, and improve government services" system, focusing on the reform of the commercial system and the "separation of licenses", simplifying the registration process, improving the level of government services and reducing systemic transaction costs. In addition, improving channels for the dissemination of government information, establishing an internet platform for the dissemination of cross-sectoral policy information, and supporting the information and digital transformation of SMEs were all under consideration. The development of market-based service providers has also been promoted to explore the establishment of incentive and evaluation mechanisms to provide diversified and high-quality services to meet the individual needs of SMEs. Finally, the government is also committed to increasing the construction of an overseas service system for SMEs to provide comprehensive support for enterprises to expand into overseas markets. Altogether, these initiatives reflect the government's efforts in upgrading social services, reducing costs, promoting the development of SMEs, and public welfare promotion.

4. Analysis of Government Policies of SMEs in Japan Compared to the Chinese Policies.

With the continuous innovation of contemporary technology, the stability of the market order, and the collaborative development of various social and economic groups in a harmonious manner, SMEs represent an important factor in the survival and development of enterprises in China and occupy an increasingly large proportion of the overall size of the national economy. Therefore, the prominence of SMEs is also rising and the value they bring cannot be ignored. Currently, various countries attach great emphasis to SMEs and have adopted public policies to support and promote their

development. These policies are worth studying and researching.

4.1. The Aims and Principles of Japanese Government Policies to Support SMEs.

Let us not take a detour and look how Japan was guiding the development of entrepreneurial firms. Small and Medium-sized Enterprise Basic Act enacted by Japan in 1963 provides detailed regulations for various aspects of SMEs, including their scope of business and standards. One of its main objectives is to provide convenience and support to SMEs and business owners, aiming to help SMEs survive and achieve sustainable development healthily and stably. In 1999, the Japanese government made further revisions to the " Small and Medium-sized Enterprise Basic Act " to adapt to economic changes, strengthening the development capabilities and motivations of SMEs in the new era, and focusing on their creativity and proactiveness to meet the requirements of the information age. The revision aimed to create a more favorable environment for SMEs, promote their sustainable development, and enhance their position and role in the economy.[3]

To enhance SMEs' competitiveness in the market, the Japanese Government has taken a series of economic measures to support SMEs, mainly as follows: Firstly, the Japanese government provides direct financing to SMEs through subsidies as support. This financial assistance helps SMEs enhance their export capabilities in the international market through innovative technologies, encouraging them to address their employment challenges. The Japanese government is willing to offer financial support, including major state-owned scientific and technological innovation programs involving state-owned enterprises and scientific research institutions. Secondly, tax incentives, including measures such as reducing fixed asset taxes, are in place to alleviate the financial burden on SMEs. Thirdly, financial support is provided to address the financing difficulties SMEs face. Numerous financial institutions have been established to assist SMEs in obtaining financing. Additionally, efforts have been made to enhance the development and support of private institutions. For instance, cooperative banks, credit unions, and other financial entities can provide certain financial support.

To some extent, SMEs rely more on the external environment than larger enterprises. Recognizing this, the Japanese government has implemented a series of

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[3] https://www.chusho.meti.go.jp/sme_english/outline/08/01.html

measures to encourage collaboration between small and large innovative investments actively, leveraging larger enterprises' capabilities to support SMEs' survival and development. This collaboration benefits both sides of the economy. In this collaboration, larger enterprises primarily focus on producing high-quality products and demand higher production technology standards. On the other hand, SMEs are responsible for producing lower-quality products that may be challenging to achieve the desired production targets during the production process. In addition, the Japanese government places great importance on promoting collaboration and cooperation among SMEs. Moreover, the government focuses on developing infrastructure in designated regions and strengthens cooperation with SMEs based on geographical location. This facilitates technical exchange and collaboration among SMEs within the industry and fosters communication and cooperation with other relevant departments and institutions.

4.2. Japanese Government Policies to Aid SMEs Amid the Pandemic.

In the Japanese economy, SMEs account for approximately 99% of the total. Amidst the pandemic, many SMEs were facing extremely challenging circumstances and obstacles, to help SMEs stay open and to protect the primary business and employment of SMEs, the Japanese government has strengthened its support for SMEs in multiple dimensions, Special Fixed Sum Benefit plan is one of the assistances. In addition to providing a full range of support to SMEs themselves, the National Life Finance Corporation (NLFC), the Agriculture, Forestry, and Fisheries Finance Corporation (AFC), the Japan Finance Corporation for Small and Medium Enterprise (JASME), and the International Financial Operations of the Japan Bank for International Cooperation (JBIC) merged on October 1, 2008, to form the Japan Finance Corporation, a government-owned policy financial institution. It promotes the growth of SMEs through flexible policy financing. In addition, it collaborates with other financial institutions to provide rapid and seamless emergency financial services in response to natural disasters, social unrest, terrorist attacks, and infectious diseases.

As of the end of March 2021, the Small and Medium Enterprise Agency of Japan Policy Finance Corporation recorded a significant increase of 298% in new financing, amounting to 456.48 billion Japanese yen compared to the previous year. Over 90% of this financing was directly related to the impact of the COVID-19 pandemic. Moving forward to March 2022, it reported new financing of 168.73 billion Japanese yen, nearly 80% being loans directly associated with the COVID-19 pandemic. As of March 2021,

the Livelihood Support Department secured new financing of 916.40 billion Japanese yen, extending the support to 1.17 million entities, with approximately 80% being small-scale businesses with less than nine employees. More than 90% of the loans were provided under the Special Fixed Sum Benefit plan. As of March 2022, the division further increased new financing to 241.15 billion Japanese yen, reaching nearly 1.2 million entities.[4] It can be demonstrated that the Japan Finance Corporation (JFC) has played a crucial role, particularly in supporting the COVID-19 response policies through its distinctive loan system - the Safety Net Financing System, strengthening collaboration with private financial institutions and providing diverse financing services.

