

The influencing factors of university-enterprise collaboration - A case study of Tsinghua Unigroup, a spin-off enterprise of a well-known Chinese university

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Abstract: This paper examines the development of Tsinghua Unigroup Group, a prominent example of a Chinese university spin-off enterprise. It explores the factors influencing the future sustainable growth of university-derived companies through a detailed case study. By analyzing work reports published by Tsinghua Unigroup over recent years and reviewing public interview records of the enterprise's senior executives, this study summarizes valuable experiences and lessons learned in achieving sustainable development. Throughout its development, Tsinghua Unigroup has accumulated significant expertise and identified critical lessons, which provide new insights, innovative approaches, and effective methods for the sustainable growth of university spin-offs. The research emphasizes that the development of university-derived enterprises relies heavily on support from universities and government agencies, as well as industry-university-research collaborations and human resource management. The findings suggest that these elements are essential for fostering innovation and ensuring long-term sustainability. This study offers new perspectives and strategies that can help university spin-off enterprises avoid common pitfalls and accelerate their progress in scientific and technological innovation and sustainable development, ultimately contributing to the broader economic and technological advancement of the region and country.

Keywords: Influence factors, Knowledge transfer, University spin-off enterprises, University-enterprise collaboration.

1. Introduction

The knowledge innovation ability of universities has been widely recognized and concerned by the industry, and enterprises are more and more willing to establish various forms of collaborative relations with universities to improve their competitiveness and cope with the challenges from the market economy [1-3]. Farinha, et al. [4] studied the knowledge-related technology transfer processes that occur during university-enterprise collaboration. Universities have strong scientific research capabilities, while enterprises have strong market operation capabilities. Knowledge of universities can only be transformed through enterprises, and the improvement of enterprise technology needs to be based on universities.

Therefore, economic growth requires the coordinated development of university research and enterprise activities. Various organizations, including enterprises, can use the advantages of universities or other research institutions in knowledge innovation to create higher social and economic value and promote the sustainable development and progress of the productivity of the whole society [5]. University spin-off enterprise is the representative of establishing long-term collaborative relationship between university and enterprise.

China's university spin-off enterprises sprouted in the early days of the founding of New China. In order to further marketize the scientific and technological achievements of universities, starting from

the 1980s, the government encouraged universities to establish university spin-off enterprises, and university spin-off enterprises were formally determined. After decades of development, university spin-off enterprises have gradually grown into an important place to promote the transformation of university scientific and technological achievements, improve the national high-tech level, and promote regional economic sustainable development [4]. Some university technology enterprises have even become world famous enterprises, with high brand influence, such as Tsinghua Unigroup.

Tsinghua Unigroup, as a representative of scientific and technological enterprises in universities, has always taken ‘industrialization of scientific and technological achievements’ as its main theme. In the process of development, Tsinghua Unigroup has not only accumulated a lot of experience, but also summed up a lot of profound lessons, so as to extract new ideas, new images and new methods on the realization of sustainable development of university spin-off enterprises. These new ideas, images and methods can help other university spin-off enterprises to avoid detours on the road of scientific and technological innovation and development.

This study explores what measures Tsinghua Unigroup has taken to address the challenges in the development process and how these measures play a role in university-enterprise collaboration. This study analyzed the work reports published by Tsinghua Unigroup over the past years and the public interview records of the enterprise’s senior executives, and paid special attention to the change of university-enterprise partnership involved in these interviews. The rest is structured as follows: The next section reviews the literature on university-enterprise collaboration and university spin-off enterprises, followed by an introduction to the development of Tsinghua Unigroup. Next, the research methods adopted in this study are introduced in detail, and then the main conclusions of this study are introduced. Finally, this study discusses the main factors that influence the sustainable development of university spin-off enterprises.

2. University-Enterprise Collaboration

Today, with the rapid development of economic globalization and information technology, it is difficult for enterprises to adapt to the ever-changing market demand only by their own capabilities. Universities realize knowledge transfer and innovation by transforming their own professional knowledge into knowledge needed in different fields [6, 7]. Asian countries such as China, Japan, South Korea, and Singapore, as well as European countries such as the United Kingdom, France, Germany, and Spain, all support the establishment of long-term partnerships between universities and enterprises as a concrete means for governments to achieve their goals of national innovation and economic strength [8].

