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The Changing Chinese Intellectual Property Landscape in the New Era: Understanding the Connections Between Corporate IP Practices and Business Performance in Shenzhen

ZHOU Lin

Doctor of Management

Supervisors:
PhD Sandro Mendonca, Assistant Professor,
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PhD XIAO Yangao, Professor,
University of Electronic Science and Technology of China

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Signed: Zhou Lin Date: 2022.5.15

Name: ZHOU Lin

作者申明

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Abstract

The recent two decades have seen a surge in patent and trademark applications by Chinese enterprises. But the volume increase has not effectively resulted in enhanced enterprise competitiveness. This unsatisfactory reality has drawn widespread attention to intellectual property (IP) capabilities.

Based on a review of the existing literature on industry positioning, resource-based view, capability-based view and IP as a resource, this Thesis constructs a theoretical model of the relationship between IP capabilities and business performance. Specifically, IP capabilities consist of patent capabilities and trademark capabilities in the scope of this Thesis, and business performance is measured by competitive position and profitability. Then measurement formulas are designed to measure the relationships between the independent variables, control variables and dependent variables of the model.

To test the reliability and validity of the proposed model, an empirical study of 204 companies with a government-recognised IP management system in Shenzhen was carried out. Statistical analyses results suggested that both patent capabilities and trademark capabilities are significantly and positively associated with business competitiveness, validating the applicability of the model.

Following the empirical study, Huawei and ZTE were selected as cases for a qualitative study. The results turned out consistent with the empirical study. Besides, how the IP capabilities of the two case companies affect their business competitiveness is discussed.

Finally, suggestions on how to optimize patent and trademark strategies, including application, commercialisation and protection, are put forward for Chinese enterprises to enhance their competitiveness.

Keywords: IP capabilities; patent capabilities; trademark capabilities; competitive advantage; resource-based view; capability-based view

JEL: O34, P14

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Resumo

Nas últimas duas décadas assistiu-se a um aumento nos pedidos de patentes e marcas registradas por empresas chinesas. Mas o aumento de volume não resultou efectivamente em maior competitividade empresarial. Esta realidade atraiu ampla atenção para os recursos que tinham sido alocados à propriedade intelectual (PI).

Com base em uma revisão da literatura existente sobre posicionamento da indústria, visão baseada em recursos, empresas assentes em capacidades dinâmicas e PI como activo, esta Tese propõe um modelo conceptual da relação entre as capacidades de PI e o desempenho empresarial. Especificamente, os recursos de PI consistem aqui em recursos de patentes e recursos de marcas registadas e o desempenho do negócio, medido pela posição competitiva e rentabilidade. Em seguida, abordagens de medição são avançadas para medir as relações entre as variáveis independentes, variáveis de controle e variáveis dependentes do modelo.

Para testar a validade do modelo proposto, foi realizado um estudo empírico de 204 empresas com um sistema de gestão de PI reconhecido pelo governo em Shenzhen. Os resultados das análises estatísticas sugerem que tanto a capacidade em patentes quanto a capacidade em marcas estão significativa e positivamente associadas à competitividade empresarial, demonstrando a aplicabilidade do modelo proposto nesta Tese.

Após o estudo empírico quantitativo, a Huawei e a ZTE são estudadas como casos com vista a um estudo qualitativo complementar para reforço da validação e aprofundamento granular dos argumentos esboçados nesta Tese. Os resultados mostraram-se consistentes com o estudo quantitativo. Além disso, discute-se como as capacidades de PI das duas empresas do caso afectam a competitividade nos seus negócios.

Por fim, são apresentadas sugestões sobre como optimizar as estratégias de patentes e marcas, incluindo aplicação, comercialização e protecção, para que as empresas chinesas aumentem sua competitividade.

Palavras-chave: capacidades de PI; capacidades em patentes; capacidades em marcas; vantagem competitiva; visão baseada em recursos; visão baseada em capacidades

JEL: O34, P14

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摘 要

近二十年来，中国企业的专利和商标申请量激增，但申请量的增加并未有效地推动企业竞争力提高，这种现状引起了人们对知识产权（IP）能力的广泛关注。

本文在回顾关于产业定位、资源基础理论、能力基础理论和作为资源的知识产权的已有文献的基础上，构建了一个知识产权能力与企业绩效之间关系的理论模型。具体而言，本文所指的知识产权能力包括专利能力和商标能力，而企业绩效则由竞争地位和盈利能力来衡量。在此基础上，本文设计了测量公式来衡量模型中自变量、控制变量和因变量之间的关系。

为了检验所提模型的信度和效度，本文对深圳 204 家拥有政府认可的知识产权管理系统的公司展开了实证研究。统计分析结果表明，专利能力和商标能力都与企业竞争力显著正相关，验证了该模型的适用性。

在实证研究之后，本文选择了华为和中兴作为案例进行了定性研究。研究结果与实证研究结果一致。此外，本文还讨论了这两个案例公司的知识产权能力如何影响其商业竞争力。

最后，对中国企业如何优化专利和商标战略，包括申请、使用和保护，提出了建议，以促使企业提高竞争力。

关键词：知识产权能力；专利能力；商标能力；竞争优势；资源基础理论；能力基础理论

JEL: O34, P14

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Acknowledgements

Currently, IP plays a key role in the global economy as an important tool to support national innovation and development strategies. IP is an abundant source of value and competitive edge for enterprises. As globalization and innovation-driven development persist, Chinese companies must develop a clear understanding of IP and improve their IP capabilities to become internationally competitive.

Helping Chinese companies build up a world-class IP management system is my long-cherished wish. My previous study and work experiences are closely related to this aspiration. Over the past decade, I have worked as a lawyer, a patent attorney and an in-house legal counsel specialized in IP. I even run an IP commercialization firm.

Despite my hard efforts, the results turned out far away from my wish of building up an IP management system to leverage the IP capabilities of all firms. But this dilemma was changed upon my meetings with Professor Xiao Yangao and Professor Sandro Mendonça. I am grateful for this arrangement.

In October 2015, I met with Professor Xiao Yangao on the hill of Boulder in Colorado, U.S., where we had an in-depth conversation on IP management. It was the first time I met a master who could talk about IP and business competitiveness of an enterprise in such a systematic way. One year later, I met with Professor Xiao again, and we drove across the U.S. for half a month. Along the journey, we continued our discussions on the study of IP practice and theory, both in the Great Canyon and while drinking in the bar. It was a wonderful and fruitful journey. Professor Xiao has a solid background of law and management. He has published many papers and books in the field of IP management.

Upon the recommendation of Professor Xiao, I met with Professor Sandro Mendonça in Lisbon in December 2016. At that time, I even visited Portuguese IP Office with the help and company of Professor Sandro. The erudition and enthusiasm of Professor Sandro greatly inspired me to delve into the research of IP management. Professor Sandro Mendonça is an international expert of innovation and IP policy. He is also a Member of the Board of ANACOM, the Portuguese national regulatory authority for electronic communications, postal affairs, spectrum management, and outer space-related economic activities.

Most fortunately, I was admitted into the UESTC and ISCTE-IUL Doctor of Management

Program with both Professor Sandro Mendonça and Professor Xiao Yangao as my supervisors. Given my work experience and the inspiration from my supervisors, I chose the connection between IP practices and business competitiveness of an enterprise as the research topic. Their inspiration and instructions instilled in me the motivation to conduct an in-depth exploration of the connection between IP practices and business competitiveness. Hence the completion of this Thesis.

I am convinced that this Thesis will contribute to the theory of strategic IP management and serve as a reference for both the government and the business community. This DoM journey has satisfied my need for in-depth exploration and fulfilled my pursuit of scholarship.

I am deeply grateful for my supervisors Professor Sandro Mendonça and Professor XIAO Yangao.

My thanks also go to all the teachers of ISCTE and UESTC. They taught me not only knowledge but also the ways of learning. I am also appreciative of the support given by Professor Virginia Trigo, Director of the Chinese Program at ISCTE, and Professor XIAO Wen, IDMgt Project Director of UESTC. I am also indebted to Professor Nelson Antonio, Professor Ma Yongkai, Professor Chai Junwu, Professor Li Ping, Professor DENG Jianping, Professor Elizabeth Reis, Professor Jose Paulo Esperança, Professor Xia Weidong, Professor Jing Runtian and Professor Rui Vinhas da Silva. They have helped me tremendously along this academic journey. I am grateful to them for their meticulous guidance, which has deeply inspired me along this journey. To them I would like to express my sincere respect and deepest appreciation.

My special thanks go to the Shenzhen Administration for Market Regulation that provided me with critical help in data collection. Without its assistance, this Thesis would not have been possible.

I would like to express my gratitude to all my classmates for their friendship and support. We spent a lot of time in Chengdu and Lisbon together, with happiness and harvest. We recited old poems amidst flourishing yellow canola flowers, discussed the management strategies alongside the Huangguoshu Waterfall, did morning exercise beside the West Lake, and attended lectures together. These fond memories remain fresh in my memory as if everything just happened yesterday.

I owe a debt of gratitude to Dr. Kong Junmin, Dr. Li Ping, Mr. Li Fei, and Dr. Zhu Xiequn, for their support in my work and academic research.

Last but not least, I would like to particularly thank my family. Without their understanding, support and encouragement, this Thesis would not have been completed. My beloved parents provided me with strong emotional support. As the Chinese saying goes, “Parents’ kindness is

more important than Mount Tai." When I was still living in a poor cottage as a child, I was inspired by my parents' words to become an educated and self-cultivated man. My two lovely daughters Xuanyi and Xuanmo also provided me with tremendous joy. Xuanyi is a talented girl who could discuss philosophical topics with me; Xuanmo has just begun to learn speaking. But she can already imitate what I said. Accompanying their growth is the greatest joy of my life. My wife Lanlan took up the responsibility of raising children and taking care of the family whether I was studying abroad or working in a different place. The time we shared, whether happy or difficult, will be treasured forever.

Finally, I would like to conclude with a poem:

Passion fuelled my combat in the business battlefield.
Curiosity drove my research in the academic field.
Mountains and oceans heard our discussions of strategies and tactics.
Days and nights witnessed our dedication to language improvements.

From Chengdu to Lisbon, from China to Portugal,
Management and economics theories were tirelessly explored.
A rich history added complexity to academic origins.
While massive data were well sorted and analysed.

Rigorousness and patience are always needed
Where an empirical study is to be completed
Practices from China are well exploited.
And Western theories are broadly cited.

Finally! The doctoral journey will be accomplished!

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致 谢

帮助中国企业搭建世界一流的知识产权管理体系是我一直以来的夙愿，我此前的学习和工作经历都在为此而努力。而这个主题，也是中国企业在全球化发展的过程中、在创新发展的过程中，必须克服迷惘、提升认知，构建知识产权能力，方能成为为有国际竞争力的企业。

命运往往会给努力的人做最好的安排。我于 2015 年 10 月，在 Boulder Colorado 的小山上，跟肖延高教授相聊甚欢，遇到知音；2016 年 5 月，驾车环绕美国，在美国的公路上、大峡谷、汽车旅馆，跟肖教授有足够的时间畅聊知识产权从理论到实践的各个方面。在 2016 年的 12 月，我又在葡萄牙里斯本见到了 Sandro 教授本人，Sandro 教授的博学、热情，对知识产权的关注，给我留下了深刻的影响；当时 Sandro 教授就带我拜访了葡萄牙知识产权局。非常幸运的是，这两位教授在博士期间都成为了我的导师。

博士读书期间，肖教授数次跟我讲解知识产权理论与经济学的理论渊源、如何用管理学的方法研究知识产权问题、如何选定研究题目、如何规范的做实证研究、手把手的教导如何阅读文献、如何编写问卷、如何做案例研究；Sandro 教授 2017 年、2018 年、2019 年多次亲自来到中国，跟我一起拜访案例研究的目标企业中兴公司和华为公司，帮我选定研究题目、指导研究方法，甚至对文章的遣词造句、英文表达都进行了非常细致的指导。甚至还帮助我将研究成果在国际组织、跨国企业进行推广。

他们的悉心指导，使得我有能力在正确的研究背景下选择正确的课题，文献研究提供理论支持、准确的界定问题、建立理论模型和测量模型、实证研究、案例研究，得出了有理论贡献和实践价值的结论。论文的局限主要是我的问题，后续的研究还将求助于导师的指导，产出新的成果。

博士研究圆我梦想，从细节的技术问题、严谨的法律问题、系统的管理学问题，在知识产权的管理与实务领域，建立了一个完整的体系。

学高为师、德高为范。感谢VirginiaTrigo教授和肖文教授；感谢Nilson Antonio 教授；感谢马永开教授、柴俊武教授、李平教授、邓建平教授、Elizabeth Reis 教授、Jose Paulo Esperrance 教授、Xia Weidong 教授、井润田教授、Rui Vinhas da Silva

教授，帮助我们建立了国际化经营管理的知识理论体系、规范的博士学术研究体系；带领我们这个跨国博士项目基业长青，成为具有全球领先意义的管理学博士项目。

感谢一起陪伴我们几年快乐和富有收获时光的同学们，成都的电子科大清水河校区的美景，历历在目；里斯本 ISCTE-IUL 的简洁古朴、里斯本城市的悠久历史和文化，给我们留下深刻印象；黄果树瀑布的水声依然在耳边回荡；西子湖畔论道，恍如昨日。感谢肖延高教授团队的康凯悦师弟、刘道亨师弟，帮我处理了研究过程中的很多难题。感谢我的同事和朋友，中细软集团董事长孔军民先生、李平先生、李飞先生、高级顾问朱谢群教授，在工作中的支持、在学术研究上给予的支持。

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大女儿轩仪年虽幼，天资聪颖，已经可以与父亲探讨深奥的哲学与自然科学问题；二女轩墨古灵精怪，各种奇思妙想并每每给家里带来欢声笑语。陪伴你们成长，是此生最大的乐趣；

感谢我的妻子兰兰，不管是在外地求学，抑或是在异地工作，一人承担起抚育孩子、照顾家庭的重担，感谢陪伴我度过人生的快乐的或者艰难的时光。

以一首诗纪念我的博士生涯

平日沙场驰骋，闲来学堂耕耘。

乾坤越论经世道，日月替诵西语声，葡国取真经。

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旁征华夏实践，博引欧美理论，博学终可成。

Contents

List of Tables

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List of Figures

List of Abbreviations

AGE: Length of operation

AI: Artificial intelligence

AIPPI: International Association for the Protection of Industrial Property

AT: Time for awarding the brand of IP

AVE: Average variance extracted

CBV: Capability-based view

CNIPA: China National Intellectual Property Administration

CPC: Communist Party of China

CR: Composite reliability

DC: Dynamic capability

EFA: Exploratory factor analysis

EPO: European Patent Office

EUIPO: European Union Intellectual Property Office

FRAND: Fair, reasonable and non-discriminatory

GNP: Gross National Products

ICT: Information, communication and technology

IND: Industry Area

IP: Intellectual Property

ITC: International Trade Commission

JPO: Japanese Patent Office

KBV: Knowledge-based view

MNC: Multi-national company

NPEs: Non-practising entities

OWN: Ownership of an enterprise

PA: patent capabilities

PC: Patent creation capability

PCT: Patent Cooperation Treaty

PER: Competitiveness of an enterprise

PM: Patent Commercialization Capability

PP: Patent Protection Capability

PRC: People's Republic of China

RBV: Resource-based view

R&D: Research and Development

ROK: Republic of Korea

RONA: Return on net assets

SEPs: Standard essential patents

SIPO: State Intellectual Property Office

SSOs: Standard setting organizations

TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights

TA: trademark capabilities

TC: Trademark Creation Capability

TD: Defensive Trademark Creation Capability

TM: Trademark Commercialization Capability

TP: Trademark Protection Capability

USPTO: United States Patent and Trademark Office

VR: Virtual reality

WIPO: World Intellectual Property Organization

WTO: World Trade Organization

Chapter 1: Introduction

In the era of industrial economy, the intellectual property (IP) system provided a new way for asset owners to obtain property as a product of modern technology and commodity economy. In the era of knowledge economy, it is the driver of modern technological progress and development of market economy. The IP system has become the protector of "capitalists" to obtain IP assets (H. D. Wu, 2001; P. Zhang, 2012). Institutionally, the IP system has played a role in regulating the relationship between the monopoly interests of IP rights holders and the public interest. It is responsible for the effective allocation of knowledge resources and the promotion of knowledge wealth.

An important type of IP is patent, which is an exclusive right granted for an invention (WIPO, 2022a). Patents initially emerged as a tool for technology transfer and the establishment of new industries. The patent system provides property owners with the most economical, effective and lasting incentives for innovation through property rights, which ensures the continuity of innovation activities to produce achievements of innovation and increase productivity. Therefore, it is very meaningful to study the evolution of the patent system (World Intellectual Property Organization [WIPO], 1993). In 1474, Venice passed the first-known written law to grant and protect patents (Alfred, 2012). In 1624, England passed the Statue of Monopolies to protect inventors' rights in their work (Dent, 2009). When the U.S. was founded, its founders believed that IP was so important that one of the specific grants of power to Congress under Article I, Section 8, Clause 8 of the U.S. Constitution, ratified in 1788, was the power "To promote the Progress of Science and the useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries" (US House of Representatives, 2007). This grant gives Congress the power to define and to protect intellectual property through measures such as the issuance of patents and copyrights.

With the development of globalization and the knowledge economy over the past three decades, scholars and entrepreneurs began to consider IP to be equivalent to such assets as land, human resources and capital. Hence, they have begun to study the impact of IP on business competitiveness from the perspective of enterprise resource management. As the society progresses, different economic times have been accompanied by different kinds of core resources, and the allocation of resources is always concentrated on core resources (S. M. Li &

Wei, 1999). The knowledge economy, which is a brand-new form of economy, is based on the production, distribution, dissemination and use of knowledge and information, creative human resources as well as high-tech and intellectual services. In the era of the knowledge economy, high-tech products such as computer software, chips, the Internet, artificial intelligence (AI) and genetic engineering outcomes, the information consulting industry and the management-oriented service industry will take the lead in driving economic development. Besides, innovation has become a scarce resource that contributes most to value creation.

IP is not only a carrier of innovation, but also a core resource. From the perspective of resource attributes, IP is the scarcest resource (Granstrand, 1999, 2018) in the era of knowledge economy, in which context research on the relationship between IP and business competitiveness has become an important topic.

1.1 Research background

As IP rights have multiple effects on innovative behaviour, the number of IP applications has surged in the recent three decades, and the application of the IP system has increased to an unprecedented level. It has been found that with the development of the knowledge economy and a growing awareness of the critical role of innovation in business success and economic growth, research and development expenditure as a percentage of GDP (R&D intensity), has been increasing, and the number of intellectual property rights (IPR) applications and authorizations, especially patent applications and authorizations, has been rising year by year, which demonstrates the value of patents in commercial competition (Granstrand, 1999, 2006; Greenhalgh & Rogers, 2010, 2012). Patent quality, value realization and protection have become the primary tasks of enterprises, especially innovative ones. All these indicators may yield a systematic and evidence-based appreciation of the countries' capacity to take part in a globalizing knowledge economy (B. Y. Wang, 2019).

1.1.1 Global increase in patent applications

Global patent applications totalled around 3.3 million in 2020, with its growth rate bouncing back to 1.6%, while trademark and industrial design applications totalled 1.4 million, representing growth rates of 13.7% and 2%, respectively. Applications for utility models, a special form of patent, totalled three million, a year-on-year growth rate of 28.1% (WIPO, 2021).

Patents in force worldwide reached around 15.9 million in 2020, representing a year-on-

year growth rate of 5.9%. The biggest numbers of patents in force were recorded in the U.S. (3.3 million), China (3.1 million) and Japan (2 million) (WIPO, 2021).

The total number of industrial design registrations in force worldwide grew by 11% in 2020, reaching around 4.8 million. The most registrations in force were represented in China (2.2 million), the U.S. (371,870) and the ROK (369,526) (WIPO, 2021).

International (PCT) applications are applications filed under the Patent Cooperation Treaty (PCT), which is an international treaty for cooperation in the field of patent. It aims to reduce the duplication of efforts by applicants and patent offices when patent applications are filed in multiple countries or regions for the same invention. From the perspective of the countries and regions, PCT applications were mainly filed in the U.S., Japan, China, Germany, the Republic of Korea (ROK), France, the U.K., Switzerland, the Netherlands and Sweden (WIPO, 2019). Among them, the U.S. took the lead in patent applications with an increase from 7,719 in 1990 to 56,674 in 2017. Japan also showed rapid growth from 1,747 in 1990 to 17,415 in 2002, surpassing Germany and surging to 48,205 in 2017. The number of patent applications in ROK increased to 7,064 in 2007, surpassing France, the U.K., Switzerland, the Netherlands and Sweden. China had no PCT applications before 1990, but the number of its PCT applications started to increase significantly in 1994, reaching 5,455 in 2007, surpassing Switzerland, the Netherlands and Sweden. Later, China surpassed the U.K., France, ROK and Germany in 2008, 2009, 2010 and 2013 respectively, ranking after the U.S. and on a par with Japan (WIPO, 2019).

International patent applications filed via WIPO's PCT system, one of the most widely used metrics for measuring innovation activity, reached 275,900 in 2020, an increase of 4% over 2019. China (68,720 applications) continued to lead as the biggest user of WIPO's PCT system in 2020, followed by the U.S. (59,230 applications), Japan (50,520 applications), the ROK (20,060 applications) and Germany (18,643 applications) (WIPO, 2021).

For the fourth consecutive year, China-based telecoms giant Huawei Technologies, with 5,464 published PCT applications, remained the top PCT applicant in 2020. It was followed by Samsung Electronics of the ROK (3,093 PCT applications), Mitsubishi Electric Corp. of Japan (2,810 PCT applications), LG Electronics Inc. of the ROK (2,759 PCT applications) and Qualcomm Inc. of the U.S. (2,173 PCT applications). Among the top 10 PCT applicants, LG Electronics recorded the fastest growth (+67.6%) in published applications in 2020 and moved up from the 10th position in 2019 to the 4th in 2020 (WIPO, 2021). China as a whole kept on strengthening its intellectual asset outlook, and was the country filling the most international patent applications for the year 2021 (WIPO, 2022c).

In 2020, China's IP applications resumed growth, with around 1.5 million patent

applications filed for the year, which was more than 2.5 times of the number of IP applications received by the IP offices of the second leading country, the U.S. (597,172 applications). The U.S. was followed by Japan (288,472 applications), the ROK (226,759 applications) and the European Patent Office (EPO) (180,346 applications). Among the top ten IP powers, only three, namely China (+6.9%), India (+5.9%) and the ROK (+3.6%), recorded an increase in patent applications in 2020 (WIPO, 2021).

The *Innovation Geographies* report (referred to as the Report below) released by Jones Lang LaSalle, the world's leading real estate consultancy, showed that Shenzhen was among the Global Top 20 for Innovation, ranking 14th out of more than 100 cities with superior innovation capabilities and technological talent in 2019 (JLL, 2019). Meanwhile, Shenzhen ranked second in the world in terms of the number of patent applications from 2015 to 2017. Shenzhen was the second most innovative city in the world, behind Tokyo, Japan, but ahead of Silicon Valley in the U.S. Seoul in Korea, Paris in France, New York in the U.S., London in the U. K. and Frankfurt in Germany. In 2016, Shenzhen filed 19,648 PCT patent applications, up 47.64% year-on-year, still maintaining a high growth rate and accounting for 46.59% of the total number of applications filed by domestic enterprises and individuals. It had been ranking first among all major cities in China for 13 consecutive years (Tao & Yuan, 2019).

The economic literature has largely focused on understanding the surge in patent applications, which is due to a number of factors. Researchers (Blind et al., 2009; Hu & Jefferson, 2009; Kortum & Lerner, 1999; Liang & Xue, 2010; Rafiquzzaman & Whewell, 1998; Shu et al., 2015) have identified the following factors to partly explain the above trend:

(1) Increased R&D investment and changing patent propensity: The significant growth in R&D spending and the shift to more applied R&D worldwide have resulted in more patentable inventions (Kortum & Lerner, 1999). In addition, the increased R&D of new technologies has contributed to increased patenting activity.

(2) Growth in the number of subsequent applications: Since the mid-1990s, patent applications have become increasingly international. Subsequent filings reflect the need for applicants to protect inventions in multiple jurisdictions.

(3) Expanding technological opportunities: Computer and telecommunications technologies are some of the most important technologies that have contributed to the growth of patents (Kortum & Lerner, 1999). Other contributors include pharmaceuticals, medical technology, electrical machinery, and, to a much lesser extent, biological and nanotechnology. From 2000 to 2007, patent filings in the fastest growing technology areas involved microstructure and nanotechnology, digital communications and other ICT products, food

chemistry and medical technology (WIPO, 2017a).

(4) Legal and institutional changes: Research suggests that legal and institutional changes have taken place in the patent system both in China and worldwide, which have contributed to increased patent activity. Relevant cases include national patent reform and the implementation of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Hu & Jefferson, 2009). In addition, the PCT and Madrid systems, as well as the European Patent Convention, facilitate cross-border patent applications.

(5) Strategic patents: Some researchers (Blind et al., 2009; Liang & Xue, 2010; Shu et al., 2015) attribute the growth of patents to so-called strategic patenting practices. These practices are designed to deter other companies from filing patents by creating a slew of defensive patents around a valuable invention, to prevent competitive infringement and litigation, and to strengthen patent portfolios in cross-licensing negotiations. Some companies also use patents to deter other competitors, or to obtain premiums from other companies. In addition, non-practicing entities, in particular, have begun to file lawsuits against other companies based on their patent portfolios.

1.1.2 Global increase in trademark applications

Economic studies show that trademarks or brands play an important role in increasing the symmetry of information between operators and consumers (Mendonça et al., 2004). With the trend of globalization and widespread use of the Internet, companies are paying more and more attention to the brand experience of consumers. Trademark data can act as a partial output indicator of innovations introduced into the goods and services markets and can therefore be used as an empirical yardstick for measuring overall changes in the patterns of economic activity" (Mendonça et al., 2004). Thus, the volume of trademark registrations also reflects the awareness of brand protection (Kong, 2017).

Because brands play an important role in increasing corporate value and driving economic growth, the number of global trademark applications and authorizations has increased year by year. The increase in the expenditures on branding and the increased economic role of such expenditures go hand in hand with a pronounced but less noticeable surge in trademark filings both at home and abroad (WIPO, 2013a).

The first period with a surge in trademark applications started in the 1970s. In fact, trademarks have been in existence since the mid-19th century. Yet, in most high-income economies, the rapid growth in trademark applications only began after 1975. Following a slow

start in the early 20st century, trademark activity accelerated significantly in the mid-1970s at the USPTO. At the Japanese Patent Office (JPO), such activity accelerated even earlier. Trademark activity in other IP offices followed much later, in the 1980s. In other words, the surge in trademark filings in high-income economies began about ten years earlier than the increase in worldwide patenting, which began in the mid-1980s. After that, middle-income economies took the turn to begin experiencing a rapid increase in trademark filings in the late 1980s and 1990s.

The second period with a significantly accelerated increase spans from the late 1990s to the present. In most high-income economies and many middle-income economies, trademark applications first peaked in 1999 or 2000, suggesting amplified demand for new registrations during the dotcom boom, followed by a contraction in registrations that corresponded with the timeline of the dotcom collapse. Applications peaked again in 2007, right before the outbreak of the global financial crisis, with demand falling again throughout the downturn, but with new filings recovering to near pre-crisis levels by 2011. Most middle-income economies saw substantial increases in trademark filings at the turn of the 21st century. By 2001, the China Trademark Office had become the top recipient of trademark filings, a position China only regained in patent filings in 2011, when it became the world's top patent recipient.

In absolute terms, trademark applications had quadrupled from just under one million per year in 1985 to 4.2 million by 2011. During this period, trademark applications multiplied approximately five-fold in the case of ROK and the US, approximately threefold in Australia, and approximately two-fold in Canada, France and Germany. In the case of middle-income economies, the increase was more striking, with an increase by a factor of close to 30 in China, 20 in Turkey, 12 in India, more than six in Mexico and three in Brazil.

Despite the important surge in trademark applications, its drivers have been subject to little systematic analysis so far. Researchers (Greenhalgh et al., 2011; Hipp & Grupp, 2005; M. C. Jensen & Meckling, 1998; P. H. Jensen & Webster, 2011; Mendonça et al., 2019; Millot, 2009; Myers, 2013; Tucker, 2002) have identified the following seven drivers:

(1) Brand growth and increased investment in upper-middle-income economies: Economic growth and increased global brand spending are highly associated with trademark activity. Higher investments by companies to maintain existing brands or develop new ones, coupled with the rise of new players in new countries using trademarks, have positively impacted filing activity.

(2) Increased product innovation: Existing literature suggests that increased trademark activity also reflects an increased rate of product innovation and quality improvement in the

economy (Mendonça et al., 2004). New products or products with improved quality often trigger the filing of a new trademark, which helps differentiate new products and services in the marketplace.

(3) Shift to an innovative service economy: At the global level, from 2004 to 2011, the number of registered trademarks for services grew much faster than that for goods (Myers, 2013). Only a few high-income economies (such as France) saw growth in trademarks for goods at roughly the same level as that for services. Among middle-income economies, Russia and South Africa were exceptions as they saw higher growth in the commodity category. Overall, most other economies experienced faster growth in filings for service marks than that for goods.

(4) Increased global demand for trademarks: Trademark filings at local and international levels are also positively affected by globalization and economic development. Trademark filings are facilitated by existing companies or other trademark holders exporting their brands to more countries and registering local variants of existing brands. Brands created by companies that are "born around the world" immediately appear on the Internet and are available to consumers around the world. For these companies, the importance of quickly registering their trademarks and using them in overseas markets to retain rights has been reinforced.

(5) The rise of the Internet: The Internet has influenced the role of trademarks in at least three main and related aspects. First, the Internet has greatly contributed to the continued growth of trademark filings. On the one hand, existing companies launch new Internet-based or related products and services, triggering new trademark filings. On the other hand, the Internet stimulates the creation of new companies and the development of new products, which in turn stimulates the use of the trademark system. Second, the Internet has increased brands' national and even global influence. More and more companies are filing not only in their home countries, but also abroad, leading to the expansion of the scope of trademark filing. Third, the Internet has increased the need for legal protection when rights holders face the online sale of counterfeit goods or other forms of trademark abuse (Bechtold & Tucker, 2014).