Firstly, the safety net function. In January 2009, the JFC implemented the Safety Net Functions, a special loan system that extends its support to many SMEs that have suffered a loss of profits as a consequence of the economic downturn. After the outbreak of the epidemic, the JFC provided services such as the Special Fixed-Sum, in which the interest rate for SMEs can be reduced by 0.9% over the benchmark interest rate for the first three years if the loan is less than 300 million yen and if the SMEs meet the eligibility requirements, which is nearly equivalent to an interest-free interest rate. In addition to providing loans, the JFC has established special consultation desks in 152 branches nationwide to provide prompt and comprehensive consulting services, including financing, to SMEs afflicted by the epidemic. Moreover, in response to significant disasters, the JFC has been actively assisting SMEs in coping with the epidemic through the COVID-19 Hybrid Subordinated Loan Program.[5]

The second factor is increased cooperation between private financial institutions. JFC has collaborated with private financial institutions to establish loan programs since 2014. The JFC had established loan programs with 437 institutions, such as local banks, credit cooperatives, credit banks, credit portfolios, etc., by the end of March 2022. As of the end of March 2021, the JFC and private financial institutions had provided 24,467 loans totaling 1,684.7 billion yen to SMEs affected by the epidemic in the current year. As of the end of March 2022, the aforementioned loans totaled 25,259 loans totaling 1,225.7 billion yen.

The third is diversified financing services. The JFC has provided diverse and differentiated loans in response to changes in the business environment and financing needs, including the previously mentioned special loan as well as the Special Loans for

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[4] https://www.jfc.go.jp/n/english/pdf/2022jfc_e.pdf
[5] https://h-ircd.jp/en/news-en/information-about-special-fixed-sum-government-subsidy.html

COVID-19 Environmental Health, Environmental Health Improvement Loans [COVID-19 related], COVID-19 Hybrid Subordinated Loan Program, etc., beginning at the end of August 2020. These loans are geared toward SMEs affected by the pandemic, but each has a distinct focus on specified financing objectives, use of funds, loan limits, and repayment terms. The JFC has designed a diverse and differentiated series of loans to meet the financing needs of SMEs affected by the epidemic, considering each customer type's unique characteristics and requirements.

4.3. A Review of Experience in the Context of China.

As a policy-oriented financial institution, the JFC not only helps SMEs alleviate their financial difficulties by developing various forms of low-interest or even interest-free loans, but it also actively collaborates with a vast array of other financial institutions to direct the flow of more social capital to SMEs. Considering the actual situation in China, Chinese policy financial institutions that support SMEs can acquire some insight. The Chinese government must first improve its policy orientation. Even though Japan's policy and financial institutions have adopted some commercial finance practices in their operations, their policy orientation has been steadily strengthened. Chinese policy-oriented financial institutions must continue to strengthen their policy orientation, serve as a part of counter-cyclical adjustment, increase support for SMEs, improve the availability of loans to SMEs, and facilitate the achievement of economic and social objectives. In addition, they must adhere to the bottom line of risk, rigorously control risks in all aspects of lending, enhance their risk-control capabilities, and provide more robust support for the growth of SMEs.

In supporting the development of SMEs, JFC and private financial institutions complement one another, recommend each other's clients, and maintain a cooperative relationship, directing a large amount of social capital to SMEs and actively "open sourcing" to meet their financial requirements. The cooperation between Chinese policy financial institutions and commercial banks is relatively limited and primarily takes the form of loan transfers. The signing of a strategic cooperation agreement between the Agricultural Development Bank of China and Zhejiang E-Commerce Bank Co., Ltd. in 2020 represents the first cooperation between a policy bank and an internet bank. Chinese policy-oriented financial institutions and other financial institutions must intensify their collaboration compared to Japan.

The JFC obtains data on SMEs through various channels, and the Small and Medium Enterprise Agency has created a database containing data on SMEs. In addition, the JFC assists clients in accessing the information they require on its website based on their specific requirements. One important factor contributing to the financing difficulties of SMEs in China is the information asymmetry between banks and enterprises. Currently, China does not have a specialized SME information database, and financial institutions mainly rely on their own investigations and the People's Bank of China's credit information system to assess SMEs. On the other hand, SMEs often lack awareness of information collection and are unable to provide the necessary information to financial institutions, which hinders the institutions' ability to obtain the required information effectively. To alleviate this situation, Chinese policy-oriented financial institutions can draw on the experience of JFC and establish an information database for SMEs. They can also establish a dedicated agency to conduct nationwide surveys on the operational conditions of SMEs and release regular reports. In addition, SMEs can proactively screen and disclose relevant information, reducing information asymmetry and increasing financial institutions' willingness to support SMEs.

I consider the policy support system in China for SMEs is still in its formative stage, with many policy supports being incomplete and lacking precision. Although the government has established a technological innovation fund to support the technological innovation projects of SMEs, there are no social organizations; additionally, socialized service organizations, such as market information networks for SMEs, have not been established. The policy measures have not been implemented effectively from top to bottom, and issues such as difficulties in accessing policy-related resources severely restrict the transformation, upgrading, and development of SMEs.

5. Analysis and Results

To explore the factors that affect the innovation performance of Chinese SMEs, this study conducts statistical analysis on the data obtained from the survey. In this section, descriptive statistics, visualization of data, correlation analysis and multiple linear regression results are shown.

5.1. Descriptive Statistical Results

According to Figure 5.1.1, the pie chart shows the size of the companies the respondents work for. It can be found that companies with 26-50 employees are the most,

accounting for 26% of the total. Followed by companies with 11-25 employees, accounting for 23% of the total. In this survey, companies with 101-200 employees are the least, accounting for only 13% of the total. This reflects the fact that firms with fewer than 50 employees are more common in this study.
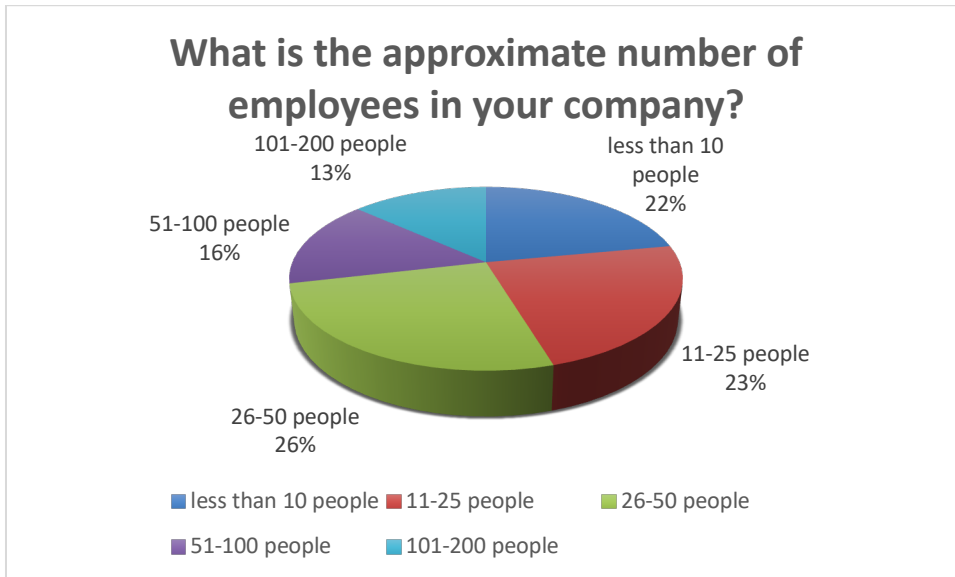
Figure 5.1.1 The size of the respondent's company