To a certain extent, the form of university-enterprise collaboration can improve the innovation ability of enterprises and drive the innovation demand of enterprises. Scholars have conducted extensive research on the complementarity of university-enterprise collaboration. This paper mainly studies the influencing factors of university-enterprise collaboration from the perspective of case studies, hoping to summarize the experience and methods that can promote the success of university-enterprise collaboration [9].

University-enterprise collaboration can not only accelerate the integration of resources and promote the transformation of scientific and technological achievements, but also play a positive role in balancing the coordinated development of education and industry. Starting from China’s national conditions, university-enterprise collaboration is one of the characteristics of comprehensive university running, but at present, the enthusiasm of colleges and universities to seek collaboration with enterprises is often met with cold treatment by enterprises, and the demand of enterprises to participate in university-enterprise collaboration is obviously insufficient [10]. Enterprises will conduct comprehensive evaluation from all levels before deciding whether to participate in university-enterprise collaboration.

From the perspective of university-enterprise collaboration intention, the consistency of interest distribution between universities and enterprises can reduce the contradictions in the process of collaboration. How to attract more enterprises to participate in university-enterprise collaboration is

also an issue that universities need to consider. For university managers, how to meet the interests of enterprises in university-enterprise collaboration as far as possible under the premise of realizing complementary advantages and resource sharing is an effective way to promote enterprises to participate in university-enterprise collaboration [11].

From the external environment of university-enterprise collaboration, the government should strengthen the policy support for university-enterprise collaboration in order to balance the imbalance of collaboration motivation between universities and enterprises. In the university-enterprise collaboration, the government's participation has formed a 'triple helix' relationship between enterprises, universities and the government [11]. The policy environment conducive to industry-university-research collaboration has a direct guiding role for enterprises to participate in university-enterprise collaboration. For government managers, how to strengthen policy support for universities and enterprises and form internal and external forces of university-enterprise collaboration policies on the premise of ensuring the coordination of upper and lower levels of university-enterprise collaboration is an important condition for promoting university-enterprise collaboration [12].

3. University Spin-Off Enterprise

Through direct collaboration with enterprises, the establishment of new enterprises and the training of innovative talents, the university forms a stable relationship with the industry and promotes the industrialization of its own scientific and technological achievements [13]. In addition to the direct collaboration between universities and enterprises, university spin-off enterprises, as a common and important interaction between academia and industry, can also promote the commercialization of university scientific and technological achievements [14]. According to Netval and Chocholáč [15], university spin-off enterprises refer to high-tech enterprises supported by universities and led by university researchers. A university spin-off is an enterprise established by a university through a formal knowledge transfer agreement [13]. If an enterprise is considered to be a university spin-off enterprise, it must have the following characteristics: (1) at least one researcher who has been engaged in scientific research activities in the university for more than three years is a shareholder; (2) the enterprise is for profit; (3) the field of production and creative activities of the enterprise is consistent with the field of research of university researchers [16].

With the participation of universities, enterprises and governments, university spin-off enterprises have become successful factors in the commercialization of knowledge achievements [16, 17]. This is because most of the university derivative enterprises are high-tech enterprises, which can promote regional economic development through knowledge innovation, and thus become the key to knowledge transfer [18].

The rise of university spin-offs enterprise can be traced back to 1920 in the United States. At that time, three well-known universities (Massachusetts Institute of Technology, Stanford University and the University of Wisconsin) as the representative of the establishment of new enterprises, intellectual patents and high-tech transfer to the new enterprises, so as to realize the commercialization of knowledge achievements [2]. Since the 1990s, universities represented by Britain, France and the Netherlands have begun to invest in the ranks of spin-off universities [19]. Since then, university spin-off enterprises have been identified as one of the important forms of commercialization of knowledge achievements [20].

4. University-Enterprise Knowledge Transfer

With the deepening impact of globalization on market competition, academic research institutions and enterprises have further strengthened collaboration in various ways [21]. Therefore, the current research topic is more and more rich. Around the world, laws are in place to encourage different forms of indigenous innovation, from knowledge transfer and knowledge sharing to collaborative innovation and knowledge co-creation.