(6) Strategic use of trademarks: More strategic use of trademark filings may contribute to the overall growth of trademark filings. In particular, in legal systems without strict usage requirements, companies or other organizations may file a large number of trademarks without immediate plans to use them. They may do this to "wall up" their existing trademarks by preparing for similar product launches in the future, or to ensure that other companies do not get too close to their namespace.

(7) Institutional and regulatory changes: In terms of institutional drivers (such as the facilitation of foreign trademark applications by international agreements), simplifying

trademark applications through a new online filing system plays an important role in explaining trademark application patterns.

1.2 Research problem and research questions

At the end of 2018, China's per-capita GDP was about 9,608 USD, ranking No. 72 in the world, well below the level of 12,616 USD in high-income countries. In 2018, R&D input accounted for 2.19% of the GDP in China, 4.53% in ROK, and 3.2% of in Japan and Germany.

In the World Intellectual Property Indicators 2018, Francis Gurry, the then Director General of WIPO, said that against the backdrop of solid economic growth worldwide, global IP filing activity set new records in 2017. China remained the main driver of global growth in IP filings. From already high levels, patent filings in China grew by 14.2%, and trademark filings by 55.2%. These high growth rates propelled China's shares of global patent filings and trademarks filing activity to reach 43.6% and 46.3%, respectively (WIPO, 2018).

In terms of patents, the number of invention patents filed in China in 2017 exceeded the total number in the U.S., Japan, ROK and Europe; invention patent applications in China ranked No.1 in the world for eight consecutive years until 2018. Regarding trademarks, China had been ranking No.1 in trademark applications worldwide for 17 consecutive years since 2002, and the number of trademark applications in China reached 5.7 million in 2018.

The drastic increase in patent and trademark applications in the recent ten years are attributable to the following reasons.

First, due to the increasing internal demand from Chinese companies and growing external pressure from developed countries such as the U.S., IP system in China has been continuously strengthened, and the scope of protection has been expanded, which now meets the protection standards of international treaties.

Second, in the recent ten years, with the improvement in its economic power and technological strength, China has developed a better understanding of the global IP system. As a result, China has taken an initiative to build up the IP system with a view to protecting rights owners, providing incentives for innovation and promoting the development of science and technology.

Third, China is positioning itself to assume global leadership in technology within the next few decades. There are three sources of competitive advantage for China's ascent in the global technology stakes: its massive domestic market, its centralized power and willingness to employ state-sponsored industrial policy and government support, and the process of

globalization that continues to transform markets worldwide. These three sources of competitive advantage offer China a path to imminent global technological leadership (K. G. L. Huang et al., 2021).

Over the past ten years, patent and trademark registrations in China have continued to explode, attracting widespread attention from the academia, industry and government departments. There is a lot of criticism against the surging patent applications and trademark registrations in China. The last few decades have seen an explosion in patent registrations in many countries. This surge has been accompanied by increasing backlogs at many patent offices, increased time periods from patent applications to decisions, problems in retaining patent examination staff, and allegations of low quality patents being granted (Van Pottelsberghe de la Potterie & Mejer, 2010). In addition to the market factors that normally drive application volume in any country, China's filings are influenced by non-market factors such as subsidies, government mandates, bad-faith filing acts and defensive countermeasures with good-faith.

Professor Vivek Wadhwa (2013), a senior associate researcher at Harvard Law School in US, criticized China's patent boom is characterized by the pursuit of quantity rather than quality. In August 2012, the European Union Chamber of Commerce in China released a report entitled "Lost in Innovation: How Do Chinese Patent Policies and Practices Impede Innovation Progress". The report pointed out that despite the explosion in the number of patents in China, the quality of patents failed to keep pace, and the overall innovation capability was overstated in China (Prud'homme, 2012).

Dang and Motohashi (2015) made a bibliometric analysis of patenting activities of Chinese large and medium-sized enterprises (LMEs). They obtained some key findings: (1) patent subsidy programs increase patent applications and grants by more than 30%; (2) patent filing subsidies encourage filing of low-quality patent applications; and (3) grant-contingent rewards stimulate firms to narrow patent claims for easier grants.

Zhu (2013) studied patent quality in the context of a large number of patent applications and identified the following characteristics regarding the number and quality of Chinese patents: (1) a large number of applications forms a contrast with a small number of authorizations; (2) the large number of patents include only a relatively small number of invention patents; and (3) the total number of invention patents is large, but the number of domestic invention patents is not large. For many years, more than half of the patentees of inventions authorized in China are foreigners; the distribution of PCT applications is extremely uneven, concentrated in some specific companies. For example, in the year 2011, the PCT applications of ZTE and Huawei accounted for 26.7% of all PCT applications in China (Zhu, 2013); the total number was high

but the average number per capita was low. As there are no standards for the quality of patents. Basically, the quality of patents should be assessed from several aspects, including the quality of application documents, the quality of the inventive step of technology, patent examination quality and economy contribution. Zhu (2013) pointed out that the rapid expansion of the number of dissertations and IP rights is an accumulation of resources, which does not represent the true capability of innovation, nor can it give enterprises a competitive advantage.

Regarding the sharp increase in the number of trademark applications and registrations in China in recent years, Mr. Liu Chuntian, said that there were seven million registered trademarks in China, but the number was 1.76 million in the U.S., 1.73 million in Japan, and less than one million in other developed countries (L. L. Zhang, 2014). “China has more registered trademarks than all the Western nations put together. But I am suspicious about what this volume means and to what extent can this be used as a criterion to assess achievements in the trademark system” (L. L. Zhang, 2014).

Mr. Cheng Yongshun, director of Beijing Intellectual Property Institute, said: “The organizing committee of the Beijing Olympic Games applied for over 800 trademarks; the organizing committee of the Guangzhou Asian Games applied for more than 2,000; and the organizing committee of the World University Games applied for over 1,200. This demonstrates some problems in Chinese people’s understanding of the function of trademarks, and the high volume of applications will put the reviewing body in trouble” (L. L. Zhang, 2014).

United States Patent and Trademark Office [USPTO] (2021) released a report on the trends and influence of non-market factors on trademark and patent development in China. China's trademark and patent filings have reached the peak point, the report said. In China, a large number of non-market factors, including government subsidies, project support, malicious trademark applications and the resulting countermeasures, have a large impact on trademark and patent applications. Without taking into account the influence of non-market factors, cross-border comparisons based solely on the raw numbers of trademark and patent applications may exaggerate the effects of China's brand creation and innovation activities. These non-market factors will weaken the driving force of the application activities of domestic and foreign registries, but at the same time expand the capacity of Chinese patent and trademark examiners and examination institutions, cause huge waste of resources, and reduce the scope of protection for legal rights holders.

China is a vast country with a large number of commercial entities, and the behavioural patterns of different subjects are very different. Besides, the level of economic development in different regions of China also differs. For example, the level of economic development in

developed coastal areas has been close to that in some developed countries, while the economic development in some inland areas is still very backward. The behaviours related to IP rights of commercial subjects in different regions and different development levels are diversified from motivation, process and result. In this context, the present study endeavours to explore the relationship between IP practices and core competitiveness of enterprises in China's developed economic regions and enterprises that have established a standardized IP management system.

Based on the above research background, the research problem of this Thesis is: as the rate of increase in patent and trademark applications in China is far beyond the rate of increase in R&D investment and GDP growth, what is the connection between Chinese companies' IP practices and business competitiveness given the dual constraints of external policies and internal resources?

To address this problem, this Thesis puts forward the following two research questions:

(1) What is the specific connection between patent capabilities and business competitiveness? Specifically, to what extent do the capabilities to create, commercialize, and protect patents contribute to the improvement of an enterprise's competitiveness?

(2) What is the specific connection between trademark capabilities and business competitiveness? Specifically, to what extent do the capabilities to create, commercialize, and protect trademarks contribute to the improvement of an enterprise's competitiveness?

1.3 Research design

The research design of this Thesis is as follows:

(1) The research problem is identified, research questions put forward, and a theoretical framework constructed based on literature review.

(2) The factors that may affect the IP capabilities of an enterprise and those that may affect the sustainable competence of an enterprise are analysed. Then a measurement model for IP capabilities and business competitiveness is built up.

(3) To unveil and analyse the connections between the IP capabilities, patent capability, trademark capabilities and sustainable competence of an enterprise, the independent variables, dependent variables and control variables are identified. After that, the measurement formula between independent variables, control variables and dependent variables is created.

(4) The survey questionnaire is designed based on literature review and the measurement model. Then questionnaire survey is carried out.

(5) Structural equation modelling is sued to further analyse the collected data and validate

the research hypotheses.

(6) The validity of the proposed views is demonstrated based on case study evidence.

1.4 Research methods

The main methods applied in this Thesis are as follows.

(1) Statistical approach

Because developed economic regions represent the mainstream of China's economic development, enterprises that have established a standardized IP management system are normal enterprises which will engage in IP practices according to market forces, rather than engaging in abnormal IP practices and abusing IP rights.

Shenzhen is not only the bridgehead of China's Reform and Opening-Up, but also the city with the most innovative vitality (China Global Television Network [CGTN], 2021). Shenzhen is home to a large number of high-tech enterprises, and it also leads the country in the number of IP rights. As of the end of 2019, Shenzhen had had more than 17,000 national high-tech enterprises, ranking second among large and medium-sized cities in China (China Daily, 2020). Besides, its investment in R&D and patent output were leading China. In 2019, Shenzhen's social investment in R&D reached RMB 132.8 billion, accounting for 4.9% of GDP, which was at the world's leading level; the number of its international patent applications reached 17,500, accounting for 30.6% of the country's total and having ranked first among major cities in China for 16 consecutive years. Shenzhen had taken the lead in forming a market-oriented science and technology innovation model characterized by efficient allocation of innovation resources. High-tech industries rapidly emerged as the first growth point of Shenzhen's economic development, and the city's innovation power had been greatly enhanced (Yi, 2020).

The Guidelines of the CPC Central Committee and the State Council on Supporting Shenzhen in Building a Pilot Demonstration Area of Socialism with Chinese Characteristics (referred to as "the Opinions" below) (August 18, 2019) clearly set out Shenzhen's three-step development goal, which is to stand in a more exuberant manner among the world's advanced cities and become a global benchmark city with outstanding competitiveness, innovation and influence by the middle of this century.

With the support of Shenzhen government, the author conducted a questionnaire survey among 219 companies in Shenzhen with a standardized IP management system regarding their IP activities and capabilities as well as the relationship between their IP engagements and business performance. After three rounds of data collection, a total of 168 questionnaires were

finally recovered, representing a recovery rate of 76.7%. Of the 168 questionnaires recovered, 156 were valid questionnaires, representing a valid rate of 92.85%. Econometric methods were used to analyse the relationship between patent application, patent commercialization, patent protection practices and core competence of enterprises, and also to analyse how the creation, commercialisation and protection of trademarks relates to the core competence of enterprises.

(2) Case study approach

To further explore the connections between IP capabilities and business performance of an enterprise, the author selected Huawei and ZTE as representative enterprises for case studies and conducted in-depth interviews with four managers in these two enterprises to get insights. The routes about how to leverage on IP capabilities to enhance the competitive advantage of enterprises are also discussed.

1.5 Thesis structure

This Thesis consists of seven chapters.

Chapter 1: Introduction. This chapter introduces the national IP strategies in the U.S., Europe and China about how to use IP as the core resource and policy to facilitate the growth of innovation capabilities and economic development from the perspective of historical development. Global increases in patents and trademark applications are introduced, and the underlying reasons analysed. On this basis, the research problem is identified, and research questions put forward. After that, the methods used in this study are mentioned, followed by the structure and main contents of this Thesis. Then research significance is touched upon.

Chapter 2: Literature Review. This chapter introduces the history and evolution of the resource-based view (RBV) and competitive advantage of enterprises. The strategic management theory, industry positioning theory, RBV, capability-based view (CBV) and knowledge-based view (KBV) are systematically reviewed. The core of the corporate strategic management is to study how a company maintains its competitive advantage; the theory of industrial positioning studies the impact of the external environment on the competitive advantage of the company; RBV and CBV focus on the impact of internal factors on the core competitiveness of the company, while KBV explains how knowledge becomes an enterprise-specific resource. As IP is a combination of innovative knowledge and legal rights, the theory of IP studies how IP becomes the most important resource for enterprises in the era of knowledge economy. On this basis, a theoretical framework for the evolution of IP and the logical relationship between IP and the business competitiveness of an enterprise is constructed.

Chapter 3: Understand Intellectual Property as a Core Resource of the Firm and the IP capabilities. This chapter first provides the definitions of IP and IP capabilities and then builds up a theoretical model on the relationships between IP, IP capabilities and the competitive advantage of enterprises.

Chapter 4: Theoretical Models of IP capabilities and competitive advantage. This chapter first focuses on the measurement model of IP capabilities and competitive advantage, then establishes a measurement model of IP capabilities and the competitive advantage of enterprises.

Chapter 5: An Empirical Study of the Relationship between IP Practices and Business Performance of Chinese Enterprises. Based on an empirical study of enterprises in Shenzhen with sound reputation of IP, this Thesis gives a positive explanation to paradoxical surge in patent and trademark applications in China, provides suggestions to enterprises regarding how to optimize the strategy of patent application, commercialization and protection as well as how to optimize the strategy of trademark registration, commercialization and protection, with a view to continuously enhancing business competitiveness.

Chapter 6: Case Study. Based on the theoretical analysis and empirical study, this chapter takes two representative companies in Shenzhen, ZTE and Huawei, as cases and discusses how their IP capabilities affect their business competitiveness. The differences in the two companies' IP capabilities indicators and the impact of such indicators on their business competitiveness are analysed. Based on the case studies, suggestions on how to improve the IP capabilities of the firms to enhance their business competitiveness are put forward. In addition, how Chinese companies could enhance their IP capabilities and improve intentional business competitiveness in the era of globalization is also discussed.

Chapter 7: Conclusions and Prospects. Conclusions of this study are drawn, limitations pointed out, and suggestions for future research lighted upon.

1.6 Research significance

This Thesis gives a positive explanation to the paradox of the surge in China's patent and trademark applications, provides suggestions to enterprises on how to optimize the strategy of patent application, commercialization and protection as well as how to optimize the strategy of trademark registration, commercialization and protection, with a view to continuously enhancing the business competitiveness. Specifically, it bears the following layers of significance.

(1) From a theoretical perspective, this Thesis introduces the history and evolution of RBV

and competitive advantage of enterprises; puts forward a definition of IP capabilities and selects three independent variables of IP capabilities; defines competitive advantages and selects four dependent variables of competitive advantages; and builds up a measurement model and a theoretical model of IP capabilities and the competitive advantage of enterprises. Notably, the theoretical model constructed makes it possible to study the correlation between IP capabilities and competitive advantages under the RBV-based framework.

(2) This Thesis opens the black box of the relationship between IP capabilities and sustainable competence of an enterprise through an empirical study based on data collected from 160 companies in Shenzhen with advantage in the field of IP. The impact on IP capabilities and competitive advantage is analysed, and the reasons for how IP capabilities affects competitive advantage are discussed. In this sense, this Thesis expands the theoretical system of RBV and CBV and helps enrich the strategic management of an enterprise from the perspective of IP capabilities management.

(3) This Thesis further validates and deepens the above research conclusions through case studies. With reference to enterprise industrial chain models, this Thesis further provides suggestions for firms to use IP capabilities to enhance their core competitiveness. It draws Chinese enterprises' attention to further strengthen IP capabilities and formulate IP capabilities development model in line with corporate strategies. This Thesis is not only conductive to explaining phenomena theoretically, but also enlightening for firms to participate in global competition.

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Chapter 2: Literature Review

This chapter introduces the historical development and evolution of RBV theory and the theory of competitive advantage of firms. The strategic management theory, industry positioning theory, RBV, CBV and KBV are systematically studied. Corporate strategic management focuses on studying how a company obtains and maintains its competitive advantage. The theory of industrial positioning studies the impact of the external environment on the competitive advantage of the company, while RBV and CBV focus on the impact of internal factors on the core competence of the company. KBV explains how knowledge becomes an enterprise-specific resource. As a combination of innovative knowledge and legal monopoly rights, IP has become the most important resource for enterprises in the era of knowledge economy. On this basis, this Thesis builds up a theoretical framework of the evolution and logic relationship between IP and the business competitiveness of an enterprise.

2.1 Theories related to business competitiveness

Some theorists (Porter, 1985, 1990; Rumelt, 1984; Rumelt et al., 1994) argue that in an environment with dynamic technology development and dynamic market, how to gain and maintain a competitive advantage is the most important issue of an enterprise's strategic management. In the past three decades, the competitive advantage theory has been analysed from the perspectives of the industry positioning theory represented by Porter (Porter, 1985) as well as RBV and CBV represented by such researchers as E. Penrose and Penrose (2009), Rumelt (1984), Wernerfelt (1984), Peteraf (1993), D. J. Teece et al. (1997) and Winter (1998)，J. B. Barney (2001), Madhani (2010). Currently, it is heading towards KBV represented by Grant (1996), D. J. Teece (2000), Winter (1998), P. H. Sullivan (1999), Steward (1991), Levin et al. (1987), Lerner (2002b) and Bently and Sherman (2014). Under KBV, knowledge has been regarded as an important resource for companies to win competitive advantages in a dynamic competitive environment. Knowledge-based business development theories are constantly being developed. In the knowledge system of enterprises, the type of knowledge that can be converted into profit is defined by scholars as intellectual property capital. Intellectual capital that can be shared and replicated in an organization is identified as intellectual assets;

intellectual property refers to intellectual assets that have acquired rights through legal procedures and are protected by law. Based on the inherent logic of knowledge, knowledge assets and IP, many scholars start to explore the inherent logical relationship and mechanism of IP as a resource of an enterprise's competitive advantage.

2.1.1 Competitive advantage theory

The research on the competitive advantage of enterprises can be traced back to Adam Smith's *The Wealth of Nations* in 1776. Adam Smith pointed out: "All the inventions of machines which greatly facilitate and reduce labor seem to have originated in the division of labor". Enterprises therefore have absolute competitive advantages through a precise division of labour and then improve the unit's production efficiency. Later, David Ricardo proposed the "comparative advantage" theory in the theory of economics (Ricardo, 1817).

The theoretical background proposed by the competitive advantage theory is a modification of the hypothesis of an equilibrium competitive market by neoclassical economics (Barca, 2017). Equilibrium competitive market under neoclassical economic theory mainly focuses on how to allocate scarce resources efficiently. It argues that a perfect competition equilibrium for resource allocation does exists and is stable. Rational brokers, decision-making independence, complete knowledge, complete certainty and complete mobility of factors are the sufficient and necessary conditions for a competitive market to be in equilibrium. Based on the above assumptions, the market is regarded as a perfect functioning machine and allocates resources spontaneously and without friction. As part of the "invisible hand" market price operating system, the company does not exist as a decision maker, but as an intermediary between resource supply and commodity demand, which looks like a black box between input and output, and only assumes the conversion function of input and output. Therefore, under the condition of equilibrium competition, when the supply and demand curves are given, the equilibrium of prices and output levels can be easily determined (Archibald, 1979).

However, in the real world, it is obvious that there are profit differences among companies in the same industry. The causes of the profit differences among companies and the formation mechanism are the common concerns of economics and management. Strategic management is the theory that analyses the relationship between enterprises and the external market environment and studies how enterprises can gain success in competition. Identifying the causes of business success or failure is a central issue in strategic management (J. Kay, 1993; Porter, 1980).

The strategic management process is a rational approach employed by entrepreneurs that companies can often use to gain strategic competitive advantage and achieve above-average returns. A firm has a competitive advantage "when it implements a strategy that creates superior value for customers and that its competitors are unable to duplicate or costly to imitate" (D. J. Teece, 2014).

2.1.2 Industry positioning theory

Before the emergence of the theory proposed by D. Teece and Pisano (1994), the strategy field was dominated by industrial economics based theories. Sustainable business performance was explained by the use of industrial economics analysis (such as Porter's Five Forces analysis) with which firms achieve sustainability by escaping economic equilibrium.

From the 1960s to the 1980s, industry positioning theory was considered to be a major determinant of a firm's sustainable business success (Hoskisson et al., 1999). Industrial positioning theory explains the dominant influence of the external environment, including economic, social, technological and political environments, on the strategic actions of firms. It believes that the company's macro choices are more important than internal management, and the industry or industry sector that participates in competition has a greater impact on its performance than the management behavior made by managers within the organization. (Bowman & Ambrosini, 2007). A company's performance is primarily determined by a range of industry attributes, including economies of scale, market entry barriers, diversification, product differentiation, the company's concentration in the industry, and market friction. The action process for obtaining above-average returns from external environment analysis is as follows: (1) learn the external environment, especially the industry environment; (2) select industries with high potential for better returns; (3) identify attractive industries (4) develop or purchase the assets and skills needed to implement the strategy; (5) leverage the firm's strengths to implement the strategy (Karabag & Berggren, 2014).

An industry is a group of companies that produce products with similar properties that can be substitutes. These companies influence each other in market competition. Often, companies use a rich mix of different competitive strategies to pursue above-average returns as they compete in a particular industry. Corporate strategic choices will be influenced by industry structure (Galbreath & Galvin, 2008).

Generally speaking, in order to obtain a better return on investment, in a specific industry, companies will study five forces that affect their profitability. The Five Forces of

Competitiveness Model is an analytical tool invented by Porter to help companies find the most profitable industries for them. The model contains multiple variables in an attempt to decipher the complexities of competing relationships. The Five Forces Model states that the profitability of a given firm in an industry is a function of the interaction between five forces: suppliers, buyers, competitors among incumbent firms in the industry, product substitutes, and potential entry into the industry (Porter, 1980, 1985).

Companies can achieve above-average returns when they can effectively study the external environment and use this as a basis for identifying attractive industries and implementing appropriate strategies. For example, in some industries, firms can reduce competitive rivalry and erect barriers to entry by forming joint ventures. Companies that develop or acquire the internal skills needed to implement strategies required by the external environment are likely to succeed, in contrast, those companies that do not develop of acquire the skills are likely to fail (Brody & Pureswaran, 2015). Hence, the external environment analysis suggests that returns are determined primarily by external characteristics rather than by the firm's unique internal resources and capabilities.

The external environment analysis also has its limitations.

Porter's Five Forces Model of Competition expands the scope of firm competition analysis. Historically, when studying the competitive environment, companies have tended to focus on the companies they directly compete with. However, businesses must conduct a broader search to identify current and potential competitors by identifying potential customers and the businesses that serve them. For example, the communications industry is now defined to include media companies, telecommunications companies, entertainment companies, and companies that manufacture devices such as smartphones (D. Sullivan & Jiang, 2010). In such an environment, firms must study many other industries to identify companies with capabilities that might be the foundation for producing a good or a service that can compete against what they are producing. As noted in the background, the characteristics of the external environment in modern times are different from historical conditions.

Research findings support the external environment analysis because approximately 20% of an enterprise's profitability is explained by the industry in which it chooses to compete. However, literature also suggests that 36% of the variance in firm profitability can be attributed to the firm's characteristics and actions (McGahan, 1999; McGahan & Porter, 2003). Thus, managers' strategic actions affect an enterprise's performance in addition to or in conjunction with external environmental influences (Foss & Klein, 2014). These findings suggest that the external environment and an enterprise's resources, capabilities and core competencies

influence the company's competitive advantages and capability to achieve strategic competitiveness.

According to Rumelt (1987), the most important source of above-average return is the uniqueness of the enterprise instead of the interrelationship within the industry. Hansen and Wernerfelt (1989) analysed the impact of economic factors including the industry variables and organizational factors on business performance with empirical study. They concluded that both factors have significant effects on business performance, that the two factors are independent of each other, and that the influence of organizational factors on corporate profitability is twice as much as that of economic factors.

Later, researchers shifted their research perspective from outside the company to inside the company. They started to explore the source and realization mechanism of the competitive advantage of the company. Amongst others, RBV and CBV are outstanding representatives of this exploration.

Above-average return RBV assumes that each organization is a collection of unique resources and capabilities whose uniqueness is the basis of its strategy and ability to achieve above-average returns (L. A. Costa et al., 2013).

2.2 Resource-based view (RBV)

2.2.1 RBV

The uniqueness of an enterprise's resources and capabilities is the basis of its strategy and competitive advantages (Jacobides et al., 2012). Penrose's resource-based theory of the firm offers another way of escaping the economic equilibrium trap. Penrose (1959) considered a firm to be a collection of productive resources, allocated among different users of resources and determined over time through management methods to determine how to achieve optimal allocation, not just an administrative unit. When we look at the operation of private enterprise from this perspective, the size of the enterprise is best measured by the productive resources it possesses and uses. A firm can increase its profits and performance by possessing scarce, desirable and hard-to-imitate products and services (E. T. Penrose, 1959).

Wernerfelt (1995) was briefly considered as "a stepping stone" in light of the RBV as he published the paper entitled "A Resource-Based View of the Firm" in 1984. This article explores the usefulness and value of analyzing businesses from a resource perspective rather than a product perspective. This paper proposes the concepts of resource location barriers and

resource product matrix. A resource is anything that can be viewed as giving a particular company an advantage or disadvantage. More formally, a firm's resources at a given time can be defined as assets that are semi-permanently related to the firm (Caves, 1980). Technical know-how, brand names, employment of technicians, trade connections, machinery and efficient procedures are all examples of resources. This paper develops a resource-product matrix to analyze a firm's resource situation and study how to make strategic choices. Looking at a company from a resource perspective yields different conclusions than traditional product perspectives. One can thus determine what are the types of highly profitable resources. (Wernerfelt, 1984).

J. Barney (1991) is generally acknowledged as the first scholar to develop the theoretical tool explanatory of RBV (Newbert, 2008). In his view, all tangible assets, capabilities, corporate attributes, know-how, brands, organizational processes, human resources, knowledge and information owned by an enterprise can be identified as resources, which are the resources that the enterprise formulates and implements strategies to improve Fundamentals of Operational Efficiency (J. B. Barney, 1986, 2001). Specifically, resources can be divided into human capital resources, physical capital resources, financial capital resources and organizational capital resources. A company's competitive advantage means that the implementation of strategies to gain above-average return cannot be replicated at the same time by other existing or potential competitors. A firm may be in one of three competitive positions: competitive disadvantage, competitive advantage, and competitive parity (J. B. Barney, 1986).

Resources are inputs into the production process of a business, such as capital, equipment, individual proficiency of employees, patents, brand name, finance and talent management. The resources themselves do not allow businesses to create value for customers as the basis for above-average returns. In effect, resources are combined to form capabilities (Shaver, 2011). Some resources of a business are tangible, while others are intangible. Tangible resources are assets that can be observed and quantified through routine ways. Production equipment, manufacturing facilities, distribution centers, and formal reporting structures are all examples of tangible resources. Intangible resources are assets deeply rooted in a company’s history that accumulate over time and are relatively difficult for competitors to analyze and imitate. Since intangible resources are embedded in unique routine patterns of a firm, competitors are difficult to analyze and imitate. Knowledge, trust between managers and employees, managerial competence, organizational practices, scientific competence, innovation, brand names, the company’s reputation for goods or services, how the company interacts with people (such as employees, customers, and suppliers), and organizational culture are intangible resources

(Anderson & Eshima, 2013).

2.2.2 An enterprise's resources and its competitive advantages

Given the heterogeneity and fixedness of resources, RBV is too abstract and vague in explaining sources of competitive advantage (Wernerfelt, 1984). Thus, J. Barney (1991) proposed a well-known VRIN analysis framework, according to which sustained competitive advantage cannot be obtained by "buying" in the open market. Not all business resources have the potential to be the basis for competitive advantage. This potential is realized when resources are precious, scarce, costly and irreplaceable. The following paragraphs will review the definitions of value, rareness, inimitability, non-substitutability and organization.

Resources are valuable when they bring opportunities to the business or eliminate threats in the external environment. E. T. Penrose (1959) identified resources as bundles of potential services. He also defined service as the result of how a company uses the resources it has. Resources are worthless unless they are used effectively. This is consistent with several other definitions of resources. When resources serve as the basis for a company to design and implement strategies that increase its efficiency and effectiveness, it creates value. Unlike traditional strengths, weaknesses, opportunities, and threats (SWOT) analysis, an attribute creates value and becomes a resource if it can exploit opportunities and/or eliminate threats (J. Barney, 1991). Valuable resources enable companies to do things that bring economic value (Fiol, 1991). Valuable resources have certain profitability and the ability to prevent losses (D. Miller & Shamsie, 1996) depending on the firm's use of the resource if: (i) they allow the exploitation of opportunities and/or the elimination of threats (J. Barney, 1991); (ii) they enable the firm to do things that bring economic value (Fiol, 1991); (iii) they have certain profitability and the ability to prevent losses (D. Miller & Shamsie, 1996). In other words, while some resources may have the potential to create valuable services, the value potential of these services remains to be realized until companies have the appropriate capabilities to deploy them (Newbert, 2008).

So what is a scarce resource? Valuable resources alone are not enough to gain a competitive advantage. For example, if most competitors have the same valuable resources, they may try to use them in similar ways and implement similar value creation strategies. Because everyone is doing the same thing, no company can gain a competitive advantage by having valuable resources (J. B. Barney & Zajac, 1994). If the resource is not scarce, then the problems of similarity and substitutability do not arise (J. Barney, 1991). They are a scarce resource only

when a few (if any) existing and potential competitors own them. Because other companies do not have access to the resource or are at a cost disadvantage in acquiring the resource compared to the company that already has the resource, the cost of imitating the resource can be high.

Does owning valuable and scarce resources sustain a competitive advantage in perpetuity? If valuable and rare resources are easily imitated, competitors quickly copy them and the potential for competitive advantage disappears. But resources are difficult to imitate if: (a) the relationship between resources and competitive advantage is unclear (Dierickx & Cool, 1989; Vergne & Durand, 2011); (b) resources are socially complex, possibly because they are beyond the ability of companies to manage and manipulate them in a systematic manner (J. Barney, 1991); (c) resources depend on paths (Dierickx & Cool, 1989; Vergne & Durand, 2011); (d) resource ownership entails legitimate property rights, such as patents (Wills‐Johnson, 2008); (e) imitating them by other firms is a lengthy process, possibly due to the time it takes to train employees or absorb the knowledge needed to master the resource (Wills‐Johnson, 2008).

Over time, many resources can be imitated or substituted. Resources are irreplaceable when there are no other identical and similar substances, that is, structural equivalents. Therefore, it is difficult to obtain and maintain a competitive advantage by relying on resources alone. However, when the four criteria of value, rareness, inimitability, non-substitutability are met, resources and capabilities become core competencies (J. B. Barney, 1997, 2001).