Further, this study investigates the annual revenue of the respondent's company. It has been reflected in Figure 5.1.2. Companies with an annual revenue of 5-10 million RMB are the most, with a total of 44 companies, followed by companies with an annual revenue of less than 5 million RMB, with a total of 36 companies. There are 35 samples with an annual income of 10-20 million RMB. In addition, this study has fewer samples with annual income above 20 million RMB.
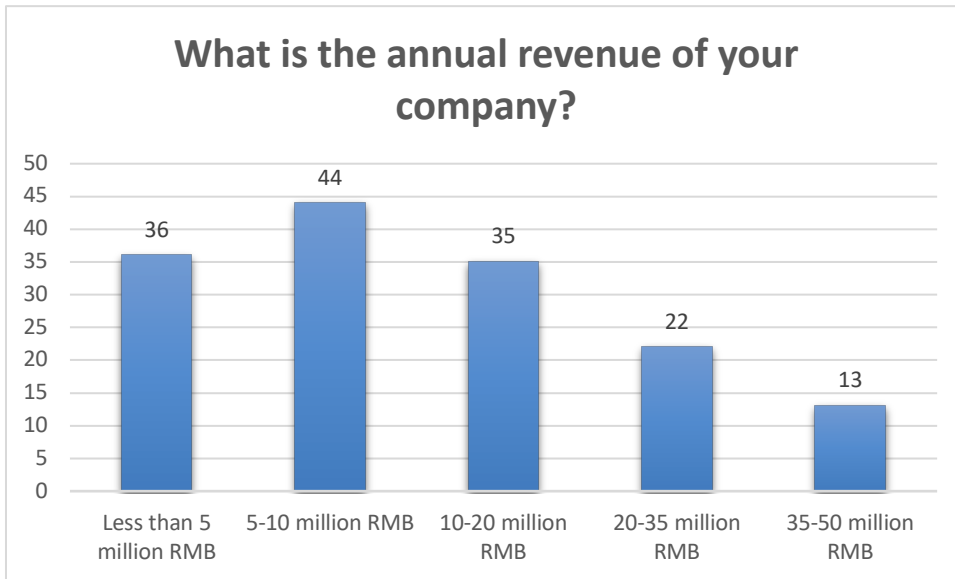
Figure 5.1.2 Annual revenue of respondent's company

Figure 5.1.3 is the statistics of the establishment time of the respondents' companies. It showed that the most established companies were 1-3 years old, with a total of 55 companies; followed by 54 companies that were established less than a year ago. There are very few companies established for 7-10 years and more than 10 years, only 12 and 9 respectively. This reflects the relatively short age (less than three years) of the SMEs in the sample above average.
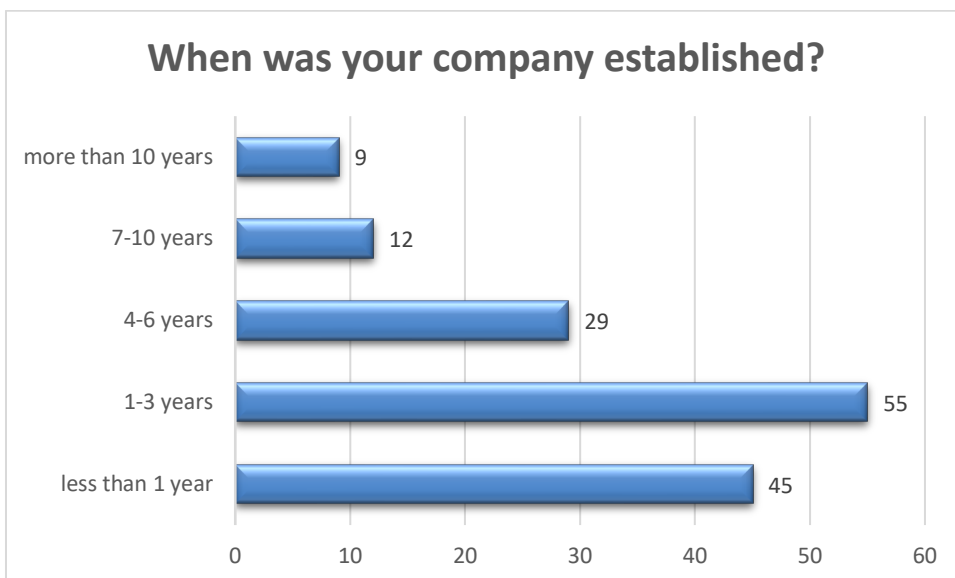
Figure 5.1.3 When the respondent's company was established