Knowledge transfer originates from the two stages of knowledge exchange proposed by Gibbons, et al. [22], that is, knowledge creation develops from having no direct impact on society to maintaining an open attitude to all participants. This includes both economic and political actors. With the development and enrichment of concepts, there are many formal and informal ways of knowledge transfer, such as patent licensing, academic collaboration, business consulting and other commercial forms [23]. In addition, knowledge transfer involves more and more factors, including collaboration, communication, trust and other factors have become research interests [24].

The concept of knowledge transfer proposed by the Organization for Economic Cooperation and Development strengthens the links among universities, enterprises and government departments in various collaboration channels and common development goals, because various organizations, including enterprises, can use the advantages of universities or other scientific research institutions in knowledge innovation to create higher social and economic value and promote the sustainable development and progress of the productivity of the whole society [5]. The collaboration among the three is considered to be an important way for knowledge transfer to promote regional economic development, and has formed a mature UTT triple helix model [25]. In the university enterprise knowledge transfer, the university leads the knowledge innovation activities, the government is responsible for the formulation and support of relevant policies, and the enterprise finally realizes the commercialization of innovation results.

Therefore, it is also important to understand the relationship between the three subjects of knowledge transfer (universities, enterprises, and governments), which are both inseparable and independent of each other [26]. Governments, enterprises, universities, and research institutions all need to continue learning, exploring, planning, and developing university-enterprise knowledge transfer [27].

5. Tsinghua Unigroup

Tsinghua Unigroup has come a long way (see Table 1) [23]. In July 1998, approved by the State Education Commission of the People's Republic of China and sponsored by Tsinghua University, the pioneering university-run high-tech Enterprise Group with ownership by the whole people as its main body was established. This is also the predecessor of Tsinghua Unigroup [28]. With the strong scientific research force of Tsinghua University and the advantages of rich human resources, Tsinghua Unigroup takes the information industry and environmental protection industry as its pillar industries and forms a new high-tech enterprise with diversified industrial system. In the course of decades of development, Tsinghua Unigroup completed ownership reform, acquisitions and market mergers until July 9, 2021, Unigroup Group declared bankruptcy and reorganization.

Table 1.
Profiles of key leaders.

Time	Event	Detail
1988	Tsinghua University Science and Technology Development Corporation was established.	Tsinghua University appointed Zhang Benzhen to be responsible for the establishment of Tsinghua University Science and Technology Development Corporation, with Zhang Xiaowen as the executive vice president, which became the predecessor of Unigroup Group.
1993	Tsinghua Unigroup Corporation was established.	Tsinghua University Science and Technology Development Corporation was reorganized into Tsinghua Unigroup Corporation and gradually formed Unigroup Group.
2003	Tsinghua Holding Company was established.	All shares of Tsinghua Unigroup Group are transferred to Tsinghua Holdings.
2005	Officially renamed Unigroup Group.	The company was transformed from an enterprise owned by the whole people into a limited liability company, namely Unigroup Group Co., LTD., with Tsinghua University holding 80% of the shares.
2010	Establish a mixed ownership model.	Tsinghua Holdings holds 51 percent, while privately held Jiankun Group holds 49 percent.
2016	Join China high-end chip alliance.	
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2018	Tsinghua Holdings sold shares.	Tsinghua Holdings, one of Unigroup's shareholders, sold 30 percent of its shares to Suzhou High-speed Railway New Town State-owned Asset Management and another 6 percent to Hainan United Asset Management, leaving the three with a combined 51 percent stake in Unigroup, reducing Tsinghua's stake to 15 percent.
2021	Unigroup Group declared bankruptcy reorganization.	
2022	Unigroup Group reorganized successfully.	Unigroup Group announced the completion of the company's equity and new directors, supervisors, general manager of the industrial and commercial change registration procedures, the strategic investor 'Zhilu construction and Guangzhou Consortium' set up the holding platform of Beijing Zhiguang Core Holdings Co., LTD. (referred to as 'Zhiguang Core') smoothly to take 100% of the shares of Unigroup Group, The two original shareholders, Tsinghua Holdings Co., Ltd. and Beijing Jiankun Investment Group Co., Ltd. all withdrew.