Compared to VRIN, Peteraf and Barney (2003) argue that competitive advantage stems from the existence of key resources, which are used more optimally. The “higher utilization” of these resources is consistent with a new approach that responds to concerns about how resources translate into competitive advantage: if VRIN resources are managed by unskilled people, it is impossible to assess their usefulness and/or benefits, and companies will be unable to properly utilize them, which will not bring any benefit to the companies (Katkalo et al., 2010).

Then the framework was updated to VRIO, which means that valuable, rare, inimitable resources and organization (VRIO) lead to competitive advantage (J. B. Barney, 1997, 2001). Competitive advantage arises from the way a firm operates and links its strategic and non-strategic resources (Pan et al., 2007), and uses organizational processes to produce what can be seen as intermediate goods between primary resources and the firm’s final product (Amit & Schoemaker, 1993). VRIO believes that it is through the internal organization of a company that resources can be transformed into competitive advantages (J. B. Barney, 1995, 1997). But what is this “organization”? Existing RBV literature does not address this point properly. Instead, the organization is seen as “something else” (Cardeal et al., 2012).

2.2.3 Limitations of RBV

RBV explains why enterprises can obtain and maintain sustainable competitive advantages from the perspective of resources and finds the driving force of enterprise development and the source of sustainable competitive advantages from the internal factors of enterprises, thus creating a new research field and forming strategic research A new branch of strategic management theory.

However, RBV still has many limitations. For example, RBV does not explain how to gain competitive advantage through resources (Priem & Butler, 2001). J. Barney (1991) uses the term "resource bundle" repeatedly, leading to references to resource integration; in VRIN, the focus is on the resource level, while in VRIO, the focus is on the function and/or usefulness of the resource. However, the unit of analysis is still a resource, equivalent to a circular argument. Thus, although resources may be valuable, rare, and difficult to imitate, priority resources cannot be a source of competitive advantage if there are any strategically equivalent resources that are not rare or difficult to imitate (J. B. Barney, 2001).

The relationship between competitive advantage and resources is difficult to clearly define, identify, separate and measure; more importantly, RBV emphasizes the analysis of existing resources, while ignoring the creation of new resources to adapt to changes in the competitive environment; it emphasizes obtaining the competitive advantage of enterprises in a balanced state, while ignoring the influence of the dynamic environment; it highlights the heterogeneity of resources while ignoring the property rights characteristics of resources. All of this destroys the value and mobility of resources in the real world. Due to the failure to elucidate the mechanisms by which resources influence competitive advantage, and the lack of empirical evidence, RBV is considered ambiguous, or even synonymous (Wójcik, 2015). As a result, competency theories consisting of core competencies and dynamic competencies continue to emerge and develop, explaining the source of sustainable competitive advantage.

2.3 Capability-based view (CBV)

2.3.1 Concept of capability

A capability is the ability to obtain a service from an asset or, in other words, the capacity for a set of resources to be made to perform a task or an activity in an integrative manner (Schilke, 2014; D. J. Teece, 2014). In fact, resources are more likely to be a source of competitive advantage only when they form capabilities (Schilke, 2014). Personal tangible and intangible

resources are combined by the company to create capabilities. Capabilities, in turn, are used to accomplish the organizational tasks required by the business to produce, distribute, and serve the goods or services that the business provides to customers to create value for them (Lin & Wu, 2014). As a basis for building core competencies and hopefully competitive advantages, competencies are usually based on developing, transferring and exchanging information and knowledge through the human capital of the company. Firms must have sufficient capacity to utilize their resources (Amit & Schoemaker, 1993). In other words, when some resources may have the potential to create valuable services, the value of these services will remain latent until the firm has the capabilities needed to deploy them (Newbert, 2008). Words, such as "enable", "contribute" or "some capacity" point to the need for something else to transform the (valuable) resource into the output that provides value.

In an attempt to operationalize the concept of valuable resources, Bowman and Ambrosini (2007) define resources in the broad sense, which include both activities and capabilities. Thus, by themselves, resources cannot be valuable (enablers of the exploitation of opportunities and/or blockers of the negative effects of threats).

Although RBV in general and dynamic capability (DC) in particular have become influential and frequently cited theories in relation to theoretical developments in the area of strategy (Kraaijenbrink et al., 2010; Lockett et al., 2009), few studies investigate in detail how resources/capabilities are developed over time (Laamanen & Wallin, 2009; Newbert, 2007), particularly in more traditional industries where there are different conditions and constraints (Easterby‐Smith et al., 2009). The resources required for competitive advantage often are not readily identifiable and some studies empirically test the most identifiable, but probably not the most important ones (Lockett et al., 2009). Competitive advantage stems from a model of how a company integrates a set of key resources. Kraaijenbrink et al. (2010) also suggest that a distinction should be confirmed between resources and capabilities, while Lockett et al. (2009) contend that researchers should make some research to understand the functionality of resources and how they relate to the markets for products/services in which companies compete.

Thus, capability is the result of how a company integrates a particular set of critical resources. Individual resources are the inputs to the capability while the capability is the "output" of how the company integrates these critical resources to the capability corresponding to the organization or the "O" of the model VRIO (J. B. Barney, 1997).

This is consistent with previous RBV literature. It can be concluded that the competitive advantage stems from a VRI capability and not from VRIO resources. The complexity of the analysed capability makes it socially complex, contributing to the reinforcement of its

inimitable characteristic. This finding is of utmost relevance for managers. The more complex capabilities that lead to competitive advantage are, in terms of bundles of resources they integrate, the more difficult it is for competitors to copy them, thus the competitive advantage will be sustained for a longer period of time (Cardeal et al., 2012).

2.3.2 Capabilities and competitive advantage of enterprises

Capabilities that can meet the criteria of valuable, rare, costly to imitate and non-substitutable are core competencies, which can lead to competitive advantages for an enterprise over its rivals. Capabilities failing to satisfy these four criteria will not be regarded as core competencies. In other words, to be a core competency, a capability must be valuable and unique from the customer's perspective. For a core competency to become a potential source of competitive advantage, it must be irreplaceable and irreplaceable by competitors.

When competitors are unable to duplicate the benefit of an enterprise's strategy, or when they lack the resources to attempt imitation, a sustainable competitive advantage will exist. The length of time an enterprise can expect to create value by using its core competencies is a function of how quickly competitors can successfully imitate a good, service or process. Value-creating core competencies may last for a relatively long period of time only when all four of the criteria discussed below are satisfied.

The capability only few competitors possessing are rare capabilities. A key question to answer when evaluating this criterion is "How many competitors have these valuable capabilities?" The capabilities that many competitors possess are unlikely to be the core competencies of any relevant company. Instead, valuable but common (i.e., not rare) capabilities are where competitors come from. Competitive advantage can only be formed if an enterprise develops and utilizes valuable capabilities that become core competencies, and these capabilities are different from those shared with competitors.

Costly-to-imitate capabilities are capabilities, if other firms cannot easily develop them (He & Li, 2006). Capabilities that are costly to imitate are created because of one reason or a combination of three reasons. Firstly, an enterprise sometimes is able to develop capabilities because of unique historical conditions. As companies grow, they often acquire or develop capabilities that are unique to them. A company that developed a unique and valuable organizational culture early in the company's history may not have exactly similar advantages over a company founded in another historical period in which less valuable or less competitively useful values and beliefs strongly influenced the development of its culture. Organizational

culture is a source of advantage when employees are held together tightly by their belief in it and the leaders who helped to create it. A second condition of being costly to imitate occurs when the link between the firm's core competencies and its competitive advantage is causally vague. In these instances, competitors are not able to clearly understand how an enterprise uses its capabilities that are core competencies as the foundation for competitive advantage. As a result, firms are uncertain about the capabilities they should develop to duplicate the benefits of a competitor's value-creating strategy. For years, firms tried to imitate Southwest Airline's low-cost strategy, but most have been unable to do so, primarily because they cannot duplicate this firm's unique culture. Complexity social phenomena of is the third reason that capabilities can be costly to imitate. Social complexity means that at least some, and frequently many, of the firm's capabilities are the product of complex social phenomena. Interpersonal relationships, trust, friendships among managers and between managers and employees, and an enterprise's reputation with suppliers and customers are examples of socially complex capabilities.

Non-substitutable capabilities are those that have no strategic equivalent. This last criterion is that no strategically equivalent valuable resources can be rare or imitable. Two valuable enterprise resources (or two sets of enterprise resources) are strategically equivalent because they each can be leveraged individually to implement the same strategy (J. Barney, 1991). In general, the strategic value of capabilities increases as they become more difficult to substitute. The more intangible, and hence invisible, capabilities are, the more difficult it is for firms to find substitutes and the greater the challenge is to competitors trying to imitate an enterprise's value-creating strategy.

In summary, only by using valuable, rare, costly-to-imitate and non-substitutable capabilities can companies have the potential to create sustainable competitive advantages. The competitive and performance implications result from the combination of the four criteria of sustainability.

2.3.3 Measurement of capabilities

Existing literature provides a rich hierarchy of capabilities. For example, Collis (1994) argues that there are first, second and third-order as well as meta and ad infinitum meta capabilities. Danneels (2002) proposed two levels of capabilities (first and second order). Winter (2000) proposed the existence of zero-level, first order and higher order capabilities while Zahra et al. (2006) classify capabilities as substantive and dynamic. They have been described also as incremental, renewal and regenerative (Ambrosini et al., 2009), or operational capabilities,

portfolios of capabilities and constellations of capabilities (Laamanen & Wallin, 2009), or as still capabilities and core capabilities (C. L. Wang & Ahmed, 2007). Given the discussion around these hierarchies of capabilities, this Thesis proposes that capabilities are organizational processes, such as skills, expertise, know-how and management, firms use to explore their resources and lower-level capabilities in day-to-day operations. They are intermediary outputs between resources, lower-level capabilities (inputs) and final products (outputs).

2.4 Dynamic capabilities (DCs)

2.4.1 Theory of DCs

Most modern industries are exposed to dynamic environments in which change occurs more or less rapidly and not always in the expected direction. The increasing number of industries undergoing dynamic change (D. Miller & Shamsie, 1996) and at an accelerated pace (Hamel & Prahalad, 1989) underpin the RBV of the firm (J. Barney, 1991; E. T. Penrose, 1959; Wernerfelt, 1984). Since 1997, studies have highlighted the importance of maintaining a competitive advantage through the mechanisms of isolation (or ownership) of valuable, rare and inimitable resources (and skills) (Espino-Rodríguez & Padrón-Robaina, 2006). Some of these views have been challenged by authors (Eisenhardt & Martin, 2000; Fiol, 1991; Langlois & Robertson, 1995; D. J. Teece et al., 1997) who pay full attention to the dynamics of markets as opposed to the static characteristic of the RBV. Different studies offer another approach to the sustainability of competitive advantage.

Dynamic Capability (DC) represents a behavioral orientation of an enterprise, that is, it continuously integrates, reconfigures, updates and recreates its own resources and capabilities, and continuously upgrades and rebuilds its core capabilities to cope with the ever-changing environment and maintain competitiveness (C. L. Wang & Ahmed, 2007). The focus is on internal processes or routines.

The concept and theory of DC was proposed by D. J. Teece et al. (1997) and attracted the attention of Adner and Helfat (2003), Eisenhardt and Martin (2000), Makadok (2001), S. G. Winter (2000), Singh et al. (2020), Rothaermel et al. (2007), Zott (2003) and Rothaermel and Hess (2007). Existing literature on DC (Helfat et al., 2009; D. J. Teece et al., 1997; Zollo & Winter, 2002) attempts to explain how firms can update existing capabilities and resources to adapt to changing business environments. The DC view explores how an enterprise's resources and capabilities evolve over time and provides a better understanding of how competitive

advantage is achieved and maintained (Ambrosini & Bowman, 2009).

What is the definition of DC concept? According to D. Teece and Pisano (1994) and D. J. Teece et al. (1997), DC refers to the competitiveness or ability of a company to create new products and processes in response to the changing market conditions. D. J. Teece et al. (1997) believe that DC refers to the ability of enterprises to integrate, reconstruct and build internal and external capabilities to adapt to the ever-changing environment, and is the origin of sustainable competitive advantages for enterprises.

Teece's core enquiry in the book and his DC theory address some of the gaps in the theory of early corporate development, such as transaction cost theory, the theory of corporate behaviour, and the evolutionary theory of the firm and strategy. In DCs, D. J. Teece (2007) draws on some of the ideas of E. T. Penrose (1959), particularly his belief that the competencies of managers and entrepreneurs should be viewed as valuable resources that can help firms gain a competitive position in the market. However, he criticizes the static approach of his model for failing to explain how a firm can maintain its resources in the event of sudden changes in the future (D. J. Teece, 2007).

D. J. Teece (2007) identified three main ways of developing dynamic capabilities: (1) exploiting opportunities; (2) identifying opportunities; (3) managing threats and reconfiguration. The first two correspond to mobilizing the necessary resources and identifying the strategic and organizational infrastructure to exploit the opportunity. The third has to do with continuously updating resources and capabilities to maintain a competitive advantage (Katkalo et al., 2010). The identification of opportunities enables us to make decisions about the direction of change.

According to D. J. Teece (2007), there is abundant evidence that the success of a business depends largely on organizational innovation, such as business model design. To enable these dynamic capabilities to be commercialized, D. J. Teece (2007) identified four micro-foundations: developing solutions and business models that are valuable to customers; choosing decision-making protocols; proposing clear boundaries that complement and control technology platforms; and Build loyalty and commitment among customers.

An organization can be confident that its strategy has resulted in one or more useful competitive advantages only after competitors' efforts to duplicate its strategy have ceased or failed. In addition, enterprises must understand that no competitive advantage is permanent. Then, why do some enterprises persistently outperform others?

Every coin has two sides. The advantages of a company in a certain situation may also be its weakness in other situations. In a high-risk and highly uncertain competitive environment, flexibility and dynamics have become the most important properties of corporate strategy

(D'Aveni et al., 2010).Therefore, how to adapt the core competence of the enterprise to the dynamic and complex environment, so as to maintain the sustainability of its competitive advantage, is a problem that CBV needs to solve. In this context, the concept of DC was proposed and continuously developed.

2.4.2 Limitations of DCs

The literature on DC focuses on conceptual elaboration work, with little empirical and case study support for this concept, implying that this is a relatively new area of knowledge (Ambrosini et al., 2009; Barreto, 2010; Di Stefano et al., 2010; W. Wu, 2010). While there is some consensus that DC is associated with the ability to develop new products and services in a changing environment, little attention has been paid to how these capabilities are developed in the existing literature. D. J. Teece (2007) proposed the concept of DC micro-foundations, emphasizing the importance of providing useful solutions when developing business models, defining corporate boundaries to manage complementary assets and platforms.

This concept applies to industries faced with rapid technological change in that it helps prevent the development of new technologies from achieving industry dominance.

The special issue of Industrial and Enterprise Change (Arora & Gambardella, 2010) features articles specific to developing countries, but none of the seven articles are empirical. However, some efforts have been made to find empirical support for developing countries. In 2009, a special issue of the British Journal of Management focused on DC with several papers on case studies and quantitative methods research in the field of pharmaceutical companies (Bruni & Verona, 2009; Macher & Mowery, 2009; V. K. Narayanan et al., 2009; Newey & Zahra, 2009).

2.4.3 Measurement of DCs

D. Teece and Pisano (1994) and D. J. Teece et al. (1997) proposed three key dimensions in their theoretical framework for dynamic capabilities: organizational and managerial process, position and paths. Different analysis dimensions include specific measurement elements and functions. S. G. Winter (2003) defined organizational capability as a set of high-level management or management, taking into account the objective existence of changes such as *force majeure* in the environment that are not related to individual or corporate behaviour and will respond to changes. The capabilities are divided into conscious DCs and reflective of ad hoc problem-solving methods. Enterprise capabilities are divided into initial capabilities (zero-

level) and high-order dynamic capabilities (high-order). Companies with higher levels of dynamic capabilities are often more flexible than those that routinely respond to familiar changes.

2.4.4 DCs and competitive advantage

D. J. Teece et al. (1997) pointed out that DCs can update the competitiveness of enterprises, thereby improving their performance, especially in a dynamic market environment. Rindova and Taylor (2002) believe that in a changing environment, DCs help companies improve management skills so that they can identify and take advantage of development opportunities and play an important role in corporate development. Lee et al. (2002) proposed that a firm's ability to identify and exploit opportunities to respond to environmental changes is a source of competitive advantage. Zahra et al. (2006) argue that the data centre impacts organizational performance through the firm's substantial capabilities, that is, the firm knows what to do, whereas relying on organizational knowledge means what the firm knows.

From the perspective of alliance function, Kale and Singh (2007) verified the role of alliance learning process in alliance function and its influence on alliance success using data from American companies. Jiang (2006) took China's ZTE as a case to explore the logical relationship between knowledge dissemination, data centre and enterprise growth. The results showed that the data centre is the driving force of enterprise growth, and knowledge dissemination indirectly affects enterprise growth through dynamic capabilities.

Compared to RBV, the difference between resources and capabilities is very clear. The source of competitive advantage in the context of DC places more emphasis on capabilities than resources, as the value of resources tends to depreciate rapidly in a dynamic market context (Collis & Montgomery, 2008). The resource still matters, not per se, but based on the configuration conferred by the DC (Cavusgil et al., 2007; Morgan et al., 2009; Prieto et al., 2009), because it is not clear that all companies are doing this even for easily accessible resources. Instead, businesses combine these resources with internal knowledge to form a complete puzzle to find valuable solutions for customers and achieve strategic and operational goals. The way these resources are interconnected as well as the most appropriate combinations and types of interconnections are relevant in DCs (N. M. Kay, 2010).

From the viewpoint of RBV, to have a competitive advantage, firms need to have VRIO resources. The unit of analysis is the resources. From the viewpoint of DCs, capabilities in the origin of the competitive advantage need to be VRI (being "O" the capability itself) (Cardeal

& Antonio, 2012). The unit of analysis is the “O”, and DCs can be seen as the “O” in VRIO according to the RBV.

To gain a competitive advantage, businesses need VRI (Valuable, Rare, and inimitable) capabilities. So, based on the previous conceptual analysis, this thesis is curious about whether the competitive advantage comes from VRIO resources or from VRI capabilities? According to RBV, the differences in company performance are primarily due to their unique resources and capabilities, rather than the structural characteristics of the companies in which they operate. The model also assumes that enterprises can acquire different resources and develop and form unique capabilities according to how to combine and use resources; unique resources and capabilities do not flow freely among companies; differences in resources and capabilities are the basis of competitive advantages (Cardeal & Antonio, 2012).

2.5 IP as resources

2.5.1 Knowledge-based view (KBV)

Knowledge, including information, intelligence and expertise, is the basis of technology and its application. In the competitive landscape of the 21st century, knowledge is a critical organizational resource and an increasingly valuable source of competitive advantage.

Technology diffusion and disruptive technologies, the information age and increasing knowledge intensity are the main three categories which can represent technology-related trends and conditions. These categories are significantly altering the nature of competition and thereby contributing to highly dynamic competitive environments (Hoskisson et al., 2019).

Starting in the 1980s, the basis of competition shifted from hard assets to intangible resources. Knowledge is an intangible resource gained through experience, observation and inference. In today's competitive landscape, the value of intangible resources, including knowledge, is growing as a portion of total shareholder value.

The Brookings Institution estimates that intangible resources contribute approximately 85% of total shareholder value (E. Sherman, 2010). A strong knowledge base is necessary for creating innovation. In fact, firms lacking the appropriate internal knowledge resources are less likely to invest money in R&D. Firms must continue learning (building up their knowledge base) because knowledge spillovers to competitors are common. In addition, companies must establish regular procedures that facilitate the dissemination of local knowledge throughout the organization for use wherever it is valuable. The history of research on the connection of

knowledge on business growth is not very long. It dates back to the publication of the *Personal Knowledge* (Polanyi, 1958) and was revisited in *The Tacit Dimension* (Polanyi, 1966) a few years later.

Drucker (1968) proposed the concept of the knowledge society and considers knowledge a kind of information that can change some people or certain things, hence the link between knowledge and information. Spender (1989) defines organizational knowledge as knowledge about the environment, resources, operating mechanisms, goals, attitudes and policies of the organization. Nonaka and Takeuchi (1995) define knowledge as the dynamic process of developing beliefs of different individuals in a population towards "truth". Davenport and Prusak (1998) give a more typical and complete definition of knowledge, they believe that knowledge is an organized dynamic combination of experience, values, relevant information and insight, and the framework formed by knowledge can continuously evaluate and absorb new experience and information. Knowledge originates from the minds of wise people and gives response to its own creation. In an organization, knowledge exists not only in files or archives but also in the procedures, processes, practices and management of the organization. Machlup (1983), Macdonald (1995) and Boisot (1998) define knowledge from the perspective of the relationship between data, information and knowledge. Among them, data are abstract representations of attributes and the relationships among things; information is purposeful and useful data, which will modify the expectations of the observer or its conditional readiness; Knowledge is a combination of information, empirical value, and insight. It is a set of expectations towards an event by an observer.

To translate the knowledge generated by R&D into commercial results, companies need to engage externally with customers and markets, and manage feedback from the wider social and institutional environment. The interaction of technology and industry is very important for the innovation ecosystem; it contributes to the creation of knowledge diversity, a defining feature of the sustainability of such systems. Today, there must be explicit recognition of the multifaceted dimensions of innovation, as well as the broader institutional context in which different forms of learning take place. The reason is simple: almost all high value-added products embody elements of science, technology and knowledge. However, science and technology are just one of many other sources of knowledge that can foster innovation-based growth. Greater emphasis should also be placed on understanding markets and organizations (Caraça et al., 2009).

From the viewpoint of management economics, knowledge can be classified in three ways: (1) from the ontological dimension, knowledge consists of personal knowledge and

organizational knowledge, the latter of which is the exchange of knowledge generated by individuals with other people to form and accumulate in the organization's knowledge network; (2) from the perspective of epistemology, knowledge consists of tacit knowledge and explicit knowledge. The former contains experience, skills, know-how and knowledge that can be obtained through practical exploration and experience but cannot be uttered; the latter is expressed in language, through books, publications, newspapers, documents, drawings and other carriers; and (3) the Organization for Economic Co-operation and Development [OECD] (1996) categorizes knowledge into four types, namely know-what, know-why, know-how and know-who. Specifically, know-how refers to the processes; know-why has to do with why things; know-what is concerned with what concepts are used; and know-who refers to who is responsible (Bernaert & Poels, 2011).

2.5.2 Intellectual capital, intellectual assets and intellectual property (IP)

The logical relationships between the concepts of knowledge assets, intellectual capital, intellectual assets and IP have become a focus of research on knowledge management. Steward (1991) demonstrated the high value-added and tacit nature of intellectual capital and defined its connotation. Intellectual capital can be considered as the most valuable assets of an enterprise, an organization, or a country. It is the sum of relevant "soft" assets known to all members of the company that can give the company a competitive advantage in the market, including the knowledge and skills of employees, customer loyalty, the company's culture, systems, and business processes, collective knowledge and experience.

Based on the above research results, P. H. Sullivan (1998); P. H. Sullivan (1999), Harrison and Sullivan (2000), Klaila and Hall (2000) and Poltorak and Lerner (2011) used the concept of intellectual capital to replace knowledge assets and link intellectual capital with corporate profits. Intellectual capital is the knowledge that can be converted into profits, including the sum of all knowledge that exists in the minds of employees. Intellectual assets are identified and proven as intellectual capital that can be shared and replicated in an organization. IP is treated as intellectual assets protected by relevant laws. Intellectual assets are a significant subset of intellectual capital, and IP is a more significant subset of intellectual assets. It is the increase of value which determines the design of management processes: filtering intellectual assets from intellectual capital and extracting IP from intellectual assets. In short, the goal of managers is to constantly discover IP.

IP is an important and unique resource for enterprises, and enterprises should use their

special resources to main competitiveness in the process of resource integration, reconstruction and acquisition. This is exactly the problem that research of IP management needs to solve in the current dynamic market environment (Eisenhardt & Martin, 2000).

2.5.3 The impact of IP system on economic growth

The different types of IP, including patents, copyrights, trademarks and various other similar legal rights, were traditionally viewed as state protections of natural or moral rights. Today, however, IPRs are recognized as an important economic mechanism, an "intellectual currency" of sorts (Kumar & Al-Ausi, 2022), that encourages R&D, creation and innovation in several significant ways (Guellec, 2007).

IPRs promote innovation by providing the legal and economic framework for market-based incentives and rewards that pay for R&D; support the promotion and distribution of the innovations that are thus developed in the form of products, services and processes in the market; promote cultural expression and diversity; make technologies widely available through the mechanism of licensing; increase the society's overall state of knowledge through the information disclosed in patent applications and publications; promote technology transfers; and broaden the dissemination of government-funded R&D.

The link between intellectual property protection and economic growth is achieved through innovation. Therefore, IP protection is important for innovation. In addition, innovation is also important for economic growth. In this sense, IP protection is critical to economic growth. Countries tend to acquire improved technology through a variety of channels, including domestic innovation, international trade, foreign direct investment (FDI), licensing, imitation and piracy. From a cross-country economic growth perspective, results may vary. Several empirical studies have investigated the impact of the IP system on cross-country economy growth.

Gould and Gruben (1996), with the utilization in their regression the IP measure of Rapp and Rozek (1990), set up a growth model on a cross-section of up to 95 countries using data averaged over the period 1960-1988. They found that IP protection has a significant positive impact on economic growth.

Gould and Gruben (1996) tested whether intellectual property protection had different effects on growth in open and closed economies by comparing a measure of intellectual property with three measures related to national trade through an empirical study. Their results suggest that for open economies, intellectual property protection can have a slightly larger

positive impact on economic growth. However, the coefficient is significant for only one measure, and even then its significance is not reliable for inclusion of other variables.

Thompson and Rushing (1996) used a switching regression model to test whether it would be more beneficial to increase IP protection (more specifically, patent protection) once a country has reached a threshold of development measured by initial GDP per capita. The results suggest that the initial level of GDP at $3,400 was a turning point. For countries below this level, there was no relationship between IP protection and growth; however, for countries above this threshold, a positive and significant relationship was identified.

In their extended study, Thompson and Rushing (1999) utilized data from 55 countries and used regression techniques on cross-sectional data from 1971 to 1990. They concluded that, for relatively rich countries, IP protection had a positive impact on the country's TFP, which in turn had a positive impact on economic output growth.

How could IPRs affect the process of economic development and growth is complex and subject to multiple variables (Maskus, 2000). IPRs can play a positive role in encouraging new technology creation and business development, leveraging inefficient industries, and guiding technology acquisition. They can increase imitation costs and allow IPR owners to engage in monopolistic behaviour, hurting development prospects. Potential gains and losses depend on the competitive structure of the market and the efficiency of relevant business regulation, including aspects of competition policy and technological development policy.

Therefore, the modern IP systems are not sufficient to encourage efficient technology transfer. Rather, they must be part of a coherent and broad set of complementary policies to maximize the potential of IP to enhance dynamic competition. These policies include enhancing human capital and skills acquisition, promoting flexibility in business organization, ensuring strong competition in domestic markets, and establishing transparent, non-discriminatory and effective competition systems.

Initially, when a country has a low level of economic development, the technological capabilities will not be able to reach a level that allows for creativity, so the focus will be mainly on imitating foreign technology, so a low-level IPR Protection policy is appropriate. However, when technological capabilities increase to a certain level, enhanced protection is needed to encourage domestic innovation activities.

Falvey et al. (2004) used five-year panel data from 80 countries to explore the impact of intellectual property protection on economic growth. By combining the IP protection index with a standard empirical growth model, they found a positive and generally significant relationship between the strength of a country's IP protection and its economic growth rate. Threshold

regression models are used to test whether the relationship between intellectual property protection and economic output growth depends on a third factor. Their findings show that the relationship between intellectual property protection and economic growth depends on the level of economic development and is represented by initial GDP per capita. In low- and high-income countries, stronger intellectual property protection was found to significantly boost growth; however, no such relationship was found in middle-income countries. Results in high-income countries were largely in line with expectations, as innovation activity in these countries was very high. Therefore, in order to encourage further innovation, innovators should be allowed to reap the economic benefits of their inventions. By contrast, in low-income countries, strong intellectual property protection encourages foreign merchandise imports and foreign direct investment inflows, thereby encouraging growth without compromising domestic imitation activity. Middle-income countries do not engage in innovation and instead rely heavily on imitation for their development. The lack of link between intellectual property protection and economic growth in these countries may reflect two opposing forces. The positive impact of intellectual property protection on growth through international trade and foreign direct investment is being offset by the negative impact of slowing the spread of knowledge and deterring imitation. They also did not find any evidence of a negative relationship between IP protection and economic growth, despite a lack of evidence for a significant relationship between IP protection and growth in middle-income countries.

Y. M. Chen and Puttitanun (2005) argue that IP protection affects developing countries because it encourages domestic innovation as measured by patent filings. Domestic innovation has a U-shaped connection with gross national product (GNP) and IPP. Maskus (2000) and Braga et al. (2000) also note that there may be an empirical U-shaped curve between IPRs and GNP per capita.

An empirical study of 64 developing countries (1975-2000) showed the same results as earlier studies on the impact of IPRs on economic growth (Y. M. Chen & Puttitanun, 2005). The authors concluded that IP protection does not affect economic growth independently or directly, but rather interacts with variables such as trade openness, national competitiveness, IP indices, human capital, foreign direct investment and government policies.

Furukawa (2007) argues that in the endogenous growth model without cost imitation, IP protection may not promote economic growth. In other words, “the stronger the better” is not correct. Not all empirical studies show evidence that there is a positive impact on IPRs protection and growth.

Furukawa (2007) pointed out that the relationship between intellectual property protection

and innovation exhibits an inverted U shape when the impact of accumulated experience on productivity is large enough. Furukawa (2007) advises not straining IP protection as a growth-promoting policy. Because of the inverted U-shaped link between IP protection and growth, protection that is too weak or too strong can harm innovation activity and the resulting economic growth. Therefore, a balanced approach is needed to gain insight into the role of IP protection in economic growth, a topic frequently discussed in public policy discussions. Furthermore, if the natural imitation rate determined by economic fundamentals is low enough, the equilibrium growth rate can be maximized without IP protection. Thus, in countries with uncertain imitation rates, the preferred growth-promoting policies may vary; in countries with little imitation, there is no need to protect IPRs for innovation and economic growth (Furukawa, 2007).