According to Figure 5.1.4, this study counts the industry of the respondents' companies. It can be found that the companies belonging to Machine made and Technology/Internet accounted for a relatively high proportion, accounting for 24% and 21% of the total respectively. In addition to companies belonging to other industries, companies belonging to e-commerce accounted for the lowest proportion, accounting for only 4% of the total. Overall, the companies participating in this study are relatively evenly distributed in different industries rather than concentrating on a specific industry. This can avoid the bias of the research results to a certain extent.
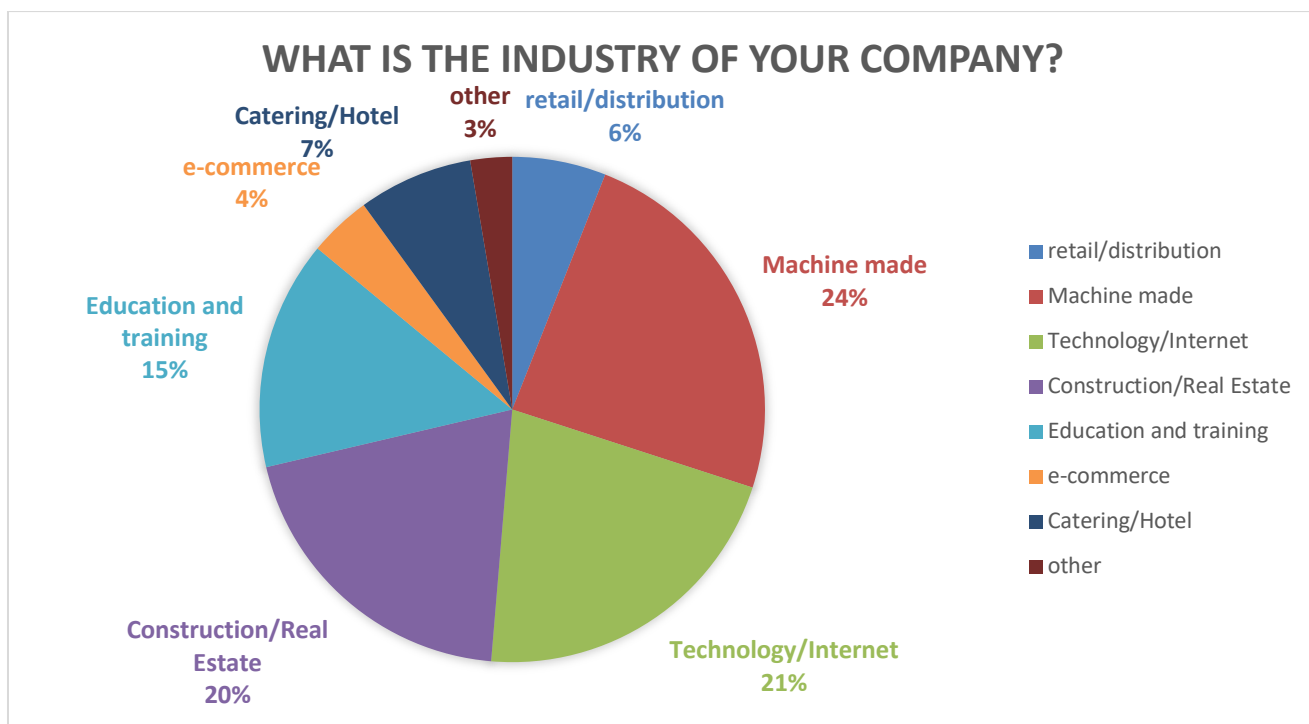
Figure 5.1.4 Respondent's company's industry

In addition, this study also focused on the position of the respondents in the company. As shown in Figure 5.1.5, more than half of the respondents are in the position of Chairman/Owner or Department manager in the company. The respondents are engaged in managerial positions in the company, which means that their views can better reflect Chinese SMEs current reality.
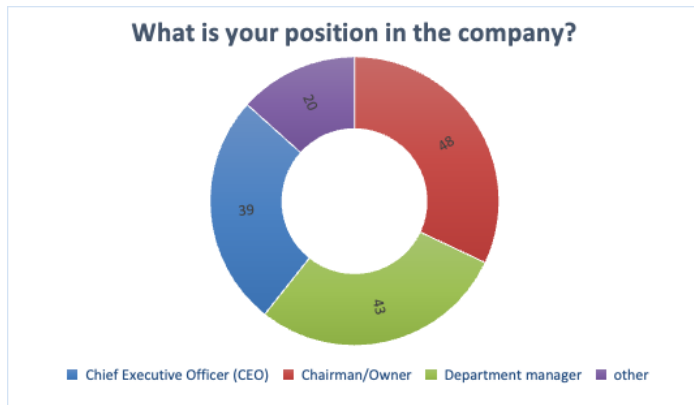
Figure 5.1.5 Respondent's position in the company

In order to understand which obstacles, affect the innovation activities of enterprises, this study provided six statements in the questionnaire, and the respondents scored according to the degree of agreement with these statements (1 = completely disagree, 5 = strongly agree). Among them, statement 1 and statement 2 reflect the respondents' views on government assistance. Statement 3 and statement 4 reflect the views of respondents on Risk Aversion. In addition, statement 5 and statement 6 reflect the respondents' views on External environment.

According to Table 5.1.1 as below, the average score of statement 1 and statement 2 are 3.36 and 3.22 respectively. This means that the respondents generally agree with the government's role in promoting companies. The average score of statement 3 and statement 4 are 3.35 and 3.55 respectively, which are also higher than 3. It reflected that the respondents generally believed that the current enterprises tend to avoid risks. However, for external environment, the average score of statement 5 and statement 6 are 1.98 and 2.32, which are smaller than 3. It means that the respondents generally hold a negative attitude towards the impact of the external environment faced by enterprises.

	Mean	Stand. Error	Median	Mode	Standard Deviation	Mini-mum	Maxi-mum
1. In the past year, government assistance policies/subsidies have eased the Company's financial position.	3.3600	0.0837	3	4	1.0251	1	5
2. The company plans to use the obtained policy subsidies or cost savings to carry out innovative activities	3.2200	0.0866	3	3	1.0610	1	5
3. Compared with obtaining higher returns, the company prefers to avoid risks	3.3533	0.0809	3	4	0.9908	1	5
4. The loss caused by innovation failure is unbearable	3.5533	0.1021	4	4	1.2507	1	5
5. Positive market and economic outlook	1.9800	0.0880	2	1	1.0773	1	5
6. The competitive environment of the industry in which the company is located is not fierce	2.3200	0.1096	2	1	1.3427	1	5

Table 5.1.1 Descriptive statistic for barriers Affecting Firms' Innovation Activities

Based on the scores of the above six statements, this study calculates the mean values of the respondents' scores on statement 1 and statement 2, statement 3 and statement 4, and statement 5 and statement 6, as the variable Government Values for assistance, Risk Aversion and External environment. The way variables are coded and synthesized is explained in detail below.

In this study, data were obtained through questionnaires and coded into numerical values. For example, the variable "Size" is obtained from the question "What is the approximate number of employees in your company?" Participants choose from five options based on their actual situation. Among them, five options were coded as 1-5, among which option a "less than 10 people" was coded as 1, and option e "100-200 people" were coded as 5. When the company is larger, the value of the variable Size (1-5) is also larger.

It should be emphasized that the variable Government assistance, Risk aversion and External environment are coded differently from the other variables. These three variables are reflected by the respondent's level of agreement with the six statements. For the variable Government assistance, respondents were asked to provide their level of agreement with the following two statements, which are "In the past year, government

assistance policies/subsidies have eased the Company's financial position"; and "The company plans to use the obtained policy subsidies or cost savings to carry out innovative activities". The 5-Likert Scale was used to reflect the respondent's level of agreement with the above statements (1-completely disagree; 2-disagree; 3-no attitude; 4-agree and 5 -strongly agree). Therefore, the higher the respondent's agreement with these statements, the larger the value (1-5). The average of the two values is used as the value of the variable Government assistance. Similarly, the variable Risk aversion and External environment are coded this way.