Note: The source all from Shang 2018 SEM [23].

After careful investigation, this study decided to take Tsinghua Unigroup as the case study object:

First of all, Tsinghua University is a famous university in China, which has a profound influence on personnel training, scientific research and innovation. In particular, Tsinghua University took the lead in setting up university spin-off enterprises, and the scale of enterprises was one of the best at that time. Therefore, no matter from time or space, Tsinghua Unigroup has a strong representative.

Second, Tsinghua Unigroup started in the late 1980s, which is synchronized with the development of China's university-enterprise collaboration. In other words, the development history of Tsinghua Unigroup is also a part of China's university-enterprise collaboration, so the development process of Tsinghua Unigroup has great research value.

In addition, in the development process of more than 20 years, Tsinghua Unigroup has experienced different stages such as establishment, growth, prosperity and depression. During this period, Tsinghua Unigroup has a complex relationship with external entities, and these relationships have an impact on Tsinghua Unigroup. These experiences provide the necessary research basis for studying the relationship between university spin-off enterprises and external entities.

6. Research Method

This study adopts the case study method, through discussing the development history of Tsinghua Unigroup, which is a university spin-off enterprise, to study the influencing factors of university-enterprise collaboration. Yin [29] believes that case study method is appropriate when it is necessary to investigate phenomena in the contemporary context. Considering the background information and access to public data of university spin-off enterprises [30], it is considered appropriate to use case study methods to collect data.

This paper chooses Tsinghua Unigroup, the representative of university spin-off enterprises, as the research object, and through the study of the interview records of leaders at different stages, we can analyze whether the development of university spin-off enterprises is influenced by the universities where they are located. Table 2 lists the five enterprise leaders included in the study sample.

Data for the case study was collected between January and June 2025. We searched at two main types of publicly available information. First, we collected Tsinghua Unigroup's corporate announcements, focusing on information related to major changes in the enterprise, such as acquisitions and financing, corporate restructuring, and leadership changes. In this process, we mainly searched the official website of Tsinghua Unigroup and related literature, and the search keywords included 'Tsinghua Unigroup', 'development history' and 'leaders'. A large number of text materials collected from the initial keyword search are classified and saved in Word documents, such as one document for development history and one document for leadership, and the data is reviewed by the author for relevance to the research. After author review, information not related to the scope of the study, such as Tsinghua Unigroup's product data and party management, will be excluded.

Then, we collected the important speeches and interview records made by the main leaders of Tsinghua Unigroup in public occasions, such as the annual meeting of the enterprise and news interviews. This part of the data is mainly collected from mainstream news media websites, and each leader's interview is saved in a separate Word document. Next, the authors examined the relevance of the interview content to the study. After the authors review, they exclude information that is not relevant to the scope of the study, such as the leaders' own family circumstances and personal honors.

Therefore, we can comprehensively collect the major events that Tsinghua Unigroup has experienced in its development process, and then combine the interview records of major leaders to study the influencing factors of university-enterprise collaboration. Finally, we once again searched for keywords on China's major search engines 'Baidu' and '360' to check whether other relevant information was missing.

7. Research Findings

The research findings are divided into two parts. The first part is a selection of interview records of main leaders, which mainly shows some materials related to the research content. The second part is the sorting and analysis of the first part of the conversation.

7.1. Excerpts From Interviews with Key Leaders

After sorting out the interview records of the main leaders of Tsinghua Unigroup, the author classified and summarized the repetitive content, and extracted four factors that affect university-enterprise collaboration, including university support, policy support, industry-university-research collaboration and human resources. Each factor has been highlighted by at least three leaders. Detailed analysis is shown in Table 2.

Table 2.
Influencing Factors of University Spin-off enterprises.