Yasuda and Kato (2007) endeavoured to understand how strengthening of IPR protection is related to national economy in an evidence-based study. IP protection has always played an important role in China's on-going opening-up policy and economic reform. The underlying logic may be that vibrant national economic growth coupled with strengthened IPR protection can attract foreign players to seek patent protection in the hope of controlling and profiting from the local market. However, the above literature review does not lead to a safe conclusion as to the impact of IPR reforms on China's national economy.

Azevedo et al. (2012) confirmed some gaps in research based on a thorough review of existing literature. In general, existing research does not address the direct and net impact of IPR on economic growth. In fact, it has only analyzed the relationship between IPR-induced factors and economic growth, or the effect of IPRs on other economic indicators such as welfare, technological change, FDI, R&D and innovation. This happens because a standard argumentation is adopted, maintaining a strict relation between these elements and economic growth.

In conclusion, existing studies do not point to a clear connection between IPRs and economic growth. IP protection can have positive, negative or even inconclusive effects on innovation.

2.5.4 IP as a key driver of global economic development

IPR is a strategic resource for countries and companies, in advanced as well as catching-up contexts, either in growth times or in cycles of macroeconomic turmoil (Mendonça, 2014). The research results and statistics of the U.S., EU and China all verified this viewpoint.

According to a 2016 report, IP-intensive industries continue to be a significant and growing segment of the U.S. economy. These IP-intensive industries directly created 27.9 million jobs in 2014, an increase of 0.8 million from 2010. In contrast, the value added of IP-intensive industries increased substantially between 2010 and 2014, both in total and as a share of GDP. IP-intensive industries generated $6.6 trillion in value added in 2014, an increase of $1.5 trillion (30%) from $5.06 trillion in 2010. Correspondingly, the share of IP-intensive industries in total U.S. GDP increased from 34.8% in 2010 to 38.2% in 2014. According to the 2021 report, IP-intensive industries continue to play an important role in the U.S. economy in terms of output as measured by gross domestic product (GDP) and employment. In 2019, IP-intensive industries contributed $7.8 trillion to GDP. After adjusting GDP for general price increases (i.e. inflation) over the 2014-2019 period, GDP attributable to IP-intensive industries grew by about 12%, or 2.3% annually. From an employment perspective, IP-intensive industries provided 47.2 million jobs in 2019. Compared with 2014, direct employment in these industries increased by about 7%. Relative to the U.S. labor market, the share of direct employment in IP-intensive industries stabilized at 33% between 2014 and 2019 (Toole et al., 2021). Innovation is a key component of the growth strategies adopted by the European Union (EU) and its member states, as well as many other countries, and an effective intellectual property system is undoubtedly one of the most important factors in creating a more competitive economy. The European Union Intellectual Property Office (EUIPO) and the European Patent Office (EPO) joined forces in a 2013 study to quantify the economic contribution of IP-intensive industries to the EU economy. The first joint study conducted in 2013 showed that IP-intensive industries accounted for 39% of EU economic output and 26% of employment in the 2008-2010 period, demonstrating the value of IP to the European economy. The study was repeated in 2016, covering the period 2011-2013. The results show that even during the severe financial crisis and recession in most of Europe, IP-intensive industries have coped better with difficult conditions than the rest of Europe. economy. The study, updated in 2019, showed that IP-intensive industries have a higher share of EU employment and GDP than the 2016 study, confirming the growing centrality of intellectual assets in modern economies. According to the report entitled “IP-Intensive Industries and Economic Performance in the EU 2019”, between 2014-2016, IP-intensive industries created 29.2% of all jobs in the EU, of which patent-intensive industries accounted for 11% and design-intensive industries accounted for 11%. Industry accounted for 14%, trademark-intensive industries accounted for 22%, copyright-intensive industries accounted for 5.5%, and geographical indication-intensive and PVR-intensive industries accounted for a smaller proportion. On average, these industries employed nearly 63 million

people in the EU during this period. IP-intensive industries contribute to economic output as measured by gross domestic product (GDP). Overall, nearly 45% of EU GDP comes from IP-intensive industries, of which 16% are patent-intensive, 16% are design-intensive, 37% are trademark-intensive, and 7% are copyright-intensive, GI-intensive industries account for a smaller proportion of PVR-intensive industries, worth 6.6 trillion euros. They also account for most of the EU's trade with the rest of the world and generate a trade surplus, helping to keep the EU's external trade roughly balanced (European Union Intellectual Property Office [EUIPO], 2019). The IP strategy has also greatly contributed to the speed and quality of China's economic development. According to statistics from the State Intellectual Property Office, from 2010 to 2014, the total output value of patent-intensive industries contributed RMB 26.7 trillion accounting for 11.0% of China's GDP. In terms of profitability, the average asset contribution rate of patent-intensive industries is 15.4%, which is 20% higher than that of non-patent-intensive industries.

From the experience of the U.S., the EU and China, the IP strategy of a country or a region must serve the marketing players and be consistent with the market players' business strategies. To create a good domestic and international environment for market players, each country seeks cooperation in competition and promotes the development of science and technology, economic progress and international influence through IP protection.

2.5.5 IP as an important source of value creation for enterprises

More and more companies treat IP as a core business asset, strategically manage and value it with a view to generating returns through active licensing (Arora et al., 2004; Gambardella et al., 2007; Lichtenthaler, 2009). Patents, in particular, are increasingly used as collateral for bank loans by patent holders, and as investment assets by financial institutions (Kamiyama, 2005; Otsuyama, 2003). Small enterprises, newly-established or research-oriented firms depend on IP to generate revenue and use IP to obtain financing, including venture capital investments (WIPO, 2011b). Beyond patents, business models and firm strategies tend to rely on complementary protection of trademarks, designs and copyright, although this trend and the complementarity to patent use are harder to quantify (WIPO, 2011b).

Innovation and creative endeavours are indispensable elements that drive economic growth and sustain the competitive edge of the U.S. economy. The U.S. has been the world leader in innovation. American companies have relied on IP as one of the leading tools with which such advances were promoted and realized. Patents, trademarks and copyrights are the principal

means to establish ownership rights to the creations, inventions and brands that can be used to generate tangible economic benefits to their owner (Antonipillai & Lee, 2016).

Investments in intangible assets often exceed investments in physical assets at the company level and at the country level. These intangibles have become a primary source of value creation and wealth (Corrado et al., 2006; Hulten & Isaksson, October, 2007; WIPO, 2011b).

To understand what precisely generates value in global value chains requires an analysis of how much income accrues to labour, tangible capital and intangible capital used in global value chain production. Economists Wen Chen, Reitze Gouma, Bart Los and Marcel Timmer performed precisely such an analysis. First, they assembled macroeconomic data on value-added shares in 19 manufacturing product groups spanning 43 economies plus one rest-of-the-world region which together captured around one-quarter of global output. Their data allowed them to divide global value chain production into three stages: distribution, final assembly and all other stages. As a second step, W. Chen et al. (2017) decomposed value added at each stage and in each country into the incomes accruing to labour, tangible capital and intangible capital. They did so by first subtracting labour income and imputed tangible capital income from value added, relying on available data on wages, employment, tangible capital asset stocks and an assumed rate of return on tangible capital of 4%. The remainder then represents income from intangible capital.

Turning to the research findings, from 2000 to 2014, the share of intangibles averaged 30.4% throughout this period, almost two times the share of tangibles. Interestingly, the share rose from 27.8% in 2000 to 31.9% in 2007 but has stagnated since then. Overall, income from intangibles in the 19 manufacturing industries increased by 75% from 2000 to 2014 in real terms. It amounted to 5.9 trillion USD in 2014 (WIPO, 2011a).

Then, for which product did the global value chains use intangibles most intensively? In 2014, for all product groups of the 19 manufacturing product groups in descending order of their global output size, intangible capital accounts for a higher share of value added than tangible capital. The intangibles share was especially high – and more than double the tangibles share – for pharmaceutical, chemical and petroleum products. It was also relatively high for computer, electronic and optical products. In terms of absolute returns, the three largest product groups – food products, motor vehicles and textiles – accounted for close to 50% of the total income generated by intangible capital in the 19 manufacturing global value chains.

Formal intangible assets such as technology, designs and brands are important in helping participants in the chain appropriate returns to their innovation investments. These intangible assets are usually protected by formal IP rights such as trademarks, copyrights, patents, utility

models, industrial designs, and trade secrets. IP and other intangibles add twice as much value to products as tangible capital) (WIPO, 2017b).

The importance of brands, and thus trademarks, as intangible assets is universally acknowledged by both business practitioners and the marketing literature (Bharadwaj et al., 2011; Day, 2011; Kallapur & Kwan, 2004; Morgan & Rego, 2009; Urwin et al., 2008; Yarbrough et al., 2011).

Research provides evidence for the positive impact of strong brands and customer loyalty on company value, revenues and profits (Askenazy et al., 2016; Cobb-Walgren et al., 1995; Keller, 2011; Simon & Sullivan, 1993). Economists have also found a positive correlation between trademark use and firm value, but the causality is difficult to establish. Schautschick and Greenhalgh (2013) found that higher trademark intensity was positively associated with productivity growth in the service sector, but the results are not significant for manufacturing firms.

Good reputation and image boost customer loyalty and the ability to command premium prices. In addition, a company can use the reputational advantage of a brand to not only extract a premium price but also grow market share, and therefore its revenue stream, at the expense of its competitors (Kashani et al., 2000). The associated additional earnings can help finance long-term investments, including R&A (Askenazy et al., 2010).

Patents, standards and their combination, standard essential patents (SEPs), are important in emergent high-tech complex product system industries such as in the information and communication technology (ICT) sector (in particular, in mobile communication), automated electric mobility systems, health and wellness technologies, etc. SEPs retain a higher share of added value domestically, and that absorptive capacity is needed to join global ICT value chains (GVCs) (Von Laer et al., 2022).

The trade effect of SEPs on China is different from that on mature economies because of their initially low value, though China entered the SEP market late and is catching up rapidly. Pohlmann et al. (2020) provide the most recent data on SEPs related to 5G and the most recent mobile communication standard following LTE (known as 4G). The new data on SEPs related to 5G confirm that the role of China as a game changer in mobile communication technologies already started before 2010 related to LTE (Pohlmann et al., 2020).

According to Von Laer et al. (2022), standards may hold less relevance for developing countries. When trying to “emerge” to become a developed country, developing a long-term strategy for standardisation is even more important. Kang and Motohashi (2015) address the importance of active participation in standardisation with respect to SEPs, as experienced

standardisation experts are more likely to successfully declare their patents as standard essential. Deng et al. (2022) empirically investigated the financial market's reaction to firms' participation in standard setting organizations (SSOs) in terms of firms' implied cost of equity capital, the discount rate that investors apply to the company's expected future cash flows.It shows a significantly lower cost of equity for SSO participants. They empirically documented a causal link between SSO membership and a firm's cost of equity by exploiting exogenous variations in membership count linked to SSO closures and an instrumental variable measuring SSO availability. Firms' ICE was reduced due to participation in SSOs to collaboratively develop technology standards (Deng et al., 2022).

Buggenhagen and Blind (2022) identified strong correlations among the publication, patent and standard contribution counts of companies offering fair, reasonable and non-discriminatory (FRAND) licensing conditions related to SEPs. They suggest that 5G technology developing companies holding a high number of 5G patents manage the three contributing factors of publishing, patenting and standardization to optimize their impact on 5G technology development. Patenting and standardization are dominated by a few large companies from the U.S., China, ROK, Japan, Finland and Sweden, while publishing is much more globally distributed and not as concentrated (Buggenhagen & Blind, 2022).

It is difficult for the owner and licensee of SEPs to reach an ex-ante agreement on royalties by negotiation when FRAND is a loose commitment. The royalty dilemma of SEPs is a topic of great interest to scholars and managers. This study indicates that it is the dual nature of shareability and private right instead of public ownership and exclusiveness that causes the dilemma of royalties of SEPs (Xiao et al., 2018).

2.5.6 Complex and diverse impact of the IP system on economic growth

IP protection is a policy initiative that provides incentive for undertaking creative and innovative activity. IP laws enable individuals and organizations to obtain exclusive rights to their inventive and creative output. Ownership of intellectual assets limits the extent to which competitors can free ride on problem-solving and related information, enabling owners to profit from their efforts and addressing the appropriability dilemma at its heart.

IP rights are an elegant means for governments to mobilize market forces to guide innovative and creative activity (Inniss, 2012). They allow innovative opportunities to be taken in a decentralized way. To the extent that individuals and firms operating at the knowledge frontier are best-informed about the likely success of innovative projects, the IP protection

system promotes an efficient allocation of resources for inventive and creative activities.

Traditionally, this has been the key economic rationale for protecting IP rights. However, there are a number of additional considerations, some of which strengthen the case for exclusive rights, while others weaken it.

Firstly, while IP rights do not directly eliminate the risk associated with inventive activity, they can improve the functioning of financial markets in mobilizing resources for risky innovation.

Secondly, invention sometimes means finding solutions to independent problems. Thirdly, the IP system promotes the specialization of firms at different stages of the innovation process.

Economic theory argues that specialization occurs wherever the transaction cost of providing specific goods or services through the market is lower than the costs of coordination within a single organization. Specialization of the innovation process depends on the technology market.

Compared to markets for standardized commodities, technology markets face especially high transaction costs in the forms of information, search, bargaining, enforcement and related costs.

To some extent, IP rights can reduce these costs. In the absence of patent rights, for instance, firms would be reluctant to disclose secret but easy-to-copy technologies to other firms when negotiating licensing contracts. As a result, licensing agreements from which all parties stand to benefit might never materialize. In addition, while inventive and creative assets can, in principle, be transferred through private contracts independent of any IP right, IP titles offer a delineation of these assets combined with an assurance of market exclusivity. IP rights thus convey important information that can facilitate the drawing up of contracts and reduce the uncertainty of contracting parties as to the commercial value of the licensed assets.

Fourthly, the grant of exclusive IP rights affords firms market power, viewed by economists as the ability to set prices above marginal production costs.

However, market power also implies a non-optimal allocation of resources, moving markets away from the economic ideal of perfect competition. Above-marginal cost pricing can raise social concerns, as witnessed by the debate on patents and access to medicines. It can also slow the adoption of new technologies, with follow-up effects on economic productivity. Finally, scholars have long recognized that the existence of economic rents may promote rent-seeking behaviour with wasteful or outright harmful consequences.

The foregoing discussion reveals that IP rights have multiple effects on innovative behavior. Understanding their net effect ultimately requires empirical insights.

2.5.7 IP system and competitive advantage

According to early economists such as Samuelson (1955) and Arrow (1962), unlike private products such as land, labour and capital, knowledge is regarded as "public good". It is theoretically infinite, and the use of knowledge by one person cannot exclude the use by others. S. G. Winter (1987) proposed the idea that knowledge is a strategic asset and believed that knowledge was closely related to corporate capabilities. Knowledge was increasingly seen as private property related to corporate profits. D. J. Teece (1998) believes that a firm's competitive advantage comes from the creation, protection and commercialization of its inimitable intellectual assets with legal ownership (including tacit and explicit knowledge). The high performance of enterprises depends on the innovation, protection and utilization of intangible knowledge assets. The profitability of technology-intensive companies is increasingly seen to be largely determined by knowledge as a fundamental asset.

Globalization, time constraints and technology integration have created a turbulent technology and market environment for many organizations (S. Narayanan & Gulati, 2002). To understand how companies gain and maintain a competitive advantage in such an environment, knowledge management has been widely regarded as the core activity of enterprises in recent years (Grant, 1996; McGaughey, 2002; D. Miller & Shamsie, 1996; D. J. Teece, 2000). An important direction of knowledge management was formed, which is the idea of obtaining value-based resources, focusing on how companies could form their own outstanding of management and organizational processes through the unique combination of knowledge and tangible resources to obtain sustainable competitive advantages (Zollo & Winter, 2002).

Inspired by the classification of tacit and explicit knowledge by Polanyi (1958), Nelson and Winter (1982) conducted a study and found that over time, the interaction between explicit and tacit knowledge can lead to business excellence. Grant (1996) also believes that knowledge is the most important strategic resource of an enterprise, and it is also the core of typical traditional researches such as learning organization, technology management, and management cognition improvement. M. Sullivan (2001) believes that an enterprise's intellectual asset management strategy includes two aspects: value creation and value extraction, focusing on how the enterprise extracts value from intellectual capital and obtains a competitive advantage. Research by D. J. Teece (2000) shows that firms' competitive advantage increasingly depends on their ability to create, transfer, exploit and protect intellectual assets that are difficult to replicate, and especially difficult to trade. However, in stark contrast to the past era when physical assets were the source of competitive advantage, knowledge and intellectual property

have become core sources of competitive advantage, which poses enormous management challenges. Knowledge, especially organizational knowledge, is not easy to buy and sell, and can usually only be created and developed by businesses themselves. A variety of knowledge is combined to reflect its value.

In terms of empirical research, Nonaka et al. (1995) analyzed the reasons for the success of Japanese companies, arguing that Japanese companies should owe their success to the continuous innovation in the areas of automotive, consumer electronics, sewing machine and air-conditioning equipment industries, and gain competitive advantages. There are two ways utilized by Japanese companies to achieve continuous innovation: one is to foresee the dynamic changes of market, technology and product competition; and the other is to obtain knowledge from the outside for widespread sharing and storage within the organization and to develop new technologies and new products widely used by people. Spencer (2003) conducted an empirical study in the field of LCD and PDP technology to explore how the degree of knowledge sharing among companies in this emerging industry relates to their innovation systems and innovation performance. The results showed that companies that share technical knowledge with innovation systems (including competitors) have a better chance of winning better innovation performance than those that are unwilling to share knowledge. In addition, companies that participate in and act actively in the global innovation system have a better chance of winning better innovation performance than companies which only operate in the national innovation system.

Academic research on the logical relationship between IP rights and corporate competitive advantage has been carried out from two perspectives. Firstly, from the perspective of the connection between innovation and competitive advantage, IP rights are considered as the institutional factor for enterprises to seek competitive advantages through innovation. Enterprises rely on the protection of the IP system to win the results of innovation and to seek sustainable competitive advantages. Secondly, from the RBV/CBV perspective, IP is considered as the origin of corporate competitive advantage, which means IP is the source of motivation for enterprises to seek and maintain competitive advantage in the knowledge economy society.

Landau and Rosenberg (1986) as well as Rogers and Allbritton (1995) drew a conclusion on invention and innovation based on literature review that invention refers to a new product or process which is created for the first time, while, innovation, including product innovation and process innovation, refers to the first use of a new product or process. Innovation is an important source of motivation for business competition and national economic growth (Porter,

1980, 1990). However, even if innovation is obviously necessary, not all companies are pursuing a positive innovation strategy. This phenomenon is partly due to the influence of external factors which affect the strategic choices and benefits of enterprises. The motivation of a company to engage in innovation activities depends on the profit which will be contributed by the investment of innovation. It is well accepted that patents can realize the function of protecting the intangible assets of a company which will be easily copied and shared with minimal marginal costs. Without patent protection, other producers can easily copy innovations and steal innovations without paying any sunk costs. Infringement and piracy will reduce firms' innovation earnings, thereby undermining their innovation drive (Allred & Park, 2007). Empirical research by Kanwar (2007) shows that the intensity of intellectual property protection has a positive impact on innovation.

Several studies have attempted to generate quantitative evidence on the importance of patent protection. A study by Arora et al. (2008) used detailed data on firms' innovation activity and patenting behavior to estimate the so-called patent premium, which is defined as the increased business value a firm adds to the acquisition of patent rights. The study's methodology takes into account that patent decisions are not random, as companies only seek patents for inventions that can be expected to generate a net benefit. The results show that the premium for patented inventions is close to 50%. Patent premiums vary widely across sectors, being highest in medical devices, pharmaceuticals, and biotechnology, and lowest in food and electronics. The results also show that large firms receive higher patent premiums; one possible explanation for this finding is that large firms are more capable of exploiting and enforcing patents than smaller firms. The study also investigated whether the prospect of obtaining patent rights would lead companies to invest more in research and development. A study by Qian (2007) focused on the experience of 26 countries in introducing drug patent protection between 1978 and 2002. The study found that patent protection had no impact on all countries but had a positive impact on more developed and more developed countries, with a high level of education. Similar conclusions also can be drawn from a closely related study by Kyle and McGahan (2012).

The study found that companies with patents were more likely to receive financing from venture capitalists than those without patents. Recent surveys in the U.S. suggest that this applies to small companies rather than large ones. Two important studies on venture capital financing of US semiconductor firms show that patent applications not only convey important information to investors about the quality of inventions, they also help firms attract funds in the earlier stages of financing (Greenberg, 2013). In the meantime, the importance of patents in

facilitating access to finance differs by industry, with, for example, patents playing a more prominent role in health care-related technologies than ICTs (Graham et al., 2009).

Hall and Ziedonis (2001) conclude that proactively building up large patent portfolios of the semiconductor companies will help them earn competitive advantage. One motivation for such portfolios is to ensure an enterprise's freedom to operate in its innovation space and pre-empt litigation. In fact, the study reveals that the large-scale and capital-intensive manufacturers most vulnerable to holdup, for example, through preliminary injunctions, invested most aggressively in securing patent rights. A second motivation for creating these portfolios is to strengthen an enterprise's bargaining position vis-à-vis its competitors. Particularly, an enterprise owning many patents in a crowded technology space can pre-empt litigation by credibly threatening to countersue competitors. In addition, it is in a better position to negotiate favourable cross-licensing arrangements that are often needed to commercialize new technologies (Cohen et al., 2000; Sichelman & Graham, 2010).

How does patent system influence the competition-innovation relationship? On the one hand, one may argue that patent rights foster a healthy competitive balance. They prevent competition of the free-riding type that undermines the appropriation of R&D investment. But they permit competition between substitute products, each of which may be protected by different patent rights. In addition, certain features of the patent system directly promote competitive market forces: the disclosure requirement of patent document enables firms to learn from the inventions of rivals; and the limited protection term ensures that the economic rent associated with a patent is time-bound, inducing firms to stay ahead by constantly innovating. On the other hand, patent ownership can, in certain situations, significantly curtail competition, while in some key technical fields with few alternatives, rare patent rights will lead to a concentrated market structure because of the legal monopoly effect of patent rights. Where patent rights overly restrict competition, society loses twice, first through higher prices and less choice in product markets, and then through insufficient competitive pressure on firms to innovate.

However, in the past three decades, there are still controversies about the logical relationship between IP and innovation among the scholars, especially the logical relationship between patent protection and innovation. This is because in addition to patent protection, inventors have multiple ways to get returns from innovation, such as time leadership, goodwill, sales and service capabilities, rapid reduction of learning curve and trade secrets. Research by D. J. Teece (1986); D. J. Teece (1998) shows that the degree of protection of innovation achievements by law or other mechanisms will affect the way of the utilization of innovation

and the profit rate of enterprises. When imitation is relatively easy with impunity, or market mechanisms are not robust, the profits of innovation often depend on specific complementary assets held by owners, rather than IP rights. Park and Ginarte (1997) and Lerner (2002a) demonstrate that there is a mutual-directional connection between IP protection and innovation with empirical research of multi-national data. Not only does IP protection affect innovation, but the degree of IP protection also determines innovation to a large extent. Because of the lack of innovations, the developing countries usually try to get profit from imitating the innovation of foreign countries and often provide weak protection of IP. In comparison, developed countries have a lot of innovations that need to be protected, hence strong IP protection.

Levin (1986) argues that, inconsistent with theoretical assumptions, knowledge is not flowing freely even without the protection of IP law in practice. The disclosure of patented technology does not guarantee adequate dissemination of knowledge, strong patent protection only provides motivation to the right holders to obtain intangible property rights by applying for patents while urging innovators to make additional efforts to realize the invention first, thereby leading to additional consumption of social welfare. In fact, non-patent protection ways can provide effective incentives of innovation because of the complexity of technology, the high cost of complex reverse engineering and the steep learning curve (Levin, 1986). Levin et al. (1987) found through an empirical study of 650 U.S. companies that companies generally are not aware that patent protection provides more contribution to their innovation gains and competitive advantage compared with technological secrecy, lead time advantages, quickly reduce learning curve and sales or service work. Nevertheless, throughout the 1990s, the number of patent applications in the U.S., EU and Japan rose sharply, and the enthusiasm for patent applications of companies increased year by year, which reflect a fierce competition of patent application and patent protection.

Based on a questionnaire survey among 1,478 R&D labs in the U.S. manufacturing sector in 1994, Cohen et al. (2000) found that firms typically protect the profits of inventions through a range of mechanisms, including patents, trade secrets, the advantage of fast delivery, and the use of superior marketing and manufacturing capabilities. Of these mechanisms, however, most manufacturing companies tend to place the least emphasis on patents, while confidentiality and lead times tend to be the most important. After comparing these findings with earlier findings by Levin et al. (1987) show that large firms may now rely more on patents than they did in the early 1980s. To protect product innovation, most industries seem to be taking trade secret protection more seriously than ever before. They conducted a special survey of the motivation for patent application and utilization, and the results showed that the reason why companies

apply for patents is usually not to obtain direct profit from the commercialization or licensing of patented innovations. In addition to preventing copying by competitors, the most prominent patent motivations include preventing competitors from filing patent-related inventions (such as patent blocking), using patents in negotiations, and preventing litigation. They found that companies file patents in discrete product industries such as chemicals, often for different reasons than in complex product industries such as telecommunications equipment or semiconductors. In the former case, companies often appear to use their patents to discourage competitors from developing alternatives, while in the latter case companies are more likely to use patents to force competitors to negotiate.

The patent purposes of enterprises in different industrial technology backgrounds are different (Levin et al., 1987). Mazzoleni and Nelson (1998) conducted an empirical study of IP performance and concluded that the effect and performance of IP will be different according to the nature of the industry, the equity structure and the size of the enterprise. No general conclusions can be drawn.

The role of IP as an institutional system on the competitive advantage of enterprises has been extensively studied in the recent three decades. Based on the theories of knowledge, knowledge assets and IP as well as the inherent logic of knowledge, many scholars have begun to explore the logical relationship and reaction mechanism between IP and competitive advantage from the perspective of regarding IP as a resource of enterprise.

Borg (1996, 2001) examined the evolution process of the value of IP from the perspective of the internal connections between information, knowledge and IP and concluded that IP is a product of free and independent minds at the beginning, instead of a product of institutional system. In the market, IP is often regarded as the intangible knowledge and information which can be utilized by enterprises to obtain and maintain competitiveness, and knowledge and information have become the fundamental assets which will determine the profitability of technology-intensive enterprises. As a result, IP is regarded as an important factor that can enhance the return of investment on innovation.

IP is an important and unique resource for enterprises, and companies should use their special resources to keep competitiveness in the process of resource integration, reconstruction and acquisition. This is precisely the problem that IP management research needs to solve in the current dynamic market environment (Carley, 2000).

Rivera and Kline (2000) summarized the competitiveness of companies such as IBM, Microsoft, Lucent, Dell, Gillette and The Dow Chemical and proposed that the competitiveness of companies originates from new ideas and innovation instead of physical assets or raw

materials. IPRs have gradually become a key source of competitiveness for successful companies, and IP management is the source of corporate value creation in a society. Companies that are good at managing and commercializing IP will win the business competition. On the contrary, those poorly managing their IP will lose their competitive advantage. Research by Reitzig (2004) also shows that by the end of the 1990s, three-quarters of the market capitalization of Fortune 100 companies was contributed by intangible assets such as patents, trademarks, and copyrights. Similarly, Penin (2005) found that unlike the traditional theoretical assumption that companies adopt the patent system only to obtain short-term commercial monopoly rents, most companies use patents as a strategic tool for technology trading or R&D cooperation in many industries.

2.6 Summary

This chapter presents the historical development and evolution of RBV and the competitive advantage of the business. The strategic management theory, industry positioning theory, RBV, CBV and KBV are systematically studied. Corporate strategic management focuses on how a company maintains its competitive advantage; industrial positioning theory studies the impact of external environment on a company's competitive advantage; RBV/CBV focuses on the impact of internal factors on a company's core competitiveness. KBV explains how knowledge becomes an enterprise-specific resource. The theory of IP as a combination of innovative knowledge and legal rights, studies how IP becomes the most important resource for enterprises in the era of knowledge economy. This chapter reviews the existing studies on the impact of IP system on economic growth and identified the impact to be complex and different from country to country; and have been controversies about the logical relationship between the IP system and competitiveness of an enterprise in the past three decades.

Chapter 3: IP and Enterprise Competitiveness

Chapter 2 has given a comprehensive introduction to the history and evolution of the RBV and competitive advantage of enterprises as well as the connection between resources and business competitiveness. This chapter will first define IP and IP capabilities, then build up a theoretical model between IP and IP capabilities of an enterprise, followed by a clear demonstration of the logical connection IP, IP capabilities and competitive advantage of enterprises.

3.1 Definition of IP

3.1.1 Concept of IP

The concept of IP, according to Comish (1996) and B. Sherman et al. (1999), shows that modern IP law did not appear as an independent legal institution until around the 1850s. Compared to the long-established categories of rights such as real property rights and debts, the concept of IP has only been used for 150 years since its first official birth in 1893. Back then, the parties to the Paris Convention for the Protection of Industrial Property (WIPO, 1883) and the Berne Convention for the Protection of Copyright (1886) each established secretariats under the Swiss Patent Office, which were merged into one secretariat in 1893. The office is located in Bern, the capital of Switzerland. It is called the International Bureau of Intellectual Property, officially BIRPI, an acronym of the French name Bureaux Internationaux Reunis pour la Protection de la Propieté Intellectuelle (B- Burau, I-International, R-Joint, PI French spelling habits) for IP.

Ricketson (1991) considers IP a broad term used to describe the rights granted by law and some human intellectual activities. Japanese scholar Fukuda (2000) defined IP from the perspective of market competition as a right system that protects the normal progress of technological development or creative management. S. G. Winter (2000) argues that the concept of IP is often used in a broad sense. The narrow sense of IPRs is the right to receive confirmation and protection under patent law, trademark law, copyright law and commercial secrets. Davis and Miller (2000) argued that IP usually has relatively vague characteristics and is a highly abstract concept of property, including patents, trademarks and copyrights. Scholars such as Bently and Sherman (2014) believe that IP is a type of intangible private rights that is recognized by the law in the broadest sense as a collection of wisdom and information with

protective value, mainly including patents, copyrights, databases, copyrights neighbouring rights, trademark, designs and undisclosed information. Maskus (2007) considers IP an asset that appears as an exclusive right conferred by the law on the results of creative activities. At present, IP is increasingly linked to systematic research in organizations, especially technology-intensive enterprises. In market competition, IP is often regarded as intangible knowledge and information that companies are trying to acquire and maintain competitiveness.