The correspondence between the statements in the questionnaire and the synthesized variables is shown in the table below.

Independent variables	Statements
Government assistance	11. In the past year, government assistance policies/subsidies have eased the Company's financial position.
	12. The company plans to use the obtained policy subsidies or cost savings to carry out innovative activities
Risk aversion	13. Compared with obtaining higher returns, the company prefers to avoid risks
	14. The loss caused by innovation failure is unbearable
External environment	15. Positive market and economic outlook
	16. The competitive environment of the industry in which the company is located is not fierce

Table 5.1.2 The main variables and the correspondence of statements

Specifically, the statement "In the past year, government assistance policies/subsidies have eased the Company's financial position." and the statement "The company plans to use the obtained policy subsidies or cost savings to carry out innovative activities" reflect the Respondents' views on the government's external assistance to businesses. Therefore, the mean of their ratings is taken as the value of the variable Government assistance. The statement "Compared with obtaining higher returns, the company prefers to avoid risks." and the statement "The loss caused by innovation failure is unbearable" reflect the respondents' views on corporate risk aversion. The mean of their

scores is taken as the value of the variable Risk Aversion. In addition, the statement "Positive market and economic outlook" and the statement "The competitive environment of the industry in which the company is located is not fierce" assessed the respondents' perception of the current external environment faced by the company. The mean of their scores is taken as the value of the variable External environment.

In the table below (Table 5.1.3), the descriptive statistical analysis for the several main variables has been displayed.

	R&D inputs	SIZE	Established time	GOVERNMENT assistance	RISK Aversion	EXTERNAL environment
Mean	2.3733	2.7467	2.2333	3.2900	3.4533	2.1500
Standard Error	0.1056	0.1079	0.0934	0.0608	0.0678	0.0660
Median	2	3	2	3.5	3.5	2
Mode	1	3	2	3.5	4	1.5
Standard Deviation	1.2930	1.3219	1.1435	0.7447	0.8301	0.8084
Sample Variance	1.6718	1.7475	1.3076	0.5546	0.6891	0.6535
Kurtosis	-0.6655	-1.0236	0.0383	0.5283	-0.4548	-0.5471
Skewness	0.6332	0.2483	0.8403	-0.2870	-0.4472	0.4191
Range	4	4	4	4	3.5	3.5
Minimum	1	1	1	1	1.5	1
Maximum	5	5	5	5	5	4.5
Sum	356	412	335	493.5	518	322.5
Count	150	150	150	150	150	150

Table 5.1.3 Descriptive statistical analysis for the main variables

5.2. Correlation

To explore the correlation relationship between variables, this study conducted a correlation analysis on the main variables. The results of the Pearson correlation test are shown below. It can be found that the correlation coefficient between the variable R&D inputs and Innovation performance is 0.7471, which is an exceptionally strong positive correlation. We highlighted correlations with a statistical significance signaling economic dependencies in yellow.

On the other hand, the absolute value of correlation coefficients of the other variables is smaller than 0.30. This means that, potentially, there is a weak (shaded in the table below) or no statistically significant correlation among the variables Size, Established time, Government assistance, Risk aversion, and External environment. Nevertheless, these variables will be still used as independent variables in the next multiple linear regression model. According to Daoud (2017), when there is a correlation relationship

between independent variables in the regression analysis, the model may have multicollinearity. Therefore, the results of correlation test prove that the regression model of this study does not have multicollinearity problems, which to a certain extent ensures the accuracy of the research conclusions.

	R&D inputs	SIZE	Established time	GOVERN-MENT assistance	RISK Aversion	EXTERNAL Environment	Innovation performance
R&D inputs	1						
SIZE	-0.5019	1					
Established time	-0.4724	0.0394	1				
GOVERNMENT	0.4061	-0.0646	-0.1903	1			
RISK	-0.2901	-0.0323	-0.0556	0.0383	1		
EXTERNAL	0.1965	0.1708	-0.0091	-0.0365	0.0130	1	
Innovation performance	0.7471	-0.3039	-0.3970	0.2549	-0.2012	0.2070	1

Table 5.2.1 Pearson correlation test results

5.3. Multiple Linear regression analysis.

In this section, this study constructs the multiple linear regression model to explore factors that affect firms' innovation input. Because the multiple linear regression model is a regression model that uses a straight line to estimate the relationship between a quantitative dependent variable and two or more independent variables (Uyanık & Güler, 2013). In this regression model, the dependent variable is R&D inputs, and the independent variables are Size, Established time, Government assistance, Risk aversion and External environment.

In the previous article, the acquisition and encoding methods of the variable Government assistance, Risk aversion and External environment were explained. Further, the acquisition and encoding methods of the dependent variable will also be explained in detail.

For the dependent variable R&D inputs, it has been obtained from the question "Approximately how much did your company invest in innovation in the past year? (Including all costs brought about by research and development of new products/new services/patents/technology)". Respondents were asked to choose from five options the range of R&D investment funds that is consistent with their company's actual situation. Option a "Less than 50k RMB" is coded as 1, and option e "More than 500k RMB" is coded as 5. When the value of enterprise innovation investment provided by the

respondent is greater, the corresponding value of the variable "R&D inputs" (1-5) is also greater.

The regression model can be written as:

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \varepsilon$$

Where,

$\hat{y}$ is the variable R&D inputs.

x_1 is the variable Size.

x_2 is the variable Established time.

x_3 is the variable Government assistance.

x_4 is the variable Risk aversion.

x_5 is the variable External environment.

ε is the error term.

Based on the multiple linear regression model above, the analysis results have been showed as below (Table 5.3.1).