Influencing Factors	Leader	Interview Content
University Support	Zhang, et al. [12]	It is precisely with such a good background of Tsinghua University that Unigroup has a natural advantage in market competition. Another advantage of relying on Tsinghua is a good talent pool Publicity Department of China [31].
	Li, et al. [32]	In the early days, our customers were looking at the two words-Tsinghua. The prospects for our company's business, Whether we can continue to receive support from Tsinghua University. The major shareholder Tsinghua University has extended its hands to help... This is the real reason why the Unigroup does not fall Sina Technology [33].
	Reporter [34]	I would like to thank Tsinghua for its tolerance, understanding and support Reporter [34].
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Policy Support	Li [9]	Tsinghua is our profound imprint, ... Lai [35].
	Zhang, et al. [12]	In the process of development, Unigroup benefited from the strong support of the policy environment in Zhongguancun, especially the 'three exemptions and three halving' policy for high-tech enterprises, which helped Unigroup a lot Publicity Department of China [31].
	Sina Technology [36]	The development and innovation of Chinese enterprises also depends to a large extent on changes in laws and regulations and related government policies. Create a good industrial environment Sina Technology [36].
	Li, et al. [32]	The country will build an innovation-oriented country, and will certainly take enterprises as the main body of technology research and development combined with the market Dalmarco, et al. [19].
Industry-University-Research Collaboration	Reporter [34]	The state should focus on supporting market-oriented enterprises in key areas that need to be broken through Reporter [34].
	Publicity Department of China [31]	Industry-university-research collaboration combines the market and resource advantages of enterprises with the technological and R&D advantages of universities and research institutes, which greatly promotes social and economic development and scientific and technological progress Publicity Department of China [31].
	Li, et al. [32]	In the transformation chain of scientific and technological achievements, research institutions and enterprises are the two ends of the chain, and each undertakes different tasks Dalmarco, et al. [19].
Human Resource	Lai [35]	The bigger the enterprise and the bigger the organization... The more extensive collaboration should be sought. Unigroup looks forward to and attaches great importance to the collaboration with Tsinghua Faculty of Economics and Management Lai [35].
	Zhang, et al. [12]	Unigroup has always believed that talent is the foundation of the enterprise, with talent, you can make the rice bowl bigger, even into a golden rice bowl. People at Tsinghua University are very smart and have a deep emotional connection to Tsinghua University Publicity Department of China [31].
	Sina Technology [36]	Now the brain drain is still relatively serious. Zhongguancun should form a good entrepreneurial mechanism and atmosphere to attract more talents Sina Technology [36].
	Yuner [37]	In addition to technology and patents, what are we missing? Talents cultivated by the top universities in the country end up in the United States Yunier [37].
	SEM [23]	Talent is the most important resource for Unigroup's strategic development, SEM [23].

7.2. Influencing Factors of University Spin-Off Enterprises

University Support. After assuming the traditional functions of knowledge production and knowledge innovation, universities also need to complete new tasks of university-enterprise collaboration, including knowledge transfer [38]. With the improvement of modern education system and the prosperity of knowledge economy, universities have become important positions for knowledge transfer and dissemination [16, 32, 35]. Chinese universities are playing an increasingly active role in

university-enterprise research collaboration [10]. As an important place of knowledge innovation, universities shoulder the responsibility and mission of scientific and technological progress and economic development [39].

Policy Support. From the government's point of view, they want to take certain measures to strengthen the collaboration between universities and enterprises [40]. On the one hand, government encouragement of university scientific research can accelerate the transformation and utilization of scientific research results [26]. On the other hand, the different needs of university-enterprise collaboration led to different requirements for partners from both sides, which may be contrary to the intention of the policy [41]. Abramowicz [42] argue that without effective government support, university-enterprise collaboration will face great difficulties.

Industry-university-research collaboration. University spin-off enterprise is one of the commercialization results of industry-university-research collaboration [43]. According to the World Science Organization, collaboration between academia and non-academia is an important way to transform scientific and technological achievements and to meet the needs of global sustainable development [17]. The Chinese government has been committed to promoting cooperation among enterprises, universities and research institutes for more than 20 years, which has resulted in a rapid growth in the scope and intensity of industry-university-research cooperation in China [11]. The government has created a good environment for industry-university-research collaborative innovation by formulating funds and policy support [44].