Although the concept of IPRs originated in Europe, European and American researchers have not paid much attention to summarizing and concluding its concept. They have described the concept of IPRs in an enumerated and delimited manner rather than giving an abstract definition of the upper concept of IP (as opposed to patents, trademarks and copyrights). This tradition is also fully reflected in international conventions, such as the Convention Establishing the World Intellectual Property Organization (WIPO, 1967), which uses enumerations and general provisions to define intellectual property. According to WIPO (2022b), IPRs include: rights on written, artistic and scientific works; rights on performances, recordings and broadcasts by performing artists; rights on people's efforts to invent in all fields; rights on scientific discovery; rights on industrial products style; rights on trademarks, service marks, manufacturer names and marks; rights to prevent unfair competition; and rights on all other intellectually-derived activities in the industrial, scientific, literary or artistic fields.

The scope of IPRs is further expanded in the WTO Agreement on TRIPs. This agreement summarizes the scope of IPRs from the perspective of international trade, including copyright and related rights, trademarks, geographical indications, design, patent, integrated circuit design, undisclosed information and control of restrictions on competition in license agreements.

These rights are grouped into areas according to the primarily subject matter involved, and each category of IPRs is governed by a legal framework to assure property rights over the related subject matter upon fulfilment of certain criteria.

3.1.2 Nature and unique attributes of IP

As to the subjects of protection of IP rights or the exercise of IP rights (W. X. Zhang, 1999), the debates on "intellectual creation achievements" and "creative intellectual achievements and industrial and commercial marks" cannot change the fact that the subjects of protection of IP rights are the results of IP. It should be noted that IP does not regard mind and activity as the subjects of protection, but the results of intellectual activities. As an important way of human intellectual activities, creation is the process of finding and selecting symbols as well as

constructing forms for the unique spiritual experiences such as thought and emotion and then realizing them. Whether the result of "creation" is creative or innovative is a relative concept compared with the results of existing human intellectual activities. In other words, the process of "creating" IP objects does not mean that the objects of IP must be "creative" or "innovative". In other words, being "creative" or "innovative" or not cannot be the judgement criterion of the objects of IP. In fact, different types of IP have different requirements for "creativity". For example, copyright requires "originality"; invention and utility model patents require "newness", "creativity" and "practicality"; and registered trademarks require "significance". But we cannot deny that these results were "created". The objects of IP are the results "created" by human intellectual activity, which is a specific range of knowledge; the essence of "knowledge" is "form", and creation is an activity of "designs form" (Liu, 2007). In other words, the unification basis of the concept of IP rights is a knowledge product that has certain uniqueness and exists in immaterial and intangible form. In short, IP rights are the dominant rights enjoyed by right holders over IP with certain uniqueness (Xiao & Fan, 2014).

The WTO Agreement on Trade-related Aspects of IP Rights (TRIPs) states that IP rights are private rights in its preface, emphasizing the legal nature of IP in the name of private rights. H. D. Wu (2005) believes that the right-based privacy is the foundation for classifying IP rights into the category of civil rights. The establishment of the "private rights" of IP rights is the result of modern social legal revolution and institutional changes and has undergone a process of evolution from feudal concessions to capitalist property rights. The establishment of the "private rights" in the intangible domain provides a new way for individuals and firms to invest and trade in the operative level of ideas and symbols as fundamental assets in the knowledge-based economy.

To grasp the essence of the "private rights" of IP rights, it is necessary to further construct the signification of IP rights, namely the unique attributes of IP rights. On this topic, Xiao (2011) gave the following summary: IP rights, the intangibility of the object, are the dominant right of the right holder to control the knowledge products with certain uniqueness according to law. Knowledge products are the objects of IP rights. They are different from the "things" in the legal sense as objects of property rights and the "behaviours" in the legal sense as objects of credits. The essence of knowledge products is intangible knowledge that exists in specific "forms" and structures. The essence of knowledge is "form", which is the product of human creative intellectual activity and an intangible spiritual wealth with significant intangibility. This is the essential attribute of the object of IP or the object of knowledge products, which distinguishes itself from property and debt rights. However, the materialized carrier as its

manifestation is the object of tangible property rights rather than IP rights.

Because of the intangible nature of IP, the special attributes of IP objects determine that the law must give IP products legal protection that is different from traditional property rights or claims, so as to better protect the interests of IP creators or their holders, and promote the improvement of human knowledge, which fully realizes the value of knowledge products. It is also due to the intangibility of IP that the rights granted to intellectual products by law have characteristics that are different from real rights or credit rights, and from which the inherent attributes of IP are derived. In other words, attributes that are unique to IP include "exclusiveness", "temporality" and "territoriality".

Exclusivity is an internal attribute of the nature of rights conferred by law. The intangibility of IP and its object determines that IP and ownership are essentially different in terms of exclusivity. First, the exclusivity of ownership is manifested by everyone's exclusion of illegal possession, obstruction or destruction of property by non-owners, while the exclusivity of IP mainly excludes the transfer of illegal imitation, counterfeiting or plagiarism of IP by non-transferees. Second, the exclusivity of ownership is absolute, which means the exercise of the right of the owner to the property does not allow interference by others, does not require active assistance from others, and is not restricted by geography and time. While the exclusivity of IP is relative, this kind of monopoly power is often restricted by its capabilities and can only take effect within a certain space and validity period.

Temporality is the intrinsic property that the law assigns to IP according to its specific properties. The limitation of IP rights means that the exclusivity of IP rights can only be enjoyed by third parties within a certain period of time. In other words, IP is not an eternal right without time limit. Such rights are only protected within the period prescribed by law and enjoy monopoly rights. They will be terminated once the statutory period has passed. Relevant knowledge products will enter the public domain and can be shared and used by others.

Territoriality is a special property inherent in IP in terms of space. IP rights are neither eternal rights without time limit nor absolute monopoly rights in infinite space. In contrast, IP is geographically restricted. After examining the origins of the IP system in countries around the world, Zheng (2007) pointed out that the rudiments of IP rights were granted by local officials or feudal monarchs and feudal states in feudal societies, whether in China or abroad. Privileges are valid only in territories over which an officer, monarch or state power has jurisdiction. Since then, IP has evolved from a privilege to a "private right" in the legal sense, but the "territorial" attribute has been retained. However, with the rapid development of science and technology and the expansion of international trade, technology and knowledge are spread

around the world, and the international market for IP transactions has gradually formed and developed. To address this contradiction, countries around the world have established an international IP protection system by signing the International Convention on the Protection of IP Rights. However, as pointed out by H. D. Wu (2005), the international protection of IP does not change the territorial principle of IP, and the major international IP conventions include some generally applicable principles, such as the principle of minimum protection, the principle of independence and the principle of national treatment.

The territoriality of IP rights is the spatial limitation of the exclusive rights of IP rights. The object of IP rights is intangible, while the object of tangible property rights is tangible. "Territory" distinguishes IP rights from tangible property ownership. Generally, there are no geographical restrictions on the protection of ownership. Whether it is property transferred by citizens from one country to another, or property transferred by a legal person from one country to another due to investment or trade, the ownership of the property belongs to the right holder. Therefore, the problem of losing the legal effect of ownership does not occur. The theoretical basis is that in the field of tangible property, all countries adhere to the “principle of equal rights in foreign property”. In other words, through “presumption of rights”, it is presumed that after movable property acquired in one country enters another country, as long as the right subject still effectively possesses movable property, the country of entry can infer and protect the subject as a legal owner in accordance with its own possession system. However, this is not the case with IP, where related rights recognized and protected under the laws of a country can only have legal effect in that specific country. This is due to the non-physical nature of the IP object as intellectual product, which determines that legal owners cannot legally possess it, nor can they apply the “presumption of rights” because of possession as with tangible property. IP is protected outside the domain.

The above analysis shows that IP rights are civil rights that rights holders have with respect to their intellectual products. From a historical perspective, IP has experienced a process of evolution from “privilege” to “private rights”. Relative to property rights (especially ownership) and creditor’s rights, IP can become an independent type of civil rights derived from the non-material nature of its objects, which are specific intellectual achievements or knowledge-knowledge products. It has such inherent attributes as the exclusive nature of rights, the temporality in the time dimension and the territoriality in the spatial dimension.

3.1.3 Types of IP

Knowledge assets cover technology and design as well as organizational, logistical, managerial and related know-how. A common characteristic of knowledge assets is that they are non-rival in nature and, in contrast to tangible assets, not necessarily tied to any particular location. For example, the R&D for a new car may occur in one location. But once the car is developed, its production can be spread across a large number of locations (WIPO, 2017b).

Brands pervade everyday life. They are an indispensable guide for consumers and a means for companies to build a reputation and an image in the marketplace. A product's brand appeal can be as important for determining competitive success as its quality or price tag. In short, a recognized brand is among the most valuable intangible assets a company can own (WIPO, 2013a).

From its humble beginning as an identifier of origin, branding has evolved into a sophisticated business tool employing professionals as diverse as data analysts, lawyers, linguists, graphic artists, psychologists and celebrity actors. Companies in all economic sectors, whether small or large, whether in more developed or in less developed economies, rely on brands when they commercialize their goods and services (WIPO, 2013a).

Reputational assets consist of the goodwill that consumers extend to a company's brand, partly because of satisfaction derived from previous brand purchases and partly because of the image associated with different brands. Reputational assets are rival in nature: brands only have reputational value if used in relation to a single product or firm (WIPO, 2017b).

In addition, while brands can sometimes gain an international reputation, they generally do not seamlessly flow across borders. Companies may possess strong reputational assets in some markets, but not in others (WIPO, 2013b).

According to the 1992 Tokyo Congress of the International Association for the Protection of Industrial Property (AIPPI), IP rights are divided into two categories: "creative rights" and "identification marks". The former category consists of seven items, namely invention patent, integrated circuit, new plant variety, know-how, industrial design, copyrights and software; and the latter category consists of three items, namely trademark, trade names and other identifying marks related to unfair competition.

This Thesis focuses on how patent rights and trademark rights are related to the competitive advantages of enterprises, hence its stresses on the definitions and connotations of patents and trademarks.

Patents

Patents refer to the protection of the exclusive rights enjoyed by people to their own inventions within a certain time and region. Unless otherwise permitted by law, no one is allowed to implement patents without the authorization of patent holders, otherwise patent infringement is constituted. At present, most countries have gradually established a patent system. The establishment of a patent system can help the right holders achieve technological monopoly in a certain period through legal means to protect their own interests. The right holders also have to disclose their technical information to obtain protection. The disclosure of information is a great way to achieve balance between individual interests and social interests, which is the most important characteristic and the basic function of the patent system. Preventing copying is not the only motivation for patenting. Using patents for blocking rivals to advance their technological trajectories, for avoiding lawsuits, and for negotiation levering are increasing patenting rationales (Mendonça, 2005). In particular, the monopoly stipulated in the Patent Law is not a comprehensive monopoly on technology but is limited to the for-profit implementation of technology; and the patent system does not prohibit the development of new technologies based on existing technologies. Therefore, it can be considered that while the patent system grants the creator of the invention a monopoly on its profitable earning, it also grants the creator of the invention monopoly rights with time and geographical restrictions and other legal restrictions and makes technical information public to provide a mechanism for balancing the interests of creators and the public.

Different countries have different regulations on patent types, usually including invention patents and design patents. Besides, the patents laws in China, Germany and Japan also provide for utility model patents.

A. R. Miller and Davis (1990) argue that there are two theories of patent protection, namely the contract theory and the natural rights theory. H. D. Wu (2005) further concluded that there are four theories that have a greater impact on the interpretation of the patent system, including natural rights theory, compensation theory, contract theory and economic development theory. The research by Pakes and Griliches (1980) shows that statistics at different firm and industry levels show a strong correlation between the number of patents and R&D capacity. The median coefficient R is 0.9, indicating that patents are indeed a good indicator of the output of inventions that are hard to observe. Griliches (1980) summarizes earlier research on the number of patents and the role of patent statistics in sources of economic growth, the rate of technological development, and the competitive position of firms and even countries. This work is highly influential and contributes to the use of patent statistics as a rich research resource for economic analysts and scientists (Mendonça et al., 2021). He also used historical data from

Lotus and Borland to study the relationship between the strength of patent and copyright protection and technological innovation and improvement performance for companies in the software industry. The results show that patent and copyright protection alternate, meaning that when one form is weak, reliance on the other increases. Furthermore, the weakening of copyright protection will disproportionately accelerate patent filings in the coming years, but there is no evidence that IP protection has any negative impact on business performance and innovation incentives. In fact, increased reliance on patents is often associated with increased sales and R&D spending.

Trademarks

A trademark is a distinctive sign that can distinguish the goods and services provided by different operators and can be perceived visually. Trademarks are essentially signs used by operators to distinguish the source of goods or services, and they play a vital role in the process of marketing innovation, helping to differentiate the attributes of goods and services in the market. These characteristics make trademarks a potential indicator of product innovation, service innovation and industry change (Castaldi & Mendonça, 2022; Mendonça et al., 2019). Therefore, trademarks have the functions of expressing the origin of goods or services, quality assurance, advertising and personality, which can reduce the cost of finding goods or services for consumers. The value of trademarks lies in their commercial promotion and use. With the investment and use of trademarks by operators, trademarks have gradually evolved into property and important resources for competition among operators, and their value is much higher than the goods or services themselves. Mendonça et al. (2004) see trademarks as indicators of innovation and industrial reform. Bei (2019) regards trademarks as specialized complementary assets besides tangible assets and the useful external sourcing of innovation.

The purpose of protecting a trademark is to prevent confusion and dilution of goods or services. The core requirement for a trademark to be registered as a trademark and protected by law is that it should have distinctive features for easy identification. National trademark laws and international conventions without exception stipulate distinctiveness as a necessary condition for trademark formation and a positive condition for trademark registration. Saliency includes inherent saliency and acquired saliency. The former means that signs have natural distinctive features due to their creativity or correct choice, while the latter means that signs lacking inherent distinctiveness have new meanings through long-term continuous use and have the ability to identify goods. In addition, the unfavourable conditions of trademark registration are non-conflicting, including not violating public order and good customs, not infringing on prior rights, that is, not in conflict with the legitimate rights and interests of prior rights holders.

Most trademarks do not have the same initial validity period in different countries, but they can be renewed continuously. In China, trademark registration is valid for ten years from the date of approval of the registration and can be renewed for ten years upon expiration.

Of all the registered forms of IP, trademarks are the most widely used type of IP in the world. It is worth noting that many companies in low- and middle-income countries are focusing on filing trademarks and using other forms of IP relatively sparingly (WIPO, 2013b).

Over the course of the last four decades, the demand for trademarks from various institutions around the world has increased to unprecedented levels.

Following a slow start in the early 20th century, trademark activity accelerated significantly in the mid-1970s at the USPTO and even earlier at the JPO; other IP offices followed suit in the 1980s. Middle-income economies, in turn, started to experience a rapid rise in trademark filings in the late 1980s and 1990s. In most economies, the number of trademark filings correlates with the business cycle; accordingly, there were sharp declines in the number of filings following both the dotcom boom in the late 1990s and the outbreak of the most recent financial crisis. Since 2001, the China Trademark Office has been the largest recipient of trademark applications for more than 20 consecutive years. For both high-income and middle-income economies, the use of trademarks relative to GDP increased considerably from 1985 to 2011.

3.2 IP capabilities

3.2.1 Definition of IP capabilities

Arai (2006) examined Japan's IP strategy, which was introduced in 2002, and summarized the five major elements of Japan's "IP Nation" strategy: (1) incentive to creation and invention, especially to promote the transfer of technology from universities to private enterprises; (2) strengthen protection, including the tripartite sharing system of innovation results, expediting patent application examination, and establishing a high IP court; (3) promote utilization, such as broadening the financing scope of SMEs; (4) promote the protection of creative industry content, mainly the IP of the film industry; and (5) promote human resources, such as attaching importance to university IP education. He believes that Japan is working to increase the contribution of IP rights to corporate growth to achieve its goal of being a "rich country with IP rights".

The *Outline of the National Intellectual Property Strategy* of China (China's State Council, 2008), regards IP as a strategic resource for national development and a core element of

international competitiveness from the perspective of national competitive advantage, "to improve creation, commercial use, IP protection and management capacity" is an important part of a country's implementation of IP strategy. Among them, the creation, use and protection of IP rights are the three links interconnected with each other, with the management running through the whole process. It is believed that the creation and use mainly involve market entities' activities, while protection and management mainly emphasize the responsibilities of the government. In addition, the *National IP Strategy Outline* regards "incentive creation, effective use, legal protection and scientific management" as part of the implementation of IP strategy. Among them, "incentive creation" is the basic task of implementing IP strategy; "effective use" is the most important purpose of effective implementation of IP strategy; "protection according to law" is the key to effective implementation of IP strategy; and "scientific management" is the fundamental guarantee for effective implementation of IP strategy (Tain, 2008).

From the perspective of corporate competitive advantage, this Thesis treats IP as a resource for enterprises to obtain and maintain a competitive advantage. From the perspective of enterprises, the transformation of IP rights into the competitive advantages of enterprises depends on the combination of specific industrial technology backgrounds and their own strategic objectives to create, use, protect and organize different forms of IP rights. The dynamic behavioural elements of IP capabilities can be structured into IP creation, IP use, IP protection and IP organization. Different behavioural elements have different content and measurement indicators. The construction of the measurement index system for the above-mentioned elements of IP behaviour is based on the patent quality questionnaire developed by the IP Development Research Centre of the State IP Office in 2004 and survey questionnaire items developed in the book entitled *Corporate Intellectual Property Capability and competitive advantage* (Xiao, 2011).

Xiao et al. (2006) analysed the value of IP in a dynamic environment and argued that compared to tangible assets, IP itself has several flexible characteristics: (1) self-creation, meaning that companies can integrate human capital and previously accumulated IP rights, creating new knowledge products; (2) dynamic use, meaning that enterprises can decide the scope and extent of the use of IP according to their own competition needs; (3) elimination of the negative consequences of uncertainty, meaning that in an uncertain technology and market environment, enterprises can improve their ability to respond by implementing IP rights such as patent layout and trademark layout in the target market. Once the uncertainty is reduced, companies can take advantage of the layout of IP rights to curb competitors and gain a competitive advantage.

The difference in rigidity and flexibility of resources determines that intangible assets can better support enterprises to adapt to dynamic technological and market competition environments than tangible assets and respond positively under uncertain competition environments so that enterprises can compete in uncertainty.

P. Li et al. (2006) examined the IP capabilities of Shenzhen IT companies from the dimensions of IP creation, utilization, protection and organization. The results suggested that IP capabilities can enhance industrial competitiveness and regional competitiveness, but their relevance is affected by the environment and service system of the IP system. Based on the findings, they put forward corresponding strategies for IP capacity development, such as strengthening the building of independent IP rights, establishing an IP early warning mechanism, using different IP tools, integrating government public service resources, improving the service level of IP intermediaries, and reducing cost of corporate property rights protection.

Based on literature review and corporate practice research, R. Li et al. (2007) defined IP capabilities as the ability of creation, utilization and protection of IP by enterprises to integrate IP resources with other resources and participate in market competition, especially international market competition. From a functional point of view, IP capabilities are composed of defensive capabilities, offensive capabilities and dynamic integration capabilities; according to customary processes, IP capabilities can be classified into creative capabilities, application capabilities and protection capabilities; and according to the difference in function and status that IP rights set in the creation of corporate value, the development stage or status of an enterprise, IP capabilities can be classified into four types: negative, defensive, integrated and profitable.

Xiao (2011), based on a literature review of RBV and CBV, defined IP rights from the perspective of corporate competitive advantage. In his view, the ability of IP refers to the creation, utilization, protection and organization of patents, trademarks, copyright, commercial secrets and other forms of IP to seek competitive advantages. The industrial technical background, market structure and scale of an enterprise are affecting not only the focus and methods of the creation, use, protection and organization of IP rights but also the choice of different forms of patents, trademarks, copyrights and commercial secrets.

Therefore, the IP capabilities of enterprises can be understood from the following three aspects: (1) the core content of IP capabilities is the ability of enterprises to create, use, protect and organize different forms of IP, such as patents, trademarks, copyrights and commercial secrets. From the perspective of RBV and CBV, IP capabilities are actually a way for companies to create IP rights through various methods such as self-creation, transfer, licensing and overall corporate mergers and acquisitions to commercialize IP rights, protect IP rights through

multiple channels such as prevention, reconciliation, mediation, litigation and arbitration, and ensure and organize the process of IP rights creation, utilization and protection through institutional design and institutional settings, staffing and other mechanisms; (2) the development and promotion of IP rights of an enterprise is not an end in itself. The goal is to match the IP strategy with the business strategy of the enterprise and to obtain and maintain a competitive advantage; and (3) enterprises gain competitive advantages through the creation, use, protection and organization of IP rights, which are affected by factors such as the industrial technical background, enterprise size and market structure. The choice of IP forms varies between companies in different industrial technology backgrounds; different enterprise sizes may affect companies 'preferences for the creation, use, protection and organizational behaviour of their IP rights; and different market structures (degree of market competition) may also affect the value of the ability to achieve and enhance efforts of IP capabilities.

3.2.2 Conceptual model of IP capabilities

To achieve the research purpose, the author opened the "black box" of IPRs and IP behavioural elements and constructed a conceptual model of IP capabilities. As shown in Figure 3.1, in an enterprise's IP capabilities system, different IP types such as patents, trademarks, copyrights and know-how constitute an IP resource portfolio; due to different industrial backgrounds, market structures and enterprise scales that affect an enterprise's IP form portfolio, different IP resource portfolio structures are formed. In the scope of this Thesis, only the two types of IPRs of enterprises, namely patents and trademarks, will be studied.

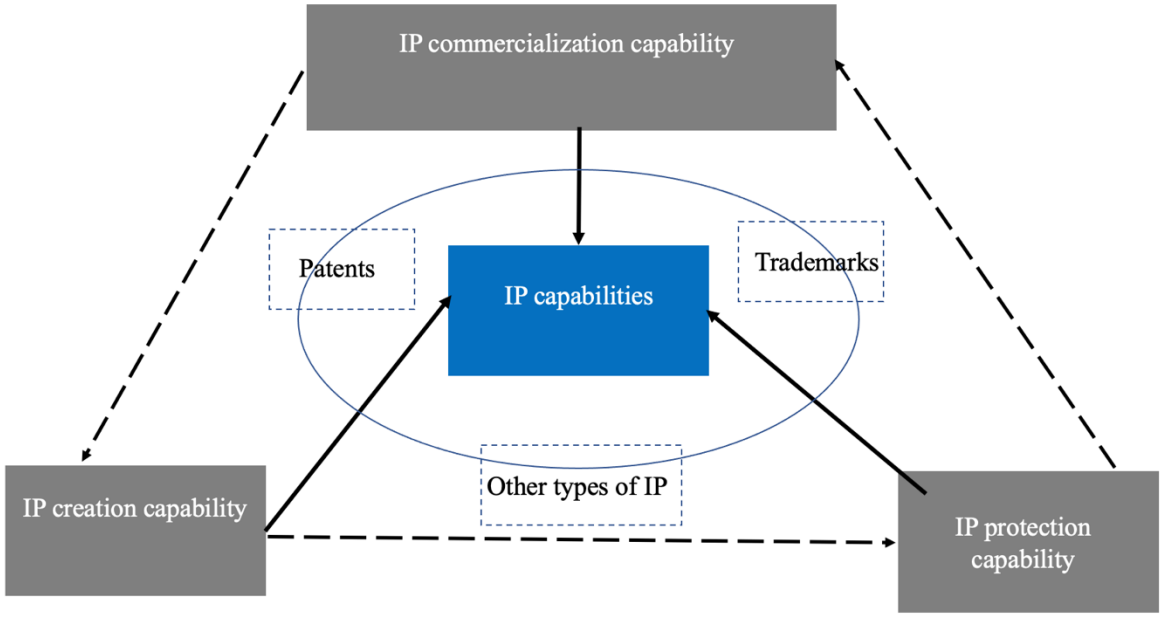

Figure 3.1 Enterprise IP capabilities model

3.2.3 Behavioural elements of IP capabilities

The combination of IP resources composed of patents, trademarks, copyrights, commercial secrets and other types of IP, constitutes the behavioural elements of enterprises' IP capabilities through the creation, use, protection and management of such types of IP. Among them, the use of IPRs is the core of IP capabilities and the main purpose of IP creation, protection and management. In other words, the implementation of IP creation, protection and management by enterprises is ultimately for the use of IPRs. Through the commercialization of IPRs, including self-use, transfer, licensing and cross-licensing, enterprises can get innovation gains and enhance the value of their products and services, thereby obtaining and maintaining competitive advantages. As a component of the IP capabilities behavioural elements, IP management is a complementary capability of the IP capabilities. It mainly provides system, institution, personnel and coordination support for the other three elements. It is an indispensable behavioural element in the IP capabilities.

(1) IP creation

IP creation refers to the process of forming protected intellectual products through creative intellectual activity. The creation of IPRs includes not only the creation and design of IPRs by enterprises themselves, but also the acquisition of IPRs through mergers, acquisitions, licenses and other methods. Of the four dynamic behavioural elements of IP capabilities, "creation" is the source of other elements.

The creation processes of different forms of IP are not the same. Taking patent creation as an example. Combined with the realization process of invention creation or product development process, patent creation is specifically realised through the following four stages: (1) concept formation stage where the company's R&D personnel and IP managers collect technical and market information to filter out interference information and form corresponding R&D concepts. The focus of patent work in this stage is to carry out patent development planning; (2) R&D planning stage, where the company's R&D personnel and institutions evaluate the costs and profits of different R&D solutions according to technological development trends and market needs, select the optimal solution, and then formulate a R&D plan to clarify its goals and processes. The patent work in this stage focuses on patent literature search and analysis, collection of existing inventions and their legal status, and prediction of the risks of patent infringement which the R&D will be faced; (3) the research and design phase, where internal inventions are realised through R&D activities, and technologies are acquired through outsourcing R&D contracts, and supportive technologies are obtained through licenses, technology transfers and even mergers and acquisitions if necessary. The focus of patent work in this stage is to conduct invention review, apply for patents, and obtain necessary patent licenses or assignments; and (4) development and testing phase, where parallel technology development and related market development are implemented. Specifically, product development corresponds to the external customer market, and process development corresponds to the internal user market. The patent focus in this stage is on peripheral patent applications, while improving other forms of IP, such as copyright registration.

Using patents granted to firms by the State Intellectual Property Office (SIPO), C. Huang and Sharif (2015) systematically and directly assessed the value of China's inventions and examined the strategic factors influencing their value. The results show that standard essential patents in China have higher value; Chinese patented inventions that will be included in the list of patent pools have higher value; companies that actively participate in patent litigation are associated with higher-value patents; companies with IP management departments are associated with higher value patented inventions (C. Huang & Sharif, 2015).

Innovation can occur at the national level in a wide range of settings. Hoti and McAleer (2006) studied the relationship between economic, financial and political and country risk rating through; they also studied the relationship between innovation measured by the number of patents registered in the country and country risk rating. The study analysed the relationship between country risk ratings and registered patents using monthly patent registration data and risk rating data from 1975 to 1997 for the leading 12 foreign patent countries in the United

States. The empirical study shows that economic, financial and political risk ratings have a considerable impact on innovation activity in 12 countries. Total U.S. patent filings also impact innovation in 12 countries (Hoti & McAleer, 2006).

A trademark is, in essence, a mark that distinguishes a company's products or services. Liu (2007) believes that, unlike the creative intellectual achievement which is the source of obtaining property value, the industrial and commercial mark itself is not the source of its property value from commercial reputation. Therefore, unlike patent creation, trademark creation includes not only the design and registration of trademarks, but also the company's reputation converted by advertising around industrial and commercial marks, as well as the process of obtaining credibility through technological transformation and product quality assurance. Therefore, trademark creation entails not only the formation of industrial and commercial marks but also the process of increasing the value of industrial and commercial marks.

IP creation capability is normally measured by three dimensions: quantity of IP, quality of IP and sustainability of IP creation. The quantity of IP is generally measured by the absolute quantity of different types of IP and the relative quantity compared with the industry level. The quality of IP is an indicator of the quality of an enterprise's ability to accumulate different forms of IP. For example, the authorization rate and patent maintenance rate of invention patents are important indicators for examining the quality of patents. Trademark quality is measured by how well a trademark prevents brand dilution and product confusion. The sustainability of IP rights mainly uses the effectiveness of the system that stimulates the creation of IPRs to measure the sustainability of IPR creation in enterprises.

(2) IP protection

China's IP protection system has gone through a long process of learning from the West, followed by self-adaptation as well as developing and maturing in the international competition. However, it must be seen that the status of IP protection in China does not meet the requirements of deepening reform and opening-up and building an innovative country. In some regions and regions, the infringement of IPRs and the production and sale of fake and shoddy goods still exist, disrupting the normal order of the market economy and harming China's international image. In addition, Chinese enterprises are not duly aware of leveraging IPRs to participate in international competition and overseas rights protection, and many technology patents, trademarks and copyrights have been infringed overseas.

The research carried out by many scholars is ahead of its time. Before the introduction of China's "National Intellectual Property Strategy Outline", relevant scholars proposed to

formulate long-term strategies to strengthen the establishment of the macro legal and administrative system framework for IP issues, which should include the implementation of "strict IP protection" policy" (C. Huang et al., 2004).

The Fifth Plenary Session of the Seventeenth Central Committee of the Communist Party of China held in 2010 clearly stated that during the "Twelfth Five-Year Plan" period, scientific and technological progress and innovation should be regarded as an important support for accelerating transformation and upgrading economic development. IP protection, as the umbrella for innovation, is a basic system that respects creative labour and stimulates innovation as well as an important part of building a country under the rule of law and a society of integrity. To build an innovative country and improve the socialist market economic system, China must attach importance to IP protection and effectively solve prominent problems in IP protection, unswervingly protect IPRs, and comprehensively facilitate greater progress in IP protection.