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.8635
R Square	0.7457
AdjustedR Square	0.7368
Standard Error	0.6633
Observations	150

ANOVA

	df	SS	MS	F	Significance F
Regression	5	185.7400	37.1480	84.4362	0.0000
Residual	144	63.3533	0.4400		
Total	149	249.0933			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	**3.8316**	0.4120	9.2991	0.0000	3.0171	4.6460
Size	**-0.5159**	0.0418	-12.333	0.0000	-0.5986	-0.4332
Established time	**-0.4608**	0.0485	-9.5024	0.0000	-0.5566	-0.3649
Government assistance	**0.5531**	0.0745	7.4237	0.0000	0.4059	0.7004
Risk aversion	**-0.5387**	0.0656	-8.2081	0.0000	-0.6684	-0.4089
External environment	**0.4782**	0.0683	7.0052	0.0000	0.3433	0.6132

Table 5.3.1 The results of regression analysis

According to Table 5.3.1, the R square of this regression model is 0.7457. As a statistical measure, R square reflects the extent to which the independent variables in the regression model can explain the variation of the dependent variable (Kasuya, 2019). In this model, R square reflected that 74.57% of the variation in dependent variables can be explained by independent variables, which is a highly positive result.

According to the Results of ANOVA, F stat is 84.4362 and significance F is 0.000. For this test of regression null hypothesis if the sig F stat is smaller than 0.01 (0.000<0.01), hence, the overall null hypothesis can be rejected at the significance of error at less than 1%. It can be claimed that our list of exogenous variables contributed highly to the significance of our model.

Furthermore, Table 5.3.1 reflects the coefficients of each independent variable in the model. The p-values of all five independent variables are smaller than 0.01. It can be concluded that for all the independent variables in this model, the error of the estimated coefficients is very small. For example, the variable Size has the t-stat 12.3329 and p-value is 0.000.. Hence, the null hypothesis can be rejected in all five cases.

The regression equation can be written as:

R&D inputs = 3.8316 – (0.5159 * Size) – (0.4608 * Established time) + (0.5531 * Government assistance) – (0.5387 * Risk aversion) + (0.4782 * External environment) + ε .

If the size of the firm is larger, then the R&D expenditure is expected to decrease. If the establishment time is longer, then R&D expenditure may decrease, since older organizations may exhibit greater risk aversion and reduce willingness to invest extensively in creative activities compared to newer firms that are more focused on growth and market positioning. If government assistance is increasing, then R&D expenditure is expected to rise, the enterprises will be able to utilize the additional funds and support to improve their ability to innovate. If risk aversion is greater, then R&D expenditure is likely to decrease, as firms that are more risk-averse may prefer to allocate resources to safer, more predictable investments rather than investing in uncertain and potentially high-risk R&D projects. If the external environment is perceived to be more advantageous, then R&D expenditure is expected to increase, as positive market conditions and supportive external factors will encourage firms to invest more in innovation to capitalize on emerging opportunities.

The regression model reflected that the relationship between the variable Size, the variable Established time and the variable Risk aversion and R&D inputs were all negative, and the coefficient of them are - 0.5159, - 0.4608 and - 0.5387 respectively. The coefficient of Government assistance and External environment are 0.5531 and 0.4782 respectively. It reflected that the relationship between these two variables and R&D inputs are positive. Variable Size deserves a special comment since its negative sign is counter-intuitive. It reveals a surprising feature confirming the fact that it is the small businesses, and especially startups, which are the bearers of the innovative progress in China. That sheds a new light on the success of the Chinese economy. Small businesses retained their entrepreneurial driving force, meanwhile the innovation in larger and long-established businesses depends on remaining two variables with positive signs, particularly the government aid. The findings contradict previous studies indicating that larger companies have inherent benefits in terms of resources and capabilities, allowing them to make more significant investments in R&D. Although larger organizations typically have greater access to resources, they also tend to display cautious conduct when it comes to allocating those resources. This conservative approach might lead to a focus on spending in areas other than R&D, mainly because their solid resources and market positions minimize the need for constant innovation to stay competitive.

Moreover, larger enterprises are often distinguished by complicated management hierarchies and decision-making procedures, which can restrict their adaptability in engaging in innovative endeavors. The complex structure of bureaucracy may hinder the flexibility required for efficient investment in R&D, thus limiting their total capacity for innovation. In addition, bigger companies tend to show lower tolerance to take risks, causing them to be more cautious with R&D, especially under uncertain market conditions. Instead of depending on innovation, these companies may choose to utilize economies of scale to promote growth. Large firms may be reluctant to be engaged in risky R&D investments in markets that are already saturated. Instead, they may choose to explore tactics that capitalize on their current market dominance. As a result, larger companies are more likely to avoid making high-risk investments in innovation, which might contribute to the difference between the predicted and actual patterns of research and development spending in these companies.

Furthermore, it can be noticed that the Risk Aversion has a negative sign. The risk aversion coefficient is -0.5387, suggesting that as a firm's risk aversion increases, its investment in R&D declines. The presence of a negative correlation suggests that

companies tend to decrease their expenditure on R&D when they encounter uncertainty. Due to the inherent uncertainty and risk of failure associated with R&D activities, risk-averse companies may opt to allocate their resources towards more secure projects, resulting in a reduction in R&D investment. Additionally, with limited resources, managers may prioritize the short-term financial stability and returns. The focus on these immediate returns limits the allocation of resources on R&D.

Hence, according to the regression model, when firms are larger, when firms have been established for longer, and when firms are more risk-averse, they invest less in innovation. However, when firms receive more government aid and their perception of the external environment is more positive, their innovation investment is higher. The role of Chinese small businesses in economic growth and efficiency is crucial. Maybe even more important than in the economies of the EU. This feature has been largely neglected in the Western economic literature. Our very simple econometric test unveiled a new look on the Chinese economic miracle. Though the big state corporations form a large sector of the economy, they are not the drivers of progress. On the contrary, they often draw scarce resources and state subsidies without contributing to the technical change and thus growth. SMEs do not depend on special programs for development. For them it is sufficient if the economic environment is free of political interference, if the markets for inputs, capital and labor are contestable and the property rights are enforced. We can say that to the moment this is what drives the SMEs in China to grow and to innovate.

I consider the results of my survey and its econometric testing the most novel finding in this thesis.

Discussion

Based on the results of the above statistical analysis, in this chapter, this study can respond to the six hypotheses proposed in the previous article. At the same time, this study will also review relevant conclusions proposed in previous studies and compare them with the findings of this study.