The mode of university-enterprise collaboration includes talent exchange and training [45-47]. Human resources play an intermediary role between industry-university-research collaboration and enterprise performance [48, 49]. However, in the current partnership between universities and enterprises, there is a lack of necessary communication between university researchers and enterprise employees. This situation directly leads to the lack of communication between universities and enterprises, which limits the sharing and progress of resources in all aspects [50].

8. Discussion and Conclusion

We take Tsinghua Unigroup as the object of university-enterprise collaboration research, because Tsinghua Unigroup, as a university spin-off enterprise, meets the research needs of university-enterprise collaboration. Tsinghua Unigroup is a university spin-off enterprise first established by Tsinghua University, a famous university in China. The problems it meets in the course of development are also encountered by most university spin-off enterprises. Therefore, it is very important to analyze the talk of Tsinghua Unigroup leaders to study the influencing factors of university spin-off enterprises and university-enterprise collaboration.

First of all, the influence of university support on Tsinghua Unigroup has been emphasized by four leaders. In the early days of the establishment of the enterprise, Tsinghua Unigroup was able to develop rapidly because it was backed by Tsinghua University. Facing the complex market competition environment, Tsinghua University has given Tsinghua Unigroup help in terms of capital and talents. When Tsinghua Unigroup faced bankruptcy crisis, it was Tsinghua University that provided support and helped Tsinghua Unigroup complete restructuring and establish the new Unigroup Group. Therefore, no matter what kind of future development of Tsinghua Unigroup, Tsinghua University will always stand with Tsinghua Unigroup.

Secondly, the development of Tsinghua Unigroup cannot be separated from the support of government policies. The development base of Unigroup is located in Zhongguancun, Haidian District, Beijing, the capital of China, which is China's first national high-tech industrial development zone, the first national independent innovation demonstration zone, and the first 'national' special talent zone. Zhongguancun is China's experimental field of institutional innovation, and is also known as 'China's Silicon Valley'. Thanks to the strong support of the Zhongguancun policy environment, especially the 'three exemptions and three halving' policy for high-tech enterprises, Tsinghua Unigroup's development has made rapid progress.

Thirdly, in addition to the university spin-off enterprise as a keyword research, industry-university-research collaboration must also be discussed. At least three of the five leaders in our sample highlighted the importance of industry-university-research collaboration in Tsinghua Unigroup's development. Industry-university-research collaboration combines the market advantages of enterprises with the technological advantages of universities and research institutions, which can promote social and economic development and scientific and technological progress. The more enterprises want to develop and grow, the more they need to seek collaboration opportunities with universities and research institutes. Therefore, Tsinghua Unigroup has always maintained collaboration with the Faculty of Economics and Management of Tsinghua University according to its own development needs.

Finally, Tsinghua Unigroup has always attached importance to the development of the group's human resources. In the human resources market, talents are fluid, and the problem of brain drain is also relatively serious in the development process of Tsinghua Unigroup. Even if the technology and patent problems are solved, there is no corresponding human resources, these patents and technologies will no longer be updated and improved. For example, outstanding graduates of Tsinghua University, after receiving further training in Tsinghua Unigroup, choose to work and settle abroad for better development. As a result, Tsinghua Unigroup has wasted the cost of training talent. Therefore, talent is the most important resource for the strategic development of Unigroup, and the group should build a platform and construct an ecology for the development of talent at the forefront of the promising hard science and technology industry.

This study discusses important issues encountered in the sustainable development of Tsinghua Unigroup, including the analysis of interview records of previous major leaders, in order to summarize the main factors influencing university spin-off enterprises, one of the representative forms of university-enterprise collaboration. We acknowledge the limitations of case information gathered based on corporate announcements and public interviews, so we present the influential factors related to Tsinghua Unigroup highlighted by key leaders. Future research may consider inviting more Tsinghua Unigroup management staff to conduct interviews and collect more comprehensive information. In addition, this study is limited to Tsinghua Unigroup, a university spin-off enterprise, so the information collected may not be universal. Future research should consider expanding the research sample, including not only more university spin-off enterprises, but also other forms of university-enterprise collaboration, so as to have a more comprehensive study on the influencing factors of university-enterprise collaboration.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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