The patent protection system must produce practical results, and only by believing that patent rights can be implemented quickly and effectively when needed will the patent system have a real effect in stimulating innovation. Based on the U.S. experience, over the past 20 years, governments, researchers, international agencies, and the private sector have devoted significant resources to collecting and analysing patent enforcement statistics. This Thesis reviews these studies on the effects of the patent protection system and finds that while infringement is relatively common, much enforcement is informal, with less than 1-2% of patents involving patent litigation. New strategic use of law enforcement systems, particularly by non-practicing entities (NPEs), is a major emerging law enforcement issue, especially in the United States. While the long-standing issue of litigation costs has attracted considerable empirical attention, it has yielded few solutions to date (Weatherall & Webster, 2014).

(3) IP commercialization

IP commercialization refers to the business activities in which IP rights holders and relevant market entities optimize resource allocation and adopt a certain business model to realize the value of IP rights. In popular terms, it can be understood as the change from "IP" to "knowledge-producing money" which is a process of changing power into money.

Commercialization modes:

1. Licensing: Patent licensing is part of how to patent an idea and is a revocable agreement between a patent owner and a licensee to transfer interest in a patent to a licensee, who can benefit from and enforce the IPRs. There are two types of patent licenses. One is exclusive licenses which transfer all the rights of utilization to a licensee except the ownership, in which

case the licensor still owns the title; the other is non-exclusive licenses which allow the licensee to produce the invention or design, in which case the licensee does not gain exclusive rights, and the licensor and other parties can also produce the invention or design.

2. Transfer: Patent transfers occur when one individual or entity agrees to hand over all or some of the exclusive rights granted to him or her by the National Patent Office. Transfer is a main form of commercialization in addition to licensing.

3. Investment: The patentee can use its patent right or patent use right to make capital contributions to a limited liability company and/or joint stock company and/or limited partnership and/or general partnership and obtain corresponding equity and/or shares and/or property shares.

The essence of patent commercialization is to promote the application of patents. To this end, market-oriented commercialization is used as a means to embed patent creation, layout, commercialization planning and management into the commercialization process of a company's industrial chain, value chain and innovation chain. Besides, the integration of corporate innovation resources and resource allocation structures are optimised to maximize the economic value of the patent market. In short, the target of patent commercialization is the transform of patents into economic value.

Obviously, the most important object in patent commercialization is high value patented invention. In recent years, the patent battle between Apple and Samsung, Google's acquisition of Motorola, Huawei's payment of patent license fees to Ericsson and Xiaomi's active purchase of US patents are typical patent commercialization events.

As to the modes of patent commercialization, the patent application methods involved in patent commercialization mainly include the layout, combination, custody, transfer, licensing, financing, stock purchase, construction of patent pools, formation of technical standards and patent litigation.

3.2.4 Levels of IP capabilities of enterprises

Ernst (2001) selected patent indicators such as relative patent activity level, number of patent applications per employee, relative European patent activity level, patent citation rate, patent application grant, based on the collection of patent-related data of 50 companies in the German mechanical engineering industry. rate and effective patent rate, and summarize patent strategies into four types of patentees, including selective patentees, unsuccessful patentees, international high-active patentees and small high-active patentees. A firm's IP strategy is usually matched

to its IP capabilities. In other words, IP strategy determines the external performance of an enterprise's IP capabilities. Therefore, according to the actual role and status of IP in enterprise value creation and business strategy, the IP capabilities of enterprises can be divided into five different levels: negative, defensive, cost, profit and integrated.

Enterprises with negative IP rights are mainly in the manufacturing industry and lack conscious IP management goals and behaviours, which are specifically manifested in the following three aspects: lack of IP awareness, neglect of IP accumulation, and lack of engagement in new product development and design.

Enterprises with IP capabilities in a defensive phase, in order to protect their technological innovation income and market position, prevent and respond to IP litigation risks from competitors and consciously carry out IP management activities reflected in the following four aspects: IP rights are regarded as legal property, and the accumulation of IP rights is valued; IP rights become a protection mechanism for investment in R&D; IP lawsuits are prevented and responded to; and defensive cross-licensing may occur.

Enterprises whose IP capabilities are in a cost stage are committed to gaining a competitive advantage through new product development or process improvement. They value product and service differentiation through product innovation and process innovation, reduce corporate costs, and pay attention to IP holding costs. The specific performance is as follows: pay close attention to the audit of IP licensing fees; control the patent applications and maintenance costs; avoid IP litigation; attach importance to the dynamic combination of IP; and learn through IP licensing to reduce the knowledge gap.

Enterprises with IP capabilities in the profit-oriented stage have a mix of core and basic patents in their technology fields. These patents bring them high profits through strong IP capabilities, and they mainly rely on IP for profit. The profit generation process is mainly demonstrated through the following five ways: generating profit through IP rights transferring, licensing, joint ventures and strategic alliances; proactive IP lawsuits are initiated to force competitors to pay compensation or license fees; IP is regarded as a commercial asset rather than only legal assets; IP management is regarded as a priority; and the use of IP is highlighted to seek rapid market penetration and development.

3.3 IP capabilities and business competitiveness

In a case study with a medium-sized Portuguese footwear manufacturer, Cardeal et al. (2012) analysed the process of the development of a capability. After reviewing the process of

development of capability, they concluded that none of the resources contributing to the capability are VRIO. Instead, the capability is VRI resource.

Barney's VRIO model of resource view theory explains why IP constitutes a resource that can create competitive advantage. Specifically, the "V" stands for a *valuable* capability that can help a business eliminate threats or exploit opportunities. IP is the product of people's intellectual activities. The process of creation is the process of value formation and appreciation. Unlike the value representation of tangible assets, the value of legally protected IP products is represented by expected returns. R represents a *rare* capability that many other competitors do not possess, and knowledge products are highly scarce due to the intellectual activity of people. Since "intangible" IP rights such as patents, trademarks and computer software are protected by law, they can ensure that the owner has a monopoly for a certain period of time and territory, and the exclusivity of the product is rare. "I" refers to "expensive *imitative* capabilities", which historically refer to a unique and valuable organizational culture or brand name; these capabilities are characterized by ambiguous cause. They may also involve societal complexities such as relationships, trust and friendship between management, suppliers and customers. The intangibility of intellectual products determines that the right holder cannot prevent others from copying and using it by possession. Instead, it maintains its exclusivity by relying on legal protections that prohibit others from copying and using it; the "O" stands for "organized capture of value", and the resource itself does not bring any value to the company if it is not effectively organized to extract value from the resource advantage. Companies must organize their internal management systems, processes, policies, organizational structures and cultures so that they can realize the full potential of their valuable, rare, and imitative-cost resources and capabilities. Knowledge products need to be integrated into core business processes such as R&D, manufacturing, procurement, sales, human resource management and financial management. Meanwhile, a systematic knowledge product management system is needed to exert its core value. From the above research results, IP is mainly regarded as an institutional factor for enterprises to achieve innovation in the early stage and gain competitive advantage. Then new research shows that technology itself can be seen as a series of knowledge, and the acquisition of knowledge is a process of gradual accumulation with "creativity". Therefore, scholars gradually regard IP as a strategic resource for enterprises to participate in competition. Core resources are the source for enterprises to obtain and maintain competitive advantage in the knowledge age and global market competition.

According to the previous research, the logical relationship between IP, IP capabilities and business competitiveness is represented in Figure 3.2 below.

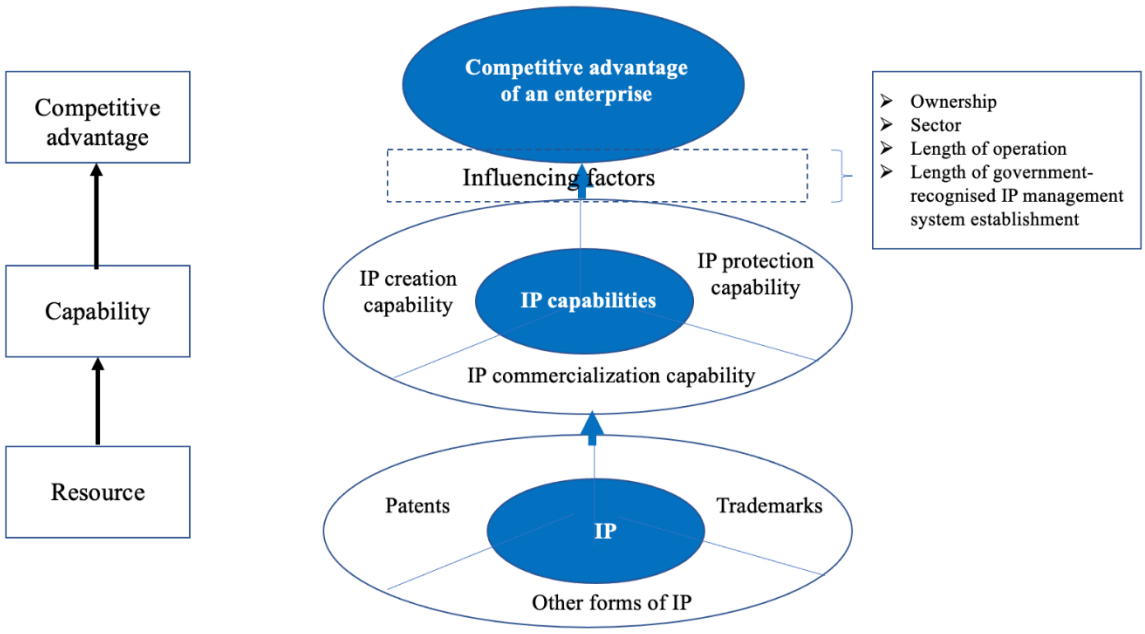

Figure 3.2 Conceptual model of IP, IP capabilities and business competitiveness

3.4 Summary

This chapter first defines IP and IP capabilities, then builds up a theoretical model of the relationship between IP and IP capabilities of an enterprise, followed by a clear demonstration of the logical relationship between IP, IP capabilities and competitive advantage of enterprises.

IP was mainly regarded as an institutional factor for enterprises to win innovation and thereby gain a competitive advantage in the early period. Subsequent research shows that IP itself can be regarded as a series of resources. From the institutional perspective, IP owns the characteristics of being granted by law, territoriality and intangibility; but from the perspective of resources, IP is a kind of flexible resources, which help companies adapt to changing technology and market environments and thereby gain competitive advantage. Scholars gradually regard IP as a strategic resource for enterprises to participate in competition. Though there are many types of IP rights in different international agreements, patents and trademarks are generally accepted by scholars and widely held by enterprises as the core IP rights. Therefore, the types of IPRs studied in this Thesis are mainly patents and trademarks. A firm should form the IP capabilities, which are the combination of IP creation, IP commercialization and IP protection, to adapt to the business development strategies accordingly before realizing the value of IP rights. IP capabilities are the juncture of IP and competitive advantage of enterprises, while Enhanced IP capabilities can help enterprises obtain and maintain

competitive advantages. Ownership of an enterprise, sector, length of operation and length of government-recognised IP management system establishment will affect an enterprise's business competitiveness.

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Chapter 4: Theoretical Models of IP Capabilities and Competitive Advantage

Chapter 3 has enabled us to have a better understanding of IP and IP Capabilities as well as the logical relationships between IP, IP capabilities and business competitiveness. This chapter focuses on the measurement model of the relationship between IP capabilities and competitive advantage. Specifically, the model is constructed with IP capabilities as the independent variable, competitive advantage as the dependent variable, and ownership of an enterprise, sector, length of operation, length of government-recognised IP system establishment as control variables. Then the measurement formula is designed between the independent variable, control variables and the dependent variable.

4.1 Dimensions and measurement of enterprise IP capabilities

In an enterprise's IP capabilities system, different types of IP such as patents, trademarks, copyrights and commercial secrets constitute an IP resource portfolio; due to different industrial backgrounds, market structures and enterprise scales that affect an enterprise's IP resource portfolio, different IP resource portfolio structures are formed. Given the scope of this study, this Thesis focuses only on two types of IP, namely patents and trademarks.

As mentioned in Chapter 3, the IP capabilities of enterprises mainly consist of IP creation capability, IP protection capability and IP commercialization capability. The use of IPRs is the core of IP capabilities and the main purpose of IP creation, protection and management. Through the commercialization of IPRs, including self-use, transfer, licensing and cross-licensing, enterprises can get innovation gains, enhance the value of their products and services, and thereby obtain and maintain competitive advantages.

IP creation capability is generally measured by three dimensions: number of IPs, quality of IP and sustainability of IP creation. Number of IPs is generally measured by the absolute number of different types of IP and the relative number compared with the industry level. Quality of IP is an indicator of the quality of an enterprise's ability to accumulate different types of IP. For example, the authorization rate and patent maintenance rate of invention patents are important indicators for examining the quality of patents. Sustainability of IP rights is mainly

measured by the effectiveness of the system that stimulates the creation of IP rights in enterprises.

IP protection refers to the process by which IP holders (including interested parties) prevent or stop IP infringement through consultation, administrative appeals or judicial means. The protection of IP rights studied in this Thesis refers to the approach and measures taken by rights holders to protect their rights and interests against actual or potential infringements, excluding the "intellectualization" process after the formation of knowledge products, which is the process where creators, authors or designers fix their knowledge products in the form of IP rights prescribed by law. IP protection capability is mainly composed of the ability to identify IP infringement risks, the ability to manage and control the risks of IP infringement, the ability to use the economic relief measures for IP infringement and the legal ability of IP litigation.

There are major differences in the protection of different types of IP. The IP protection studied in this Thesis involves the internal and external IP protection mechanisms and processes available to enterprises. In view of this, IP protection capability in this Thesis is mainly measured by three items: protection mechanism, protection intensity and timeliness protection. Specifically, protection mechanism refers to the system and process of enterprises using various methods and means of IP protection to respect the IPRs of others and protect their own IP rights. It mainly involves such elements as IP early-warning mechanism, IP infringement response mechanism and familiarity with different forms of IP protection channels and procedures; protection intensity refers to enterprises' use of various IP protection channels and methods to protect their own IPRs. Inputs in terms of personnel, funds and time are mainly related to the combination of IPRs and the legal responsibility for investigating IP infringements; and timeliness protection refers to the timeliness of enterprises' response to IP infringements.

IP commercialization, alternatively known as IP utilization, refers to the process of utilizing IP by means such as its own use, transfer, licensing and cross-licensing to externalize the value of IP to products or services to seek or obtain corresponding benefits or competitive advantages. IPRs can be used in two ways. One is the licensing and transfer of IPRs; and the other is the use of IPRs. In the process of using IPRs, attention must be paid to avoid infringement and abuse. The IP system itself is the product of the "equilibrium" between the private rights enjoyed by rights holders and the public interest in science and technology development. IP holders should be restricted from violating their basic public order and good practices, seriously impeding the spread and progress of science and technology while harming human public health.

Measurement models of patent capabilities and trademark capabilities

In the scope of this Thesis, the IP capabilities of an enterprise mainly consist of patent

capabilities and trademark capabilities. Similar to the dimensions of IP capabilities, patent capabilities include patent creation capability, patent protection capability and patent commercialization capability, while trademark capabilities include trademark creation capability (a defensive trademark creation capability shall also be considered), trademark protection capability and trademark commercialization capability.

This Thesis measures the utilization ability of IP from two dimensions: the degree of IP use and the value of IP use. The degree of IP use indicates the proportion of different types of IP held by an enterprise's own implementation, transfer, licensing and cross-licensing; and the value of IP use indicates the value of different types of IP held by the enterprise's own implementation, transfer, licensing and cross-licensing which is specifically reflected in the contribution of IP to the enterprise's sales performance. The design of the patent capabilities measurement index system and trademark capabilities measurement index system is shown in Table 4.1 below.

Table 4.1 Patent capabilities measurement index system

First-order dimension	Second-order dimension	Measurement indicators
A. Patent capabilities	A_1: Patent creation capability	A_{11}: Total number of domestic patent applications
		A_{12}: Total number of foreign patent applications
		A_{13}: Grant rate for patent applications
		A_{14}: The validity of internal patent incentive system to encourage patent application
		A_{15}: Level of internal patent application evaluation mechanism
	A_2: Patent commercialization capability	A_{21}: Patent licensing and transfer ratio
		A_{22}: Patent self-enforcement ratio
		A_{23}: Annual growth rate of the sales of patented products in the recent three years
		A_{24}: Proportion of the sales of patented products to total sales in the recent three years
	A_3: Patent protection capability	A_{31}: Combined protection level of core patents and general patents
		A_{32}: Establishment and improvement of a patent infringement warning mechanism
		A_{33}: Level of familiarity with patent protection approaches and procedures
		A_{34}: Capability of holding infringers legally liable for patent infringement
		A_{35}: Timeliness and validity of patent protection in current legal system
B. Trademark capabilities	B_1: Trademark creation capability	B_{11}: Number of registered trademarks
		B_{12}: Regional distribution of registered trademarks
		B_{13}: Capability to apply for trademark registration in time according to product or market requirements
	B_2: Defensive trademark creation capability	B_{21}: Capability to apply for United trademarks [4] to prevent trademark dilution

	B_{22}: Capability to apply for defensive trademarks [5] to prevent trademark dilution or to advance market development
	B_{23}: Capability to apply for associated trademarks to meet the requirements of different types of goods
B_3: Trademark commercialization capability	B_{31}: Ratio of products/services sales with own trademarks
	B_{32}: Ratio of value contribution of to product or service by own trademarks
	B_{33}: Market value of trademarks
	B34: Reputation of own trademarks
	B_{35}: Combination of main trademarks and affiliated trademarks
B_4: Trademark protection capability	B_{41}: Capability to prevent dilution with main trademarks and affiliated trademarks
	B_{42}: Validity of the protection with domain name related to trademarks or tradename
	B_{43}: Response time to trademark infringement by a third party
	B_{44}: Level of familiarity with trademark protection approaches and procedures
	B_{45}: Capability of holding infringers legally liable for patent infringement

4.2 Measurement model of enterprise competitive advantage

Enterprise performance is mainly composed of enterprise competitiveness position, enterprise profitability and sustainable development. Enterprise competitiveness is mainly reflected in its position in the domestic industry and market share of leading products; corporate profitability is mainly reflected in sale revenue growth, corporate net asset growth and profit growth after setting up a standard IP management system; corporate sustainable development capabilities are mainly reflected in new product sales, new product profit margins and new product revenue share.

4.2.1 Measurement model of competitive advantage

Regarding the internal structure of competitive advantage and its measurement, Oral (1986) as well as Oral and Reisman (1988) constructed a model to evaluate the competitiveness of enterprises to describe their competitive advantages. The model can quantitatively describe the overall competitiveness of an enterprise and identify its advantages and disadvantages. It defines corporate competitiveness as a function of three basic factors, namely industry advantages, cost advantages as well as political and economic environment advantages. Industry advantage is an external indicator that indicates the company's advantages over

competitors in acquiring resources and operating management. A high industry advantage score means that the company has done better than its competitors in selecting the product portfolio matrix, production capacity, technology, equipment and plant location. Having an industry advantage does not necessarily secure success in competition. If the cost of the company's investment is higher than its competitors, the industry advantage will be weakened. Therefore, companies should introduce cost advantage indicators into their models. Cost advantage is the advantage that the company has over its competitors in the cost of investment in the target market. Besides, the political and economic environment has a direct impact on an enterprise's competitiveness, reflected in such aspects as interest rates, taxes, communications, energy and transportation, infrastructure, supply capacity, foreign trade agreements as well as import and export quotas. The government plays an important role in these respects.

The competitive position of enterprises falls into three categories, namely competitive advantage, competitive equality and competitive disadvantage (J. B. Barney, 2002; Porter, 1985). Among them, the performance of a company that obtains a competitive advantage is better than that of a company that only obtains an equal competitive position. Therefore, performance evaluation has become an important quantitative method for researchers to measure the competitive advantage of enterprises. Some researchers, such as (Coase, 1937), Alchian and Demsetz (1972) as well as M. C. Jensen and Meckling (1998), define performance by comparing the value created by the production line assets with the value expected by the asset owner. The positive difference between expected value and actual value is called economic profit or economic rent. Companies that earn higher-than-normal economic profits generally enjoy a certain competitive advantage in their industries or markets. J. B. Barney and Hesterly (2008) summarized the measurement of competitive advantage and pointed out that competitive advantage is closely linked to economic value, which is defined as the difference between the expected return of customers when they consume products or services and the economic costs of the production and sale of these products or services. But these definitions are both abstract and simple, and thus cannot be easily measured directly. A more operable definition was given by Peteraf and Barney (2003) who defined enterprise competitive advantage as creating more economic value than a marginal competitor that achieves only break-even. At present, there are two main ways to measure the competitive advantage of enterprises: (1) estimation of an enterprise's competitive advantage by examining its accounting performance. Commonly used accounting ratios to describe business performance include profitability ratio, liquidity ratio, debt ratio and operating ratio; (2) use of economic performance analysis to evaluate an enterprise's competitive advantage. Relative to the

accounting measurement, the economic measurement of competitive advantage compares an enterprise's profit margin to its cost of capital rather than the industry's average profit.

This Thesis integrates the above-mentioned methods of measuring competitive advantage and draws on the "Survey Questionnaire on the Coordination Mechanism of Innovation Elements in the Innovation Process" designed by the School of Management of Zhejiang University in 2003 and the design of business performance indicators in the "2007 Chinese Enterprise Innovation Survey" by the Technology Innovation Research Centre of the School of Economics and Management of Tsinghua University. The indicators of corporate competitive advantage fall into three categories, namely the competitive position, profitability and sustainability of the enterprise. Specifically, competitive position is measured by two indicators, namely industry status and market share; profitability is measured by important financial indicators of the company in the past three years, including sales growth rate, return on net assets and average profit rate; and enterprise sustainability is measured by the development indicators of the company's new products, including sales and profit margins of new products.

Enterprise performance is measured by the competitiveness and profitability of the company. The competitiveness of the company is mainly reflected in its status in domestic industry (P_1); and the profitability of the company is mainly reflected in annual sales growth rate after government recognition of the IP management system (P_2), annual return on net assets (RONA) after government recognition of the IP management system (P_3) and Annual profit rate after government recognition of the IP management system (P_4).

4.2.2 Basic information and IP development of an enterprise

To measure the competitive advantage and business performance of an enterprise, the basic information and IP development status of the enterprise are investigated first.

(1) Basic information of an enterprise

The basic information of an enterprise collected in this study includes total assets (unit: RMB 100 million), sales revenue (unit: RMB one million), R&D expenditure (unit: RMB one million), profit (unit: RMB one million), number of employees (unit: thousand people) and number of R&D personnel of the enterprise with a government-recognised IP management system.

(2) IP development status

As indicated in Table 4.2 below, IP development status investigated includes number of patent applications, number of authorised patents and number of trademarks registration of the

enterprise with a government-recognised IP management system.

Table 4.2 IP development status

Enterprise IP Development Status			
Patent application	The annual total		
	Invention		Domestic
			Foreign
	Utility model		
	Industrial design		
	PCT		
	America		
	Europe		
	Japan		
	Other area		
	Cumulative applications over the years		
Patent authorization	The annual total		
	Invention		Domestic
			Foreign
	Utility model		
	Industrial design		
	PCT		
	America		
	Europe		
	Japan		
	Other area		
	Cumulative authorizations over the years		
Registered trademarks	The annual total		
	Registered trademarks in China		
	Registered trademarks abroad		
	Annual total registrations		
	Cumulative registrations of well-known trademarks		
	Cumulative registrations of famous trademarks		

4.3 A theoretic model on enterprise IP capabilities and competitive advantage

4.3.1 Determination and measurement of variables

As mentioned in previous sections, this Thesis focuses on studying the relationship between IP capabilities, consisting of patent capabilities and trademark capabilities, and enterprise business performance. Therefore, six variables were chosen (see Table 4.3). The dependent variables are the two major dimensions of business performance: competitive position and profitability.

Table 4.3 Determination of key variables

Type of variable	Name of variable	Abbreviation	Description (the mean value of the data between 2014 and 2016)
Dependent variable	Business performance	PER	An overall assessment of the enterprise's status in domestic industry, market share of leading products, sales growth rate, return on equity and profit margin, and the proportion of new product sales to the total

Type of variable	Name of variable	Abbreviation	Description (the mean value of the data between 2014 and 2016)
			sales of the enterprise
Independent variables	IP capabilities	IPC	A composite variable consisting of IP creation capability, IP commercialization capability, IP operation capability and IP management capability
	IP creation capability	IRR	A composite indicator formed by patent creation capability, overall trademark creation capability and defensive trademark creation capability
	IP protection capability	IPP	A composite indicator formed by patent protection capability and trademark protection capability
	IP commercialization capability	IPC	A composite indicator formed by patent commercialization capability and trademark commercialization capability
	IP operation capability	IPO	A composite indicator formed by IP system capability and the level of IP embeddedness
	Patent capabilities	PA	A composite indicator consisting of patent creation capability, patent commercialization capability and patent protection capability
	Patent creation capability	PC	See the relevant factors listed in the questionnaire.
	Patent commercialization capability	PM	See the relevant factors listed in the questionnaire.
	Patent protection capability	PP	See the factors listed in the questionnaire.
	Trademark capabilities	TA	A composite indicator consisting of trademark creation capability, defensive trademark creation capability, trademark commercialization capability and trademark protection capability
	Trademark creation capability	TC	See the relevant factors listed in the questionnaire.
	Defensive trademark creation capability	TD	See the relevant factors listed in the questionnaire.
	Trademark commercialization capability	TM	See the relevant factors listed in the questionnaire.
	Trademark protection capability	TP	See the relevant factors listed in the questionnaire.
Control variables	Length of operation	AGE	2016 - year of establishment
	Length of government-recognised IP management system	AT	2016 - year of government recognition of IP management system
	Ownership of an enterprise	OWN	Local privately owned=1; other forms of ownership=0
	Sector	IND	Information and telecommunications sector=1; other sectors=0

4.3.2 The model on enterprise IP capabilities and business performance

The IP capabilities of an enterprises referred to in this Thesis mainly consist of patent capabilities and trademark capabilities. Specifically, patent capabilities consist of patent creation capability, patent protection capability and patent commercialization capability; and trademark capabilities consist of trademark creation capability, defensive trademark creation capability, trademark commercialization capability and trademark protection capability.

Business performance in this Thesis is mainly measured by the competitiveness and profitability of an enterprise. The competitiveness of an enterprise mainly refers to its position in the domestic industry and the market share of its main products; profitability is measured by three main indicators, namely annual sales growth rate after government recognition of IP management system, annual return on net assets after government recognition of IP management system and annual profit rate after government recognition of IP management system. The model illustrated in Figure 4.1 below shows the relationship between the IP capabilities and business of performance of an enterprise.

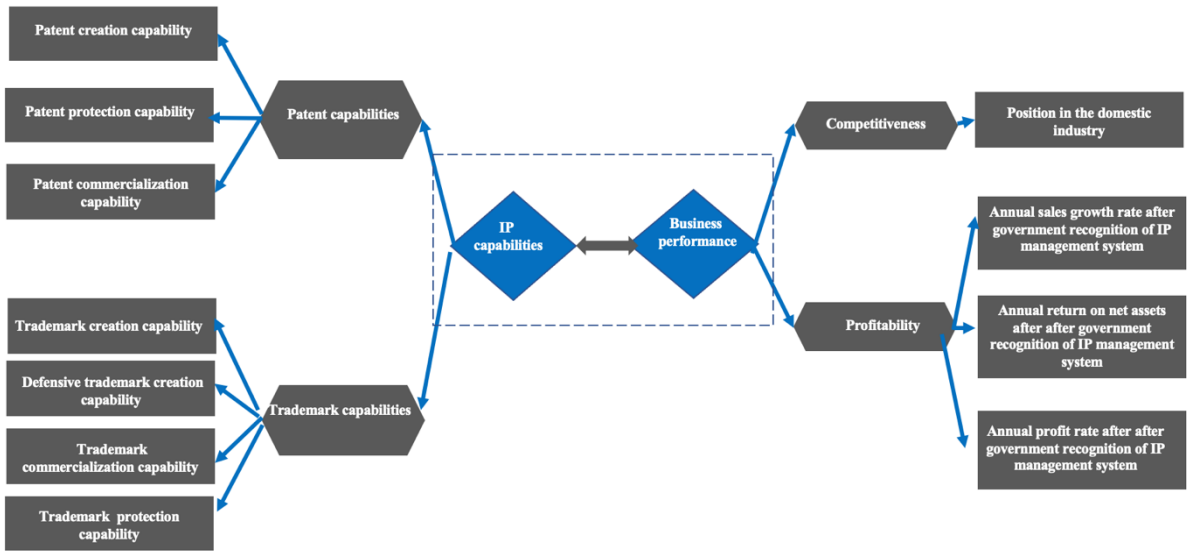

Figure 4.1 Measurement model for the relationship between IP capabilities and competitive advantage

4.3.3 Measurement model

1. Patent capabilities and business performance

Model 1 and Model 2 are constructed to verify the connection between patent capabilities and enterprise competitiveness. Enterprise competitiveness is the dependent variable (*PER*); patent capabilities (*PA*), as the independent variable for Model 1, construct consisting of the weighted average of patent creation capability (*PC*), patent commercialization capability (*PM*)

and patent protection capability (*PP*). *PC*, *PM* and *PP* are the independent variables of Model 2. Control variables include ownership of an enterprise (OWN), sector (SEC), length of operation (AGE) and length of government-recognised IP management system establishment (AT).

$$\mathbf{PER_i = \alpha_0 + \alpha_1 PA_i + \alpha_2 OWN_i + \alpha_3 IND_i + \alpha_4 AGE_i + \alpha_5 AT_i + \varepsilon_i} \quad (1)$$

$$\mathbf{PER_i = \alpha_0 + \alpha_1 PC_i + \alpha_2 PU_i + \alpha_3 PP_i + \alpha_4 OWN_i + \alpha_5 IND_i + \alpha_{46} AGE_i + \alpha_7 AT_i + \varepsilon_i} \quad (2)$$

2. Trademark capabilities and business performance

Model 3 and Model 4 are set up to verify the connection between trademark capabilities and enterprise competitiveness. Business performance is the dependent variable (*PER*); trademark capabilities (*TA*), as the independent variable for Model3, is a composite indicator consisting of the weighted average of trademark registration capability (*TR*), trademark association capability (*TA*), trademark commercialization capability (*TC*) and trademark protection capability (*TP*). *TR*, *TA*, *TC* and *TP* are the independent variables for Model 4. Control variables include ownership of an enterprise (OWN), Sector (SEC), number of employees, total assets, R&D staff ratio, profit and length of operation (AGE).

$$\mathbf{PER_i = \alpha_0 + \alpha_1 TA_i + \alpha_2 OWN_i + \alpha_3 IND_i + \alpha_4 NUM_i + \alpha_5 SIZE_i + \alpha_6 RENUM_i + \alpha_7 PROFIT_i + \alpha_8 AGE_i + \varepsilon_i} \quad (3)$$

$$\mathbf{PER_i = \alpha_0 + \alpha_1 TR_i + \alpha_2 TJ_i + \alpha_3 TU_i + \alpha_4 TP_i + \alpha_5 OWN_i + \alpha_6 IND_i + \alpha_7 NUM_i + \alpha_8 SIZE_i + \alpha_9 RENUM_i + \alpha_{10} PROFIT_i + \alpha_{11} AGE_i + \varepsilon_i} \quad (4)$$

3. IP capabilities and business performance

Model 5 and Model 6 are established to verify the connection between IP capabilities and enterprise competitiveness. Enterprise competitiveness is the dependent variable (*PER*); IP capabilities (*IPC*), as the independent variable for Model 5, is a construct consisting of the weighted average of patent capabilities (*PA*) and trademark capabilities (*TA*). *PA* and *TA* are the independent variables for Model 6. Control variables include ownership of an enterprise (OWN), Sector (IND), length of operation (AGE) and length of government-recognised IP management system establishment (AT).

$$\mathbf{PER_i = \alpha_0 + \alpha_1 IPC_i + \alpha_2 OWN_i + \alpha_3 IND_i + \alpha_4 AGE_i + \alpha_5 AT_i + \varepsilon_i} \quad (5)$$

$$\mathbf{PER_i = \alpha_0 + \alpha_1 PA_i + \alpha_2 TA_i + \alpha_3 OWN_i + \alpha_4 IND_i + \alpha_5 AGE_i + \alpha_{56} AT_i + \varepsilon_i} \quad (6)$$

4.4 Research design

China is a vast country with a large number of business entities, and the behaviour patterns of different entities are very different; There are also great differences in the level of economic

development in different regions of China. The level of economic development in developed coastal areas has been close to that in some developed countries, while the economic development in some inland areas is still very backward. The IP-related behaviours of business entities in different regions and at different development levels are diversified in terms of motivations, process and results. This Thesis endeavours to explore the relationship between IP practices and core competitiveness of enterprises in China's developed economic regions and enterprises that have established a standardized IP management system.