First, this study found that for Chinese SMEs, there is a positive relationship between R&D investment and innovation performance. This is consistent with previous research results. For example, in the study of Furawo and Scheepers (2018), it was pointed out that lack of funds is an important obstacle that small and medium-sized enterprises face when carrying out innovative activities. In order to promote innovation, some business owners even have to use personal funds (Furawo & Scheepers, 2018). This is also similar to the

conclusions of previous studies mentioned above. As Seeniah and Rath (2018) mentioned in their research, companies that can invest large amounts of money in R&D are more likely to have the ability to create new products. Furthermore, Arta et al. (2010) posited that there is a notably positive link between companies' investment in Research and Development (R&D) and their innovation outcomes. While these findings align with those of this study, Zhu et al. (2019) argued that the connection between R&D spending and innovation success isn't straightforwardly linear, suggesting it could be influenced by various factors, including the size of the enterprise and market conditions. However, this particular aspect wasn't confirmed in this study. In conclusion, this research has established a significant positive correlation between R&D investment and innovation performance specifically in Chinese small and medium-sized enterprises (SMEs), thereby supporting Hypothesis 1.

Moreover, this research discovered a connection between government support and the innovation performance of companies, indicating that government assistance can effectively enhance corporate innovation. This observation aligns with findings from prior studies. For instance, Jiang et al. (2022) noted that the innovation performance of small and medium-sized enterprises (SMEs) in China is influenced by government subsidies. The study suggested that when SMEs receive more funding from the government, they are better equipped to engage in innovation-boosting activities (Jiang et al., 2022). Consequently, financial backing is crucial for the innovative progress of Chinese SMEs. Compared to larger companies, SMEs generally have a limited capacity to generate profits. Without financial aid from the government or individual entrepreneurs, it becomes challenging for some firms to secure extra resources for innovation. This indicates a strong link between financial investment and the innovation performance of SMEs. Access to funding for innovative endeavors is essential for enhancing the innovation capabilities of China's SMEs. Therefore, Hypothesis 2 has been validated in this study.

In previous statistical analysis, this study has found that there is a negative correlation between enterprise size and enterprise R&D investment. This is a finding completely contrary to previous research conclusions. In the study of Tan (2015), it was mentioned that compared with large companies, SMEs are significantly less likely to engage in innovative activities. Not only that, Cohen and Klepper (1996) believe that there is a significant positive correlation between R&D work and company size. Some researchers believe that compared with large companies, small and medium-sized

enterprises are subject to more obvious resource and capability constraints, and thus face greater pressure to innovate (Winch & Bianchi, 2006). The conclusion of this study may be completely different from previous researchers. This is because the subjects of this study are all small and medium-sized enterprises and do not cover large enterprises. However, some researchers believe that this result occurs because small companies have lower internal coordination and communication costs, thereby investing a higher proportion of funds in innovation (Stock et.al, 2002). In summary, the hypothesis 3 is proven in this study.

In addition to the relationship between firm size and R&D investment, this study also found a negative relationship between the establishment time of the firm and R&D investment. This is a conclusion consistent with previous research. As Czarnitzki and Kraft (2004) mentioned in their research, older firms do not allocate more resources to R&D than newly established firms. Some researchers also believe that many small and medium-sized enterprises use innovation as an important means to obtain and maintain market position (Brunswicker & Van de Vrande, 2014). However, according to statistics, only half of small and medium-sized enterprises can survive for more than five years (Klonowski, 2012). Therefore, companies that have been established for a short time are more susceptible to various negative impacts from the business environment (Sousa et.al., 2012). This means that they have to increase investment in innovation, aiming to improve the company's performance in a short period of time competitiveness within the industry. In contrast, older companies have already withstood the test of the market and competitors, so investing money in innovation is less attractive to them. Therefore, the hypothesis 4 has been evidenced in this study.

As mentioned above, the impact of the external environment on small and medium-sized enterprises cannot be ignored. This study found that for Chinese small and medium-sized enterprises, there is a positive relationship between positive perceptions of the external environment and the company's R&D investment. In fact, this conclusion has been unanimously recognized by previous researchers. As Zhu et.al (2019) mentioned in the study, there is a positive relationship between forecasts of economic prospects and growth and the innovation performance of SMEs. Compared with large enterprises, the survival and development of small and medium-sized enterprises face challenges from many aspects. Lack of capital is an obstacle faced by almost all young businesses. Unlike large enterprises, the future of SMEs is often significantly affected by the economic environment. Therefore, when corporate managers are pessimistic about future

macroeconomic development and growth, they will tend to reduce corporate R&D investment. Therefore, the hypothesis 5 has been evidenced.

In addition, this study believes that there is a negative relationship between the degree of risk aversion and R&D investment. This conclusion is consistent with previous researchers. As mentioned earlier, since SMEs tend to show a higher degree of risk aversion, their investment in innovation may be hindered (Hadjimanolis, 2000). Compared with large enterprises, managers of SMEs are usually more closely related to corporate income. In order not to damage short-term interests and save costs as much as possible, these managers tend to reduce the proportion of R&D investment (Li et.al, 2021). At the same time, a considerable number of China's small and medium-sized enterprises are family members. enterprise. In such a situation, there is a close kinship relationship between the stakeholders of the enterprise. In order to obtain the highest possible returns in the short term, they are even more reluctant to invest in R&D activities. Therefore, it has been evidenced that there is a negative relationship between the risk aversion and R&D investment of Chinese SMEs. Hypothesis 6 was validated as consistent in this study, i.e. it was not refuted by the analyzed data.

In summary, the research conclusions obtained by this study through various statistical methods are summarized. These research conclusions are also compared with previous views and related theories to discover their consistency and differences. By combining the views of previous researchers, this study explores the rationality of the research conclusions in the context of Chinese small and medium-sized enterprises and verifies the six hypotheses proposed in the previous article.

Conclusions

Conclusion and Recommendations

As highlighted in the earlier article, the swift growth of China's economy and its escalating global influence make the investigation of innovation capabilities in small and medium-sized enterprises (SMEs) within the Chinese context an increasingly critical subject. This study compiled insights from previous research in the innovation field of SMEs through a comprehensive literature review. Building on the theories put forward by past scholars, this study introduced six hypotheses concerning R&D investment in SMEs. To evaluate these hypotheses, the research utilized primary data collection for

quantitative analysis. Employing a variety of statistical techniques, including descriptive statistics, the Pearson correlation test, and multiple linear regression analysis, the study derived conclusions specific to the backdrop of Chinese SMEs. The findings reveal several key insights for China's SMEs: 1) a positive link exists between R&D investment and innovation performance; 2) government support measures or subsidies positively influence R&D investment; 3) a negative correlation is observed between the size of an enterprise and its R&D investment; 4) the age of a company inversely relates to its R&D spending; 5) a firm's favorable perception of its external environment correlates positively with its R&D investment; and 6) an enterprise's aversion to risk has a negative association with its R&D expenditure.

Therefore, based on the above research conclusions, this study makes the following recommendations to managers of China's small and medium-sized enterprises and policy makers of relevant government departments:

Recommendation 1. For managers of small and medium-sized enterprises

In order to avoid the limitations of small and medium-sized enterprises due to their own management and leader's cognition, managers of small and medium-sized enterprises should actively participate in some organizations composed of small and medium-sized enterprise owners, such as industry associations. By participating in external organizations, managers of small and medium-sized enterprises can gain timely access to various external organizations and knowledge sources. Not only that, but external organizations can also provide exchange and training opportunities for managers of small and medium-sized enterprises. These activities can enhance the ability of SMEs to explore and exploit external knowledge. By acting as active members, SMEs can identify the capabilities of external organizations. In communicating with managers of other small and medium-sized enterprises, organizational members can have a clearer understanding of the current economic environment and industry development. Such exchanges may also lead to cooperation and resource exchange among SMEs.

Recommendation 2. For policy makers in government departments

As mentioned earlier, government subsidies and support are crucial to improving the innovation capabilities of small and medium-sized enterprises. Therefore, this study believes that policymakers in government departments responsible for promoting the development of SMEs should conduct more research, consultation, and contact with SMEs to better promote the development of SMEs. By communicating with SME managers, policymakers can understand the challenges they face and effectively help

defend their businesses. Specifically, policymakers should pay attention to the challenges that the current regulatory framework brings to SMEs, simplify and rationalize government supervision, and bring more convenience to the innovation of SMEs.

Limitations and Future Research

It is undeniable that this study still has some regrets and limitations. On the one hand, during the data collection process, researchers are limited by time and cannot collect more samples. Only 150 samples were finally included in this study. The small sample size may lead to certain biases in the conclusions of the study. This has led to a reduction in the validity of the research to a certain extent. Therefore, in future research, more extensive collection of data from Chinese SMEs will be necessary. Analytical conclusions based on a larger sample size will not only be more credible, but also provide a more valuable reference for the innovative development of China's small and medium-sized enterprises.

Undoubtedly, the conclusions of this study provide a basis for exploring the factors affecting innovation in Chinese SMEs. However, the samples selected for this study are companies from different industries. Although this avoids to a certain extent the bias in research results that may be caused by a single industry. However, this also means that the conclusions of this study have limited reference significance for SMEs in specific industries. Therefore, the exploration of SMEs in specific industries would be a valuable direction in future research. In this case, researchers can have an in-depth discussion on the government supportive policies available to small and medium-sized enterprises in this industry, as well as provide suggestions based on the characteristics of the industry and the current development status. In addition to this, it would also be valuable for the researcher to conduct in-depth face-to-face interviews with the respondents during the data collection process for subsequent studies. Because small and medium-sized enterprises often face complex real-life situations, it is still difficult to discover the true situation of innovation among small and medium-sized enterprises in China from a deeper level only by collecting data through questionnaires.

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APPENDIX: QUESTIONNAIRE

The samples were collected in Hefei city, located in Anhui Province, which is situated in the central region of China. The city has a Gross Domestic Product (GDP) of 1.27 trillion yuan and a GDP growth rate of 5.8% in 2023, as reported by the Bureau of Statistics of Anhui Province. There were 150 samples in total and we received 87 valid questionnaires in the end.

	PART 1: Basic Business Information
	Note: First, is your company a Chinese SME? (The number of employees does not exceed 200, and the annual income does not exceed RMB 50 million)
	Y
	N
	If the answer is yes, please tick (v) the option you think is correct in the following questions. If you come across a question you don't want to answer, please forego filling out the questionnaire.
No.	**question**
1	**What is the approximate number of employees in your company?**
a.	less than 10 people
b.	11-25 people
c.	26-50 people
d.	51-100 people
e.	101-200 people
2	**What is the annual revenue of your company?**
a.	Less than 5 million RMB
b.	5-10 million RMB
c.	10-20 million RMB
d.	20-35 million RMB
e.	35-50 million RMB
3	**When was your company established?**
a.	less than 1 year
b.	1-3 years
c.	4-6 years

d.	7-10 years
e.	more than 10 years
4	**What is the industry of your company?**
a.	retail/distribution
b.	Machine made
c.	Technology/Internet
d.	Construction/Real Estate
e.	Education and training
f.	e-commerce
g.	Catering/Hotel
h	other
5	**What is your position in the company?**
a.	Chief Executive Officer (CEO)
b.	Chairman/Owner
c.	Department manager
d.	other
	PART 2: Innovation Activity and Innovation Performance
	This section addresses questions about firms' innovation activities and innovation performance
6	**In the past year, how many times has your company applied for patents with the National Patent Office?**
a.	almost never been
b.	1-5 times
c.	6-10 times
d.	11-20 times
e.	more than 20 times
7	**Approximately how much did your company invest in innovation in the past year? (Including all costs brought about by research and development of new products/new services/patents/technology)**
a.	Less than 50k RMB

b.	50k-100k RMB
c.	100k-200k RMB
d.	200k-500k RMB
e.	More than 500k RMB
8	**In which areas has your company developed innovative activities in the past year?**
a.	Supply Chain/Outsourcing
b.	Produce products/Provide major services
c.	Sales/Marketing Activities
d.	internal or external communication
e.	other
9	**How does your company manage innovation activities?**
a.	Management based on independent departments
b.	belonging to certain business units
c.	Configure innovation tasks for each department group
d.	Create project teams when innovation is needed
e.	No definitive way of managing innovation campaigns
10	**Which innovation activity is your company more inclined to develop?**
a.	Incremental improvements to products/existing activities
b.	Develop new products or activities
c.	Provide solutions for existing products or activities that are completely different from those of competitors
d.	other

	PART-3: Barriers Affecting Firms' Innovation Activities	
	Note: Please consider the following statements, where 5 means strongly agree and 1 means completely disagree; additionally, 4 = agree, 3 = no attitude, 2 = disagree	
	To what extent do you agree with the following statements?	**Rate**

11	In the past year, government assistance policies/subsidies have eased the Company's financial position.	1	2	3	4	5
12	The company plans to use the obtained policy subsidies or cost savings to carry out innovative activities	1	2	3	4	5
13	Compared with obtaining higher returns, the company prefers to avoid risks	1	2	3	4	5
14	The loss caused by innovation failure is unbearable	1	2	3	4	5
15	Positive market and economic outlook	1	2	3	4	5
16	The competitive environment of the industry in which the company is located is not fierce	1	2	3	4	5