Because developed economic regions are representative of China's economic development status and trend, enterprises that have established a standardized IP management system are normal enterprises which will engage in IP practices according to market forces rather than engage in abnormal IP practices or abusing IPRs.

Shenzhen is one of the most innovative big cities in China with a leading number of IPs. With the support of Shenzhen government, the author surveyed 219 leading companies in Shenzhen with a standardized IP management system with a questionnaire designed to find out their IP activities, IP capabilities and the relationship between IP capabilities and business performance.

4.4.1 Questionnaire design

Based on the literature review, this Thesis uses the Likert scale for questionnaire design with items created to address the research problem and answer the research questions. Two questionnaires are deigned, namely the "Questionnaire on the IP Development of Enterprises with a Government-Recognised IP Management System in Shenzhen" and "Questionnaire on the Business Performance and IP Development of Enterprises with a Government-Recognised IP Management System in Shenzhen".

The former consists of items containing five response options. The questionnaire is composed of two parts. The first part deals with general information of IP capabilities, patent capabilities, trademark capabilities, business performance and basic information (see Annex 2 for the details of the questionnaire.). The two sub-scales of the questionnaire are the IP Capabilities Sub-scale and the competitive advantage Sub-Scale. The IP Capabilities Sub-scale consist of general Information of IP capabilities, patent capabilities and trademark capabilities. Patent capabilities consist of patent creation capability, patent commercialization capability and patent protection capability; trademark capabilities consist of trademark creation capability, defensive trademark creation capability, trademark commercialization capability and trademark

protection capability. The competitive advantage Sub-Scale measures the competitiveness and profitability of the enterprise. The competitiveness of the enterprise is mainly reflected in its position in the domestic industry; and the profitability of the enterprise is mainly reflected in the growth of sales revenue, the growth of RONA and the growth of profits after government recognition of its IP management system.

The latter questionnaire is designed to collect financial data such as R&D expenses, sales income and statistics on the number of patent applications and the number of authorized patents for the sample enterprises between 2005 and 2016.

4.4.2 Questionnaire survey and recovery

Since 2005, Shenzhen has attached great importance to IP development. Through the continuous implementation of the strategy of empowering the city with IP, a large number of innovative enterprises with outstanding capabilities in IPR creation, application, protection and management have been nurtured. As of 2017, the number of enterprises with a government-recognised IP management system in Shenzhen had reached 204.

Enterprises with a government-recognised IP management system refer to enterprise that have established an IP management system as per the National Standards of the Specifications for the Administration of Intellectual Property Rights of Enterprises (GB/T29490-2013), have achieved good results in the creation, protection and operation of IP, and have been certified as "Enterprise with Standardized IP Management" after filing an application to the Shenzhen Administration for Market Regulation and passing the review procedure by the government department.

This survey was conducted to gain a comprehensive understanding of the development status of various types of enterprises with a government-recognised IP management system in Shenzhen at all levels and to study in depth the relationship between enterprises' IP capabilities and business performance.

(1) Sample: 204 enterprises with a government-recognised IP management system

(2) Survey method: On November 30, 2017, Shenzhen Administration for Market Regulation issued a notice about the Survey through the official website of the Shenzhen Administration for Market Regulation, requesting enterprises to fill in the "Questionnaire on the IP Development of Enterprises with a Government-Recognised IP Management System in Shenzhen", which could be submitted online or through post, fax or email, then the survey team sent Questionnaire to the contact person of the enterprises, the information of the contact person

was provided by the Shenzhen Administration for Market Regulation.

(3) Time of survey: The project team engaged in communication and data collection between November 20, 2017 and March 27, 2018. Overall, the survey had been completed by January 20, 2018.

(4) Specific implementation: The survey team sent the survey questionnaire to the enterprises by phone, SMS, WeChat, email and mailed paper documents, explained the way to fill in the questionnaire, and actively answered questions to the survey enterprises. The team tracked questionnaire completion in a timely manner and efficiently collated the recovered questionnaires.

(5) Questionnaires were returned from different departments such as IP Department, Legal Department, Board of Directors Office, President's Office, R&D Department, Securities and Public Relations Department, Technology Management Centre, Administration Department, Corporate Development Department and Human Resources Department.

A total of 204 enterprises in Shenzhen with a government-recognised IP management system were surveyed, 168 of which were recovered. After eliminating 12 invalid questionnaires, 156 valid questionnaires were retained.

Descriptive statistics of the surveyed enterprises: Statistics were compiled on the enterprises recognised by the government as having set up a standard IP management system, sector, nature of ownership, sales revenue and length of operation. Then the development status of the enterprises' IP creation, application, protection and management capabilities were collated separately. On this basis, the average data of the last three years were used to analyse the proportion of profits of the surveyed enterprises to the total profits of Shenzhen enterprises, as well as the proportion of patents held by the surveyed enterprises to the total number of patents held by all enterprises in Shenzhen.

An empirical analysis of the correlation between the IP practices and business performance of the surveyed companies was made. Econometric methods were used to analyse how patent application, commercialization and protection is associated with the core competitiveness of enterprises as well as the how trademark creation, commercialisation and protection is associated with the core competitiveness of enterprises. The Thesis adopts OLS linear regression method to analyse the relationship between patent application, commercialization and protection and the core competitiveness of enterprises. As a common mathematical optimization method, the core idea of Ordinary Least Square (OLS) is to estimate by minimizing the sum of squares of residuals.

4.4.3 An overview of enterprises in Shenzhen

During the survey, the average data of the surveyed enterprises over the past three years were analysed to determine the proportion of the profits of the surveyed enterprises to the total profits of Shenzhen enterprises as well as the proportion of patents held by the surveyed enterprises to the total number of patents held by all enterprises in Shenzhen. Statistics were compiled on whether the enterprises had a government-recognized IP management system, sector, nature of ownership, scale and length of operation. On this basis, the development status of enterprises' IP creation, application, protection and management capabilities were collated separately.

1. Weight of the total profit of the sample enterprises

As shown in Figure 4.2 below, between 2014 and 2016, the average total profit of all the enterprises in Shenzhen was 17,385.533 million RMB, while the average total profit of all the 156 sample enterprises was 11,529.137 million RMB, representing a percentage of 66.31%.

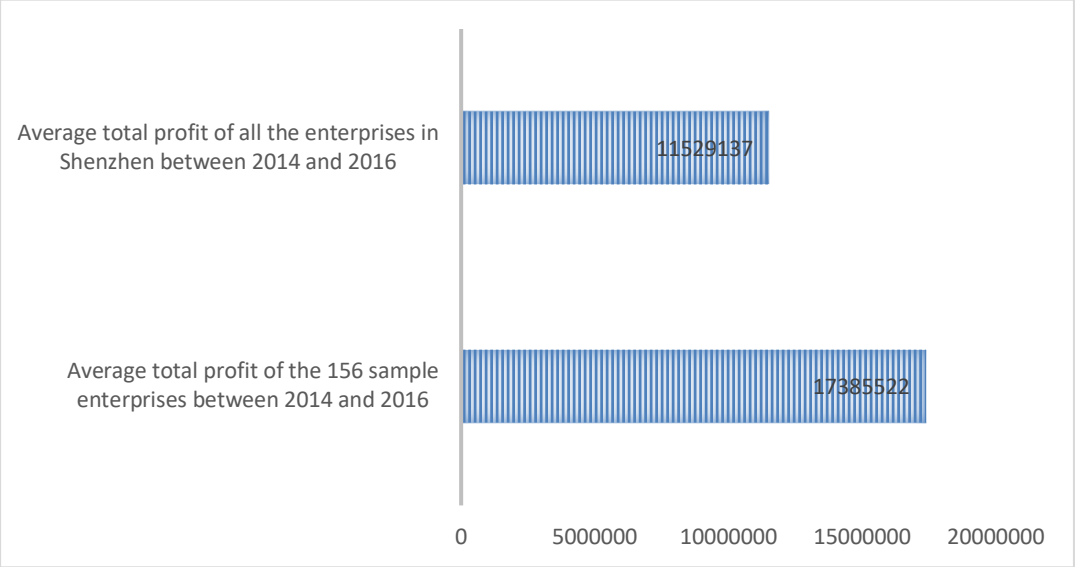

Figure 4.2 Percentage of the total profit of the sample enterprises

2. Descriptive statistics of the sample enterprises by percentage of the number of patents

As shown in Figure 4.3 below, the sample enterprises are the main innovators in Shenzhen. According to the survey, between 2014 and 2016, the average total number of patent applications held by all the enterprises in Shenzhen was 764,772, while the average total number of patent applications held by all the 156 sample enterprises was 185,107, representing a percentage of 24.11%; the average total number of authorised patents for all the enterprises in Shenzhen was 454,310, while the average total number of authorised patents held by all the 156 sample enterprises was 99,560, representing a percentage of 29.72%; the average total number of PCT applications filed by all the enterprises in Shenzhen was 84,870, while the

average total number of PCT applications filed by all the 156 sample enterprises was 28,409, representing a percentage of 34.07% (see Annex A-2).

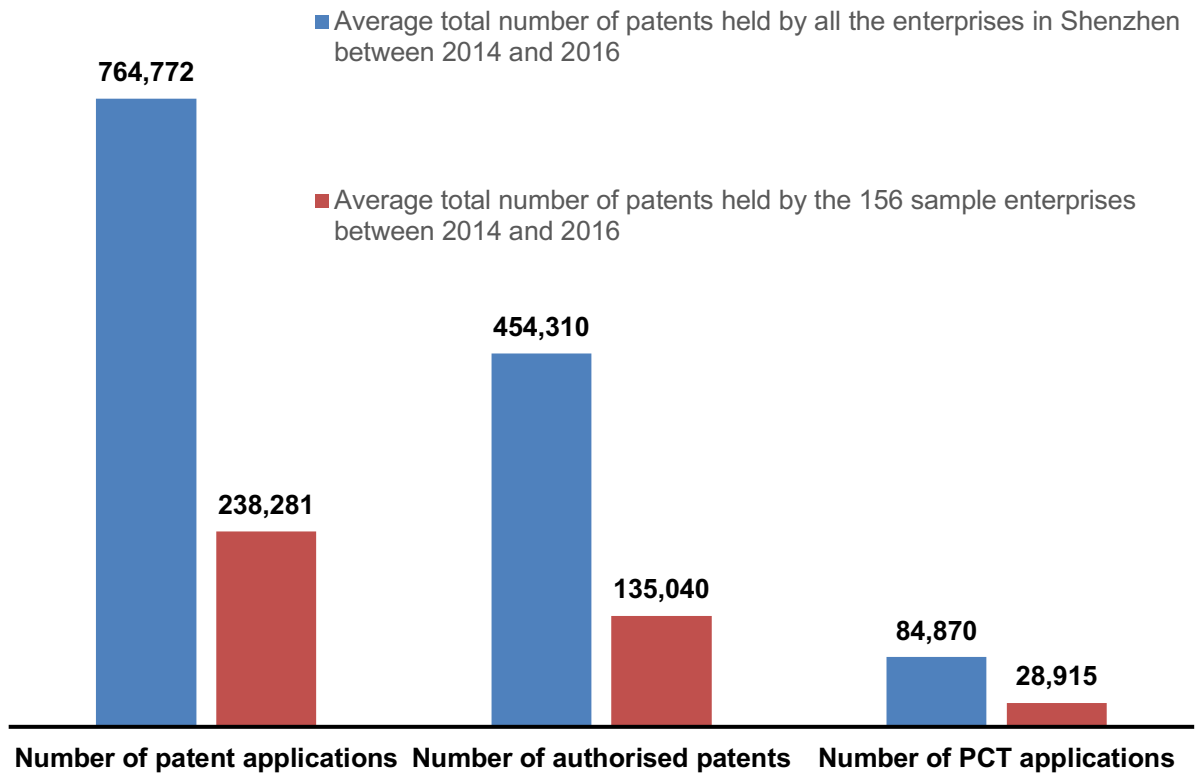

Figure 4.3 Patents filed or held by the sample enterprises to those by all the enterprises in Shenzhen

3. Distribution of the sample enterprises by the year when they were firstly certificated to have set up a standard IP management system

The distribution of the 156 sample enterprises at all levels in Shenzhen by the year when they were firstly certificated as having set up a standard IP management system is shown in Figure 4.4 below. Among the enterprises that submitted valid questionnaires, ten were recognised by the Shenzhen government as having set up a standard IP management system, followed by a steady increase in the number of enterprises gaining this recognition except a decrease in 2008, and then somewhat a stable number of such enterprises all the way till 2015.

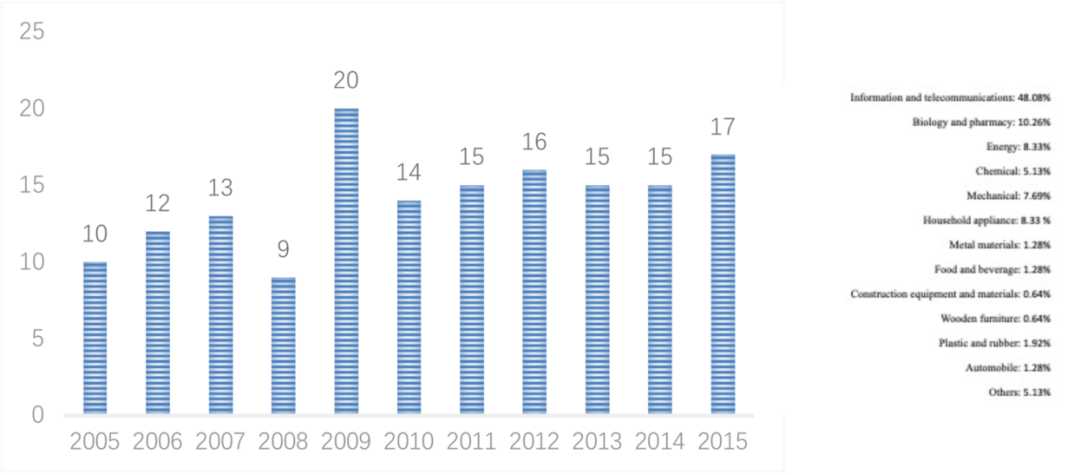

Figure 4.4 Distribution of the sample enterprise by the year when they were first certificated as having set up a standard IP management system

4. Descriptive statistics of the sample enterprises by sector

Figure 4.5 below shows the distribution of the sample enterprises by sector. Specifically, 75 enterprises (48.08%) were in the information and telecommunication sector, 16 enterprises (10.26%) in the biology and pharmacy sector, 13 enterprises (8.33%) in the energy sector, eight enterprises (5.13%) in the chemical sector, 12 enterprises in the mechanical sector (7.69%), 13 enterprises (8.33%) in the household appliance sector; two enterprises (1.28%) in the metal materials sector; two enterprises (1.28%) in the food and beverage sector; one enterprise (0.64%) in the construction equipment and materials sector, one enterprise (0.64%) in the wooden furniture sector, three enterprises (1.92%) in the plastic and rubber sector, two enterprises (1.28%) in the automobile sector, and eight enterprises (5.13%) in other sectors.

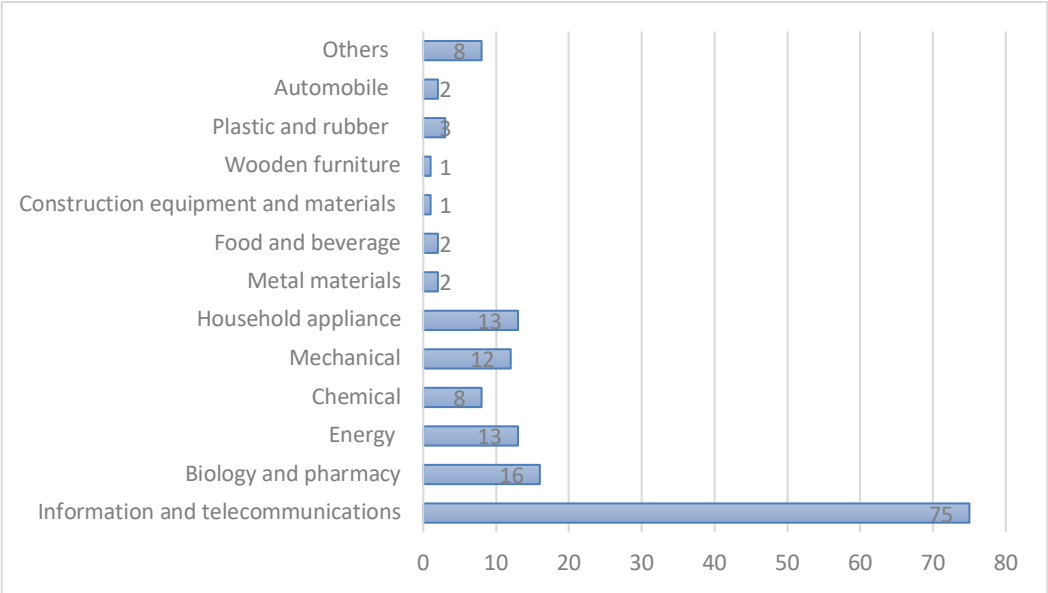

Figure 4.5 Distribution of the sample enterprises by sector

5. Distribution of the sample enterprises by form of business ownership

As shown in Figure 4.6 below, 111 of the sample enterprises (71.15%) were privately owned enterprises, 20 (12.82%) state owned or controlled enterprises, 19 (12.18%) foreign invested or controlled enterprises, and six (3.85%) having other forms of business ownership.

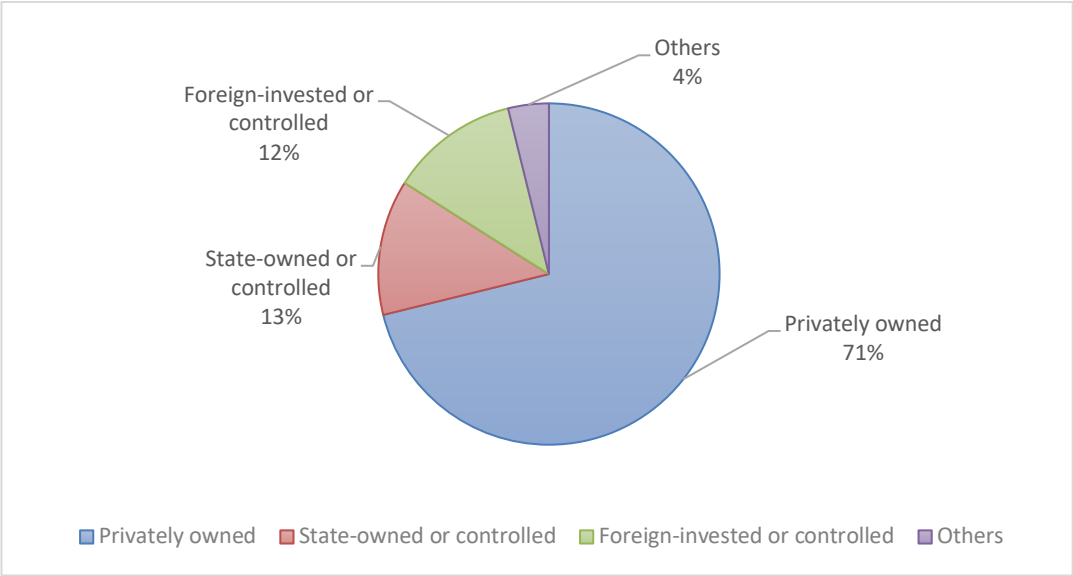

Figure 4.6 Distribution of the 156 sample enterprises by form of business ownership

6. Distribution of the sample enterprises by length of operation

As shown in Figure 4.7 below, the length of operation of 88 sample enterprises (56.41%) was 10-20 years; that of 12 enterprises (7.69%) was less than 10 years; that of 46 enterprises (29.48%) was 20-30 years; and that of seven enterprises (6.41%) was more than 30 years.

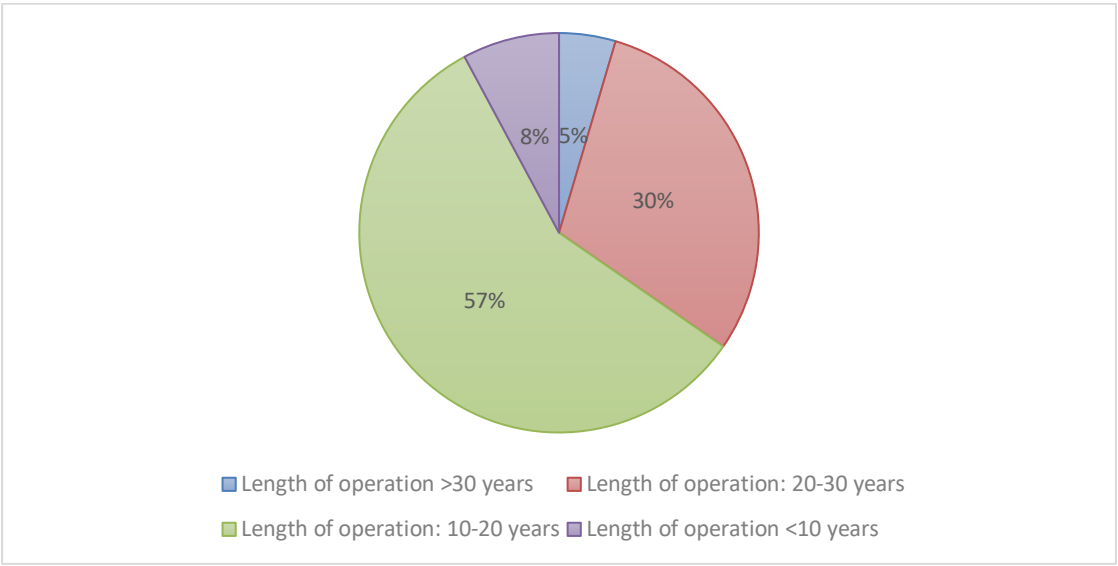

Figure 4.7 Distribution of the sample enterprises by length of business operation

7. Distribution of the sample enterprises by sales revenue

As shown in Figure 4.8 below, 30 enterprises had a sales revenue of less than RMB 100 million, accounting for 19.23%; 37 enterprises had a sales revenue concentrated between RMB

100 million and RMB 500 million, representing a percentage of 23.72%; 30 enterprises had a sales revenue of RMB 500 million to RMB one billion, taking up 19.23%; 21 enterprises had a sales revenue of RMB one billion to RMB two billion, accounting for 13.46%; and 38 enterprises had a sales revenue of more than RMB two billion, representing 24.36% of the total in Shenzhen.

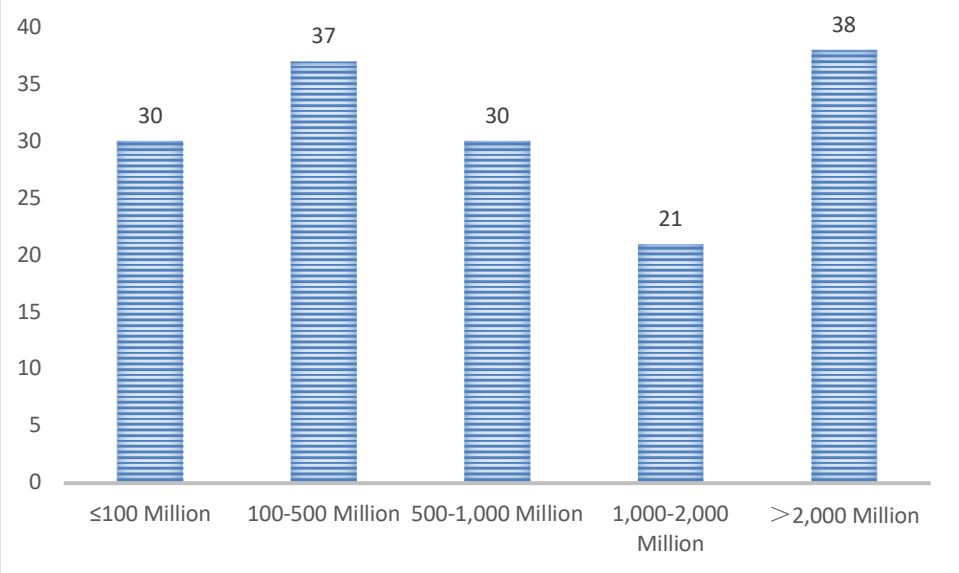

Figure 4.8 Distribution of the sample enterprises by sales revenue

4.5 Questionnaire reliability and validity tests

Cronbach's α coefficient was used to test the overall reliability of the questionnaire. The minimum acceptable value is between 0.65 and 0.70; a value between 0.70 and 0.80 is acceptable; a value between 0.80 and 0.90 is good, and a value above 0.90 is ideal.

Exploratory factor analysis (EFA) was conducted to investigate if the underlying structure of a large set of variables makes sense. The indicator for measuring reliability and validity was composite reliability (CR), while average variance extracted (AVE) was used to test the convergent validity of variables. A factor loading for each variable being greater than 0.5 indicates a strong correlation between the variable and the extracted factor. If the CR is greater than the threshold 0.7, it indicates that the variables have good composite reliability. If AVE is greater than 0.5, it indicates that the variables have good convergent validity. If AVE is greater than the square of the correlation between the structure and other factors, it indicates that the variables have good discriminant validity (Ab Hamid et al., 2017). The reliability and validity tests of this questionnaire are demonstrated in Table 4.4 below.

Table 4.4 Reliability and validity analyses of the variables of IP capabilities, patent capabilities and trademark capabilities

First-order dimension	Second-order dimension	Measurement indicator	Load factor
Patent capabilities	Patent creation capability CR=0.845 AVE=0.5247	Total number of patent applications in China	0.729
		Total number of patent applications abroad	0.588
		Grant rate for patent applications	0.686
		The validity of internal patent incentive system to encourage patent application	0.781
		Level of internal patent application evaluation mechanism	0.816
	Patent commercialization capability CR= 0.8642 AVE= 0.6168	Patent licensing and transfer ratio	0.677
		Patent self-implementation ratio	0.717
		Annual growth rate of patented products sales in the recent three years	0.862
		Proportion of patented products sales to total sales in the recent three years	0.867
	Patent protection capability CR= 0.9282 AVE= 0.7213	Combined protection level of core patents[7] and general patents[7]	0.794
		Establishment and improvement of a patent infringement warning mechanism	0.873
		Level of familiarity with patent protection approaches and procedures	0.864
		Capability of holding infringers legally liable for patent infringement	0.860
		Timeliness and validity of patent protection in current legal system	0.853
trademark capabilities	Trademark creation capability CR= 0.8958 AVE= 0.7418	Number of registered trademarks	0.914
		Regional distribution of registered trademarks	0.867
		Capability to apply for trademark registration in time according to product or market requirements	0.799
	Defensive trademark creation capability CR= 0.9079 AVE= 0.7669	Capability to apply for united trademarks [4] to prevent trademark dilution	0.883
		Capability to apply for defensive trademarks [5] to prevent trademark dilution or advance market development	0.903
		Capability to apply for associated trademarks to meet the requirements of different types of goods	0.840
	Trademark commercialization capability CR= 0.9238 AVE= 0.7096	Ratio of products/services sales with own trademark	0.803
		Ratio of value contribution of to product or service by own trademarks	0.871
		Market value of trademarks	0.917
		Reputation of own trademarks	0.895
		Combination of main trademarks and affiliated trademarks	0.709
	Trademark protection capability CR= 0.923 AVE= 0.7067	Capability to prevent dilution with main trademarks and affiliated trademarks	0.768
		Validity of the protection with domain name related to trademarks or tradename	0.800
		Response time to trademark Infringement by a third party	0.800
		Level of familiarity with trademark protection	0.907

	approaches and procedures	
	Capability of holding infringers legally liable for patent infringement	0.917
Patent Capabilities	Patent creation capability	0.849
CR= 0.8357	Patent commercialization capability	0.681
AVE= 0.6312	Patent protection capability	0.842
Trademark capabilities	Trademark creation capability	0.842
CR= 0.8783	Defensive trademark creation capability	0.741
AVE= 0.644	Trademark commercialization capacity	0.789
	Trademark protection capacity	0.834
IP capabilities	IP capabilities	0.851
CR=0.7242		
AVE=0.7242		

(1) IP capabilities, patent capabilities and trademark capabilities

Seen from Table 4.4, the Load factor, CR and AVE for each variable and dimension are greater than the threshold requirement, indicating that the questionnaire has high reliability and validity for the variables of IP capabilities, patent capabilities and trademark capabilities.

(2) Business performance

Results of the reliability and validity tests of the business performance variable in this questionnaire showed CR = 0.945 and AVE = 0.8123. The load factor of each variable and dimension was greater than the threshold requirements. 0.761 for status in domestic industry, 0.931 for annual sales growth rate in the recent three years compared with the industry level in China, 0.959 for annual RONA in the recent three years compared with the industry level in China, and 0.940 for annual profit rate in the recent three years compared with the industry level in China, indicating that the questionnaire had high reliability and validity for the business performance variable. Table 4.5 shows the correlation coefficient matrix between the variables. It can be observed that the correlation coefficient between the independent variables and the dependent variable is <0.7, which indicates no collinearity between them. It can be inferred that IP capabilities, patent capabilities and trademark capabilities are significantly and positively correlated with the business performance of an enterprise.

4.6 Summary

This chapter focuses on the measurement model of the relationship between IP capabilities and enterprise competitive advantage, with IP capabilities as the independent variable, competitive advantage as the dependent variable and setting ownership of an enterprise, sector, length of operation and length of government-recognised IP management system establishment as control variables. On this basis, the measurement equation between the independent variable, the control variables and the dependent variable was created.

Table 4.5 Matrix of correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.PER	1														
2.IPC	.201*	1													
3.PA	.453**	.630**	1												
4.PC	.454**	.539**	.797**	1											
5.PU	.398**	.327**	.743**	.363**	1										
6.PP	.238**	.631**	.827**	.593**	.352**	1									
7.TA	.383**	.350**	.556**	.453**	.344**	.522**	1								
8.TC	.402**	.235**	.425**	.448**	.230**	.349**	.833**	1							
9.TD	.228**	.293**	.454**	.373**	.259**	.445**	.774**	.524**	1						
10.TU	.322**	.190*	.331**	.264**	.267**	.251**	.776**	.579**	.382**	1					
11.TP	.285**	.402**	.570**	.362**	.348**	.622**	.822**	.579**	.511**	.568**	1				
12.AGE	.018	.030	.043	.087	.039	-.014	.097	.058	.097	.135	.018	1			
13.AT	.150	.034	-.100	-.120	-.069	-.055	-.037	-.114	.067	-.026	-.060	.348**	1		
14.OWN	.108	.070	-.001	-.044	.015	.018	.150	.112	.021	.169*	.195*	-.162*	-.223**	1	
15.IND	.090	.145	.051	.036	-.037	.121	.111	.081	.171*	-.004	.095	-.146	-.159*	.014	1

Note: *p<0.05; **p<0.01; *** p<0.001.

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Chapter 5: An empirical study on IP capabilities and business performance of Chinese enterprises

Chapter 4 has established a theoretical model of the relationship between IP capabilities and competitive advantage of enterprises. This chapter will provide an empirical study of the connection between the IP practices and business performance of Chinese enterprises. Based on an empirical study of the enterprises with a government-recognised IP management system in Shenzhen, the Thesis will give a positive explanation to the paradox of the surge in patent and trademark registrations in China, provide suggestions to enterprises on how to optimize the strategy of patent application, commercialization and protection as well as on how to optimize the strategy of trademark registration, commercialization and protection, thereby continuously enhancing business competitiveness.

5.1 Descriptive statistics

5.1.1 Basic IP information of the sample enterprises

(1) Distribution of IP types

As shown in Figure 5.1, the main types of IP owned by the sample enterprises included patents, trademarks, copyrights and know-how. All the 156 sample enterprises owned patents; 146 sample enterprises owned trademarks; 106 sample enterprises owned copyrights; 89 sample enterprises owned know-how; and 41 sample enterprises owned other types of IP.

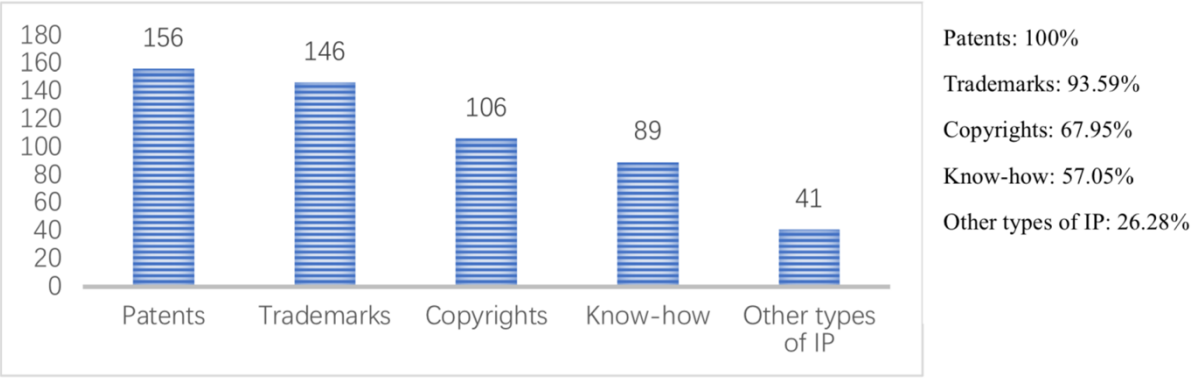

Figure 5.1 Types of IP owned by the sample enterprises

(2) Ways to acquire IP

As shown in Figure 5.2 below, the sample enterprises acquired IP through such ways as independent innovation, acquisition, licensing and enterprise mergers. All the 156 sample enterprises could generate IP by independent innovation; 35 sample enterprises acquired IP through acquisition; 27 sample enterprises acquired IP through enterprise mergers; 26 sample enterprises acquired IP through licensing; and 15 sample enterprises acquired IP through other ways.

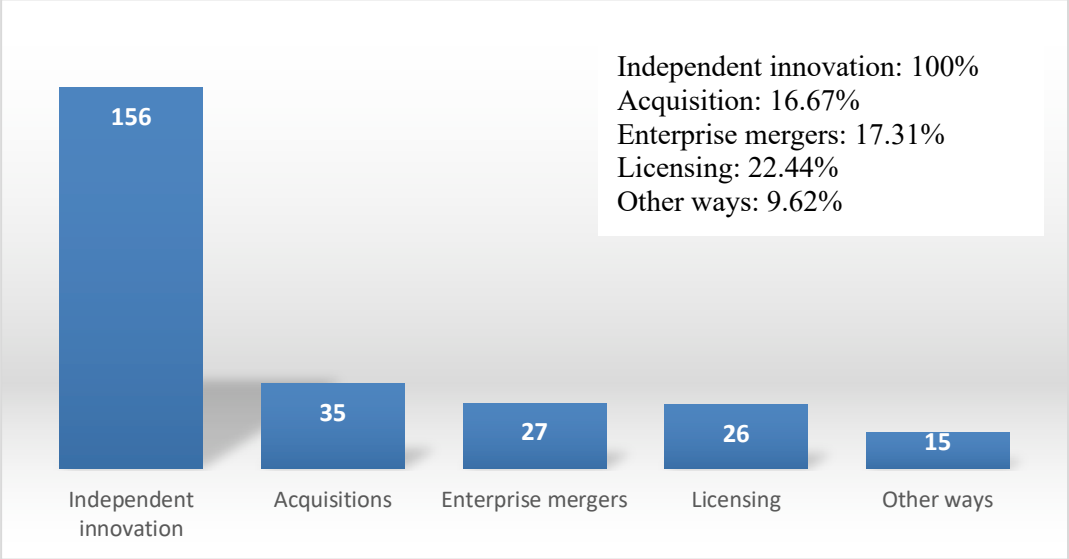

Figure 5.2 Ways to acquire IP adopted by the sample enterprises

(3) Ways of IP commercialization

As shown in Figure 5.3 below, the sample enterprises commercialized the IP in such ways as self-implementation, out-licensing, transfer and other financing ways. All the 155 sample enterprises made self-implementation of the IP; 61 sample enterprises licensed their IP out; 52 sample enterprises engaged in IP transaction; 18 sample enterprises commercialized the IP with other ways of financing, such as IP investment, IP insurance and IP mortgage.

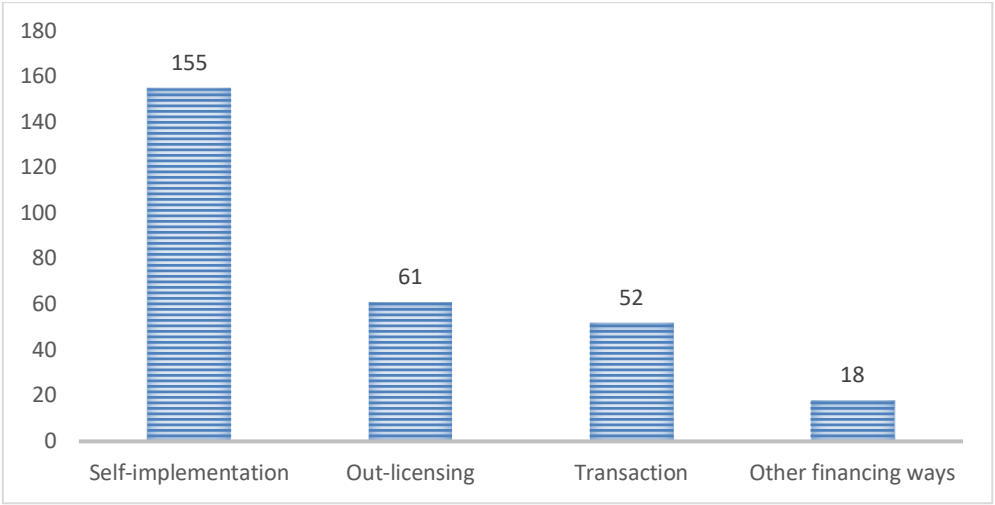

Figure 5.3 Ways of IP commercialization by the sample enterprises

(4) Ways to resolve IP disputes

The survey results suggested that the sample enterprises preferred to choose settlement through negotiation (3.38 points) and litigation (3.60 points) in favour of administrative management (3.28 points), arbitration (3.26 points) and discipline by industry associations (2.61 points), to resolve IP disputes.

5.1.2 Patent capabilities of the sample enterprises

The evaluation results of patent creation, commercialisation and protection capabilities of the sample enterprises are presented in Table 5.1 below.

Table 5.1 Evaluation results of patent creation, commercialisation and protection capabilities of the sample enterprises

Indicators of patent creation capability	Evaluation
Total number of domestic patent applications compared with the industry level in China	4.08
Total number of patent applications abroad compared with the industry level in China	3.21
Grant rate for patent applications	4.06
The validity of internal patent incentive system to encourage patent applications	4.06
Level of internal patent application evaluation mechanism	3.99
Indicators of patent commercialization capability	**Evaluation**
Patent licensing and transfer ratio	3.59
Patent self-implementation ratio	4.16
Annual growth rate of patented products sales in the recent three years	3.77
Proportion of patented products sales to total sales in the recent three years	3.97
Indicators of patent protection capability	**Evaluation**
Combined protection level of core patents and general patents	3.98
Establishment and improvement of a patent infringement warning mechanism	3.76
Level of familiarity with patent protection approaches and procedures	4.06
Capability of holding infringers legally liable for patent infringement	3.62
Timeliness and validity of patent protection in the current legal system	3.70

5.1.3 Trademark capabilities of the sample enterprises

The evaluation results of trademark creation, commercialisation and protection capabilities of the sample enterprises are presented in Table 5.2 below.

Table 5.2 Evaluation results of trademark creation, commercialisation and protection capabilities of the sample enterprises

Indicators of trademark commercialization capability	Evaluation
Number of registered trademarks compared with the industry level in China	3.87
Regional distribution of registered trademarks compared with the industry level in China	3.62
Capability to apply for trademark registration in time according to product or market requirements	4.09
Capability to apply for united trademarks [4] to prevent trademark dilution	3.21

Capability to apply for defensive trademarks [5] to prevent trademark dilution or to advance market development	3.38
Capability to apply for associated trademarks to meet the requirements of different types of goods	3.48
Indicators of trademark commercialization capability	Evaluation
Ratio of products/services sales with own trademarks	4.37
Ratio of value contribution of to product or service by own trademarks	4.11
Market value of trademarks compared with the industry level	4.07
Reputation of own trademarks compared with the industry level in China	4.14
Combination of main trademarks and associated trademarks	3.49
Indicators of trademark protection capability	Evaluation
Capability to prevent dilution with main trademarks and associated trademarks	3.77
Validity of the protection with domain name related to trademarks or tradename	3.86
Response time to trademark infringement by a third party	3.96
Level of familiarity with trademark protection approaches and procedures	3.99
Capability of holding infringers legally liable for trademark infringement	3.87

5.2 Empirical analyses of IP capabilities and competitive advantage of enterprises

5.2.1 General analysis

In this part of regression analysis, control variables included ownership of an enterprise (OWN), sector (IND), length of operation (AGE) and length of government-recognised IP management system establishment (AT). IP capabilities is a construct consisting of patent capabilities and trademark capabilities. The results of regression analyses of the relationship between general IP capabilities and business competitiveness are demonstrated in Table 5.3 below. It can be seen that when competitiveness of an enterprise was set as the dependent variable, IP capabilities was positively correlated to business competitiveness at the significance level of 0.1% ($\beta=0.399$, $p<0.01$), indicating that among the sample enterprises, the stronger the IP capabilities, the stronger the business competitiveness. Specifically, ΔR^2 referred to the increase in R^2 resulting from the R^2 of Model 2 subtracting the R^2 of Model 1. Specifically, 0.200 - 0.042 = 0.158. The result showed that after the addition of the independent variable, the R^2 value increased, indicating increased goodness-of-fit of the model.

Table 5.3 Results of regression analyses of the relationship between general IP capabilities and business competitiveness

	Model 1		Model 2	
	Standard coefficient β	t-value	Standard coefficient β	t-value
Control variables:				
Length of operation	0.121	1.355	0.079	0.962
Length of government-recognised IP management system establishment	-0.198*	-2.178	-0.168*	-2.014
Ownership	0.051	0.587	0.050	0.634
Independent variable:				
IP capabilities			0.399**	5.210
R^2	0.042		0.200	
ΔR^2			0.158	
Control variables:				
Length of operation	0.069	0.824	0.015	0.197
Length of government-recognised IP management system establishment	-0.183*	-2.148	-0.125	-1.608
Ownership	0.097	1.205	0.056	0.749
Sector	-0.144*	-1.79	-0.147*	-2.032
Independent variables:				
IP capabilities	0.233**	2.947		
trademark capabilities			0.197*	2.248
patent capabilities			0.337***	3.914
R^2	0.099		0.267	
ΔR^2	0.069		0.237	

Note: *p<0.05; **p<0.01; *** p<0.001

5.2.2 Patent capabilities and business performance of enterprises

Patent capabilities consist of patent creation capability, patent commercialization capability and patent protection capability. The results of regression analyses of the relationship between patent capabilities and business competitiveness are demonstrated in Table 5.4 below. It can be seen that when the competitiveness of an enterprise was set as the dependent variable, patent capabilities was positively correlated to business competitiveness at the significance level of 0.1% ($\beta=0.456, p<0.01$), indicating that among the sample enterprises, the stronger the patent capabilities, the stronger the business competitiveness.

Table 5.4 Results of regression analyses of the relationship between patent capabilities and business competitiveness

	Model 1		Model 2	
	Standard Coefficient β	t-value	Standard Coefficient β	t-value
Control variables:				
Length of operation	0.121	1.355	0.090	1.125
Length of government-recognised IP management system establishment	-0.198*	-2.178	-0.138	-1.691
Ownership	0.051	0.587	0.079	1.028
Independent variable:				
patent capabilities			0.456**	6.112
R^2	0.042		0.246	
ΔR^2			0.208	
Control variables:				
Length of operation	0.036	0.459	0.001	0.009
Length of government-recognised IP management system establishment	-0.118	-1.496	-0.079	-1.024
Ownership	0.09	1.221	0.108	1.513
Sector	-0.127*	-1.745	-0.097	-1.364
Independent variables:				
patent capabilities	0.446***	6.168		
patent creation capability			0.411***	4.588
patent commercialization capability			0.272***	3.592
patent protection capability			-0.096	-1.087
R^2	0.241		0.304	
ΔR^2	0.216		0.271	

Note: *p<0.05; **p<0.01; *** p<0.001

5.2.3 Trademark capabilities and business performance

Trademark capabilities consist of trademark creation capability, defensive trademark creation capability, trademark commercialization capability and trademark protection capability. The results of regression analyses of the relationship between trademark capabilities and business competitiveness are demonstrated in Table 5.5 below. As is shown in the table, when the

competitiveness of an enterprise was as the dependent variable, trademark capabilities was positively correlated to business competitiveness at the significance level of 0.1% (*β=0.398, p<0.01*), indicating that among the sample enterprises, the stronger the patent capabilities, the stronger the business competitiveness.

Table 5.5 Results of regression analyses of the relationship between trademark capabilities and business competitiveness

	Model 1		Model 2	
	Standard Coefficient β	t-value	Standard Coefficient β	t-value
Control variables:				
Length of operation	0.121	1.355	0.060	0.718
Length of government-recognised IP management system establishment	-0.198*	-2.178	-0.176*	-2.103
Sector	0.051	0.587	-0.004	-0.047
Independent variable: trademark capabilities			0.398**	5.116
R^2	0.042		0.195	
ΔR^2			0.153	
Control variables:				
Length of operation	0.016	0.204	0.012	0.142
Length of government-recognised IP management system establishment	-0.162*	-2.002	-0.138*	-1.676
Ownership	0.019	0.240	0.024	0.303
Sector	-0.157*	-2.063	-0.145*	-1.883
Independent variables: trademark capabilities	0.390***	5.126		
General trademark creation capability			0.286**	2.756
Defensive trademark creation capability			0.053	0.563
Trademark commercialization capability			0.108	1.098
Trademark protection capability			0.032	0.313
R^2	0.190		0.207	
ΔR^2	0.163		0.164	

Note: *p<0.05; **p<0.01; *** p<0.001

5.3 Summary

In economics theory, the design of IP rights has been treated as an optimisation problem. Governments adjust IP policy to maximize the net benefit that accrues to society from new inventions, taking into account the possibly adverse effects exclusive rights have on

competition and follow-on innovation. Economist William Nordhaus first applied the optimization approach to setting the term of patent protection (Nordhaus, 2011). It can also be applied to the breadth of IP protection as determined by the claims set out in IP titles and their interpretation by courts (Gilbert & Shapiro, 1990; Scotchmer, 2004). The following findings are obtained through the above analyses.

1. IP capabilities, patent capabilities and trademark capabilities are significantly and positively correlated with the business competitiveness of enterprises. Specifically, the stronger the IP capabilities, the stronger the business competitiveness of enterprises, indicating that the IP of an enterprise has significant commercial value. The competitive advantage of enterprises can be enhanced by improving IP capabilities. The correlation between IP capabilities and business competitiveness (β = 0.399), that between patent capabilities and business competitiveness (β = 0.456), and that between trademark capabilities and business competitiveness (β = 0.398) are slightly different, with patent capabilities (β = 0.456) having a relatively more significant impact on business competitiveness.

2. Patent capabilities of an enterprise have a significantly positive effect on its business performance. This indicates that regardless of the motivation of patent application, even the surge in patent applications over the past decade because of external government support would have led to enhanced patent creation capability, patent commercialization capability and patent protection capability which have produced a positive effect on the competitiveness of enterprises comprehensively. Specifically, position ranking in the industry, revenue growth rate, RONA and profit margin will be promoted by enhanced patent capabilities. Therefore, it is an effective way for enterprises to integrate internal resources and external support from the government to improve their patent capabilities, thus enhancing their business competitiveness.

3. The empirical study opened the black box of patent capabilities. Analyses results show that the impacts of patent creation capability, patent commercialization capability and patent protection capability on business performance competitiveness are different. Among them, patent creation ability and patent commercialization capability are significantly and positively related to the competitive advantage of enterprises, while patent protection capability has no significant impact on business performance. This indicates that the domestic and foreign patent application activity, the increasing grant rate for patent applications, incentives policies, patent evaluation mechanisms, increasing sales of patented products and the commercialization of patent rights made positive contributions to the business performance of enterprises. In comparison, the protection of patent portfolio, patent warning letters, offensive patent infringement actions and defensive patent infringement actions have not yet provided a strong

support for the improvement of business performance. It can be inferred that in the globalization process, Chinese enterprises remain in the stage of product competition and have not yet reached the stage of patent competition. Hence, Chinese enterprises need to enhance their patent protection capability.

4. Trademark capabilities of enterprises have a significantly positive effect on business performance. This indicates that regardless of the motivation of trademark application, even the surge in trademark applications over the past decade because of external government support would have led to enhanced trademark creation capability, trademark commercialization capability and trademark protection capability which have produced a positive effect on the competitiveness of enterprises comprehensively. Specifically, position ranking in the industry, revenue growth rate, RONA and profit margin will be promoted by enhanced trademark capabilities. Therefore, it is an effective way for enterprises to integrate internal resources and external support from the government to improve their trademark capabilities, thus enhancing their business competitiveness.

5. The impacts of trademark creation capability, defensive trademark creation capability, trademark commercialization capability and trademark protection capability on business performance competitiveness are different. Among them, trademark creation capability and trademark commercialization capability are significantly and positively related to the competitive advantage of enterprises, while trademark protection capability has no significant impact on business performance. This indicates that the domestic and foreign trademark application activity, increased trademark reputation and increased use of trademarks on products have made positive contributions to the business performance of enterprises. In comparison, the offensive trademark infringement actions and defensive trademark infringement actions have not yet provided a strong support for the improvement of business performance. It can be inferred that in the globalization process, Chinese enterprises remain in the stage of product competition and have not yet reached the stage of trademark competition. Hence, Chinese enterprises need to enhance their trademark protection capability.

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Chapter 6: A close-up view of IP capabilities and business performance: Comparing the cases of Huawei and ZTE

Based on the theoretical analysis and empirical study in previous chapters, this chapter takes ZTE and Huawei, two representative companies in Shenzhen, for two case studies to find out how their IP capabilities affect their business competitiveness. The differences of the two companies' IP capabilities indicators and the impacts of such indictors on their business competitiveness will be analysed. Then, suggestions on how to improve the IP capabilities of the enterprises to enhance their business competitiveness will be put forward. From the aspect of the external environment, with the development of the "Belt and Road Initiative" and China's increased international status, China is actively promoting a new round of globalization. How Chinese enterprises should enhance their IP capabilities to improve their global business competitiveness is also discussed.

6.1 Research background

6.1.1 IP is the source of competitive advantage for enterprises in modern times.

To maintain the leading position in the economy and technological innovation, the U.S. has been continuously strengthening IP protection worldwide. It has managed to establish a set of worldwide IP protection norms and systems with American standards which are in line with its economic interests.

The United States Congress (2018) passed the Omnibus Trade and Competitiveness Act of 1988, using "Special Section 301" to link IPRs with trade to suppress competitors. Under the WTO framework, the U.S. actively led and promoted the signing of the TRIPS Agreement and incorporated other countries within the bounds of the TRIPS Agreement through trade threats, thereby promoting the "American-standard" IP policy worldwide.

After studying the competitiveness of such companies as IBM, Microsoft, Lucent, Dell, Gillette and Dow Chemical, Rivette and Kline (2000) proposed an idea that IPRs have gradually become the key source of competitiveness of successful companies, and IP management is the source of corporate value creation in a society where competitiveness is increasingly benefiting from innovative outcomes of new ideas rather than controlling markets and raw materials.

Companies that are good at managing IP will win the competition, and those poor at it will lose the competition.

By the year 2000, American companies had already been adept at using IP capabilities to enhance their competitive advantages, while Chinese companies were still very ignorant when facing IP related issues.

According to Zhou (2006), Chief Legal Counsel of Foxconn Group, "From 1996 to 2005, about 100 patent infringement lawsuits were filed against Taiwanese companies, and huge sums of legal service fees, settlements fees and damages were paid; many companies were even forced to abandon the markets and sales of many products. Meanwhile, the Taiwanese high-tech companies and traditional enterprises still had to pay about NT $ 150 billion royalties to companies in the U.S., Europe, Japan and ROK to obtain the license of IP such as patent technology, brands and works."

After China's accession into the WTO, Chinese Mainland enterprises accelerated their entry into the global market, and various products continuously moved to overseas markets. Then Chinese companies were constantly met with tremendous IP pressure from Western companies and organizations. For example, since 2002, Chinese DVD companies began to suffer from patent royalties offered by 6C which was a patent pool management organization, consisting of Toshiba, Panasonic, Japan Victory, Mitsubishi Electric, Hitachi, and Time Warner and 3C which was another patent pool management organization consisting of Philips, Sony and Pioneer companies. A huge number of DVD products were seized at customs, and DVD manufacturers were almost unprofitable after paying the royalties. As a result, the DVD manufacturers were forced to close their factories or switch to other industries areas.

With the development and expansion of China's digital TV industry, European and American digital TV markets have been occupied by Chinese products. However, since 2007, Hisense, TCL, Skyworth, Haier, Changhong, Konka and other Chinese digital TV companies have been suffering from the royalty payments to Western organizations such as MPEG-LA, SISVEL, Thomson and Dolby. The royalty was equal to 20%-50% of the profit of each product. If the digital TV manufacturers failed to get the license, the products would end up in a series of serious consequences such as customs deductions, withdrawal of products in the market, injunction and IP infringement claims.

In the era of DVD and Digital TV, Chinese enterprises were lack of IP capabilities to fight against the foreign competitors. However, after more than a decade of global business practice and competition, a group of qualified IP managers and lawyers had grown up in China. Meanwhile, Chinese entrepreneurs were incubated with a more strategic and in-depth

understanding of IP. The management of Chinese companies gradually managed to integrate such IP practices as IP creation, IP protection, IP commercialization and IP management with business performance such as strategy planning, R&D, manufacturing management, marketing, human resource management and finance management. By doing so, the Chinese enterprises could utilize IP to create more revenue and profits, reduce costs, control risks, and better serve the strategic targets, thus leading to enhanced business competitiveness.

In the era of mobile communications characterised by such sectors as 4G, 5G and electric vehicles, Chinese companies have gradually become adept at the business competition with IP capabilities. According to Mendonça et al. (2022), originally 5G works were mostly published in the West, but Far Eastern countries later jumped ahead. 5G-related publications took off in 2014, followed by citations. Chinese authors dominate in terms of output, but US-based scholars are more cited.

6.1.2 ZTE and Huawei show competitiveness during business competition.

As one of China's most prominent multinational companies, Huawei was involved in a geopolitical battle between the U.S. and China, it has received unfair attention in the Western media since 2018, when the U.S. government make every effort to persuade other Western countries to ban Huawei's 5G technology from their telecommunications infrastructure (Murmann et al., 2021).

Motorola, Ericsson and Nokia were early leaders in feature phones, but when the smartphone came along, they all failed to transform themselves into successful smartphone makers. While in contrast, Huawei, which only entered the Mobil phone business in 2003, supplying phone operators with cheap 2G and 3G equipment, managed to become the largest smart phone in the second quarter of 2020. Then the US government intervened to strip it of key technology components, urged Huawei to sell smartphone brand (Honor) to regain access to American technology. Yan et al. (2021) conducted an instructive study on how Huawei's mobile phone business can achieve what most Western competitors cannot.

Huawei, on June 27, 2019, released a white paper on innovation and IP at the Bantian base in Shenzhen. The white paper states that innovation and IP protection had been the foundation of Huawei's success over the past 30 years. By the end of 2018, Huawei had accumulatively obtained 87,805 granted patents, of which 11,152 were U.S. patents, and more than 6,600 were European patents. Besides, Huawei was the company with the most patents granted in China and one of the companies with the most PCT patent applications in the world. In 2018, Huawei

filed 5,405 PCT applications to WIPO. The WIPO Director General Francis Gurry said: “This is the highest record ever for a company (WIPO, 2018).”

As of January 1st, 2020, Huawei had declared most 5G patents followed by Samsung (Korea), ZTE (China), LG (Korea), Nokia (Finland), Ericsson (Sweden) and Qualcomm (US) (Von Laer et al., 2022). They have been actively involved in the development of the LTE standard, but some new market players from China are also on the list of top patent owners. In summary, new data on 5G SEPs confirms China’s role as a game-changer in LTE-related mobile communication technologies that had already begun before 2010 (Von Laer et al., 2022).

ZTE and Huawei are typical Chinese enterprises that make use of IP capabilities to enhance their global competitiveness in the era of global business competition.

6.2 Problem description

From the theory of Porter’s “value-chain”, Huawei should own special competitive capabilities in R&D, marketing and sales, supply-chain management, manufacturing and HR management.

IP is a powerful tool for competition as well as a source of competitiveness for an enterprise. It is supposed that there should be some sort of connection between an enterprise’s IP capabilities and its business competitiveness.

It seems that both Huawei and ZTE own a large IP pool as internal resources. But there are differences regarding the influence of IP capabilities on business performance, and the factors that caused such differences remain unknown.

Therefore, this chapter carries out an in-depth analysis of the IP capabilities of Huawei and ZTE, including patent creation capability, patent protection capability and patent commercialization capability and trademark creation capability. The statistics and analysis will reveal the differences in the impacts of IP capabilities on business competitiveness between the two companies.

This chapter also compares the business performance of the two companies, including the comparation of revenue, profit and position in the industry. With the interview of the management of both companies, this chapter tries to find out the connection between IP capabilities and business performance, and the factors which caused the difference in business performance.

Based on the case studies of ZTE and Huawei, this chapter provides some useful suggestions for the enterprises to improve their IP capabilities and enhance business performance.

6.3 Research method

This chapter uses the method of case study to understand the IP capabilities formed by the two companies in the development process as well as the connections between IP capabilities and business performance, to reveal the causes of different results. According to Eisenhardt (1989), Yin (2003) and C. M. Costa and Mendonça (2019), when answering "how" or "why" types of questions, case study should be selected as the research method with priority. A case study method is appropriate if the phenomenon under study is neither separable nor distinguishable from its context (Yin, 2003), and the interest is in understanding how behaviour events or processes are influenced by, and influence, the context (Hartley, 2004). In term of the characteristics of research questions, there are three types of research questions, namely, interpretive research, descriptive research and exploratory research.

This case study is an explanatory study that seeks to find an explanation for the link between cause and solution. Yin (2003) believes that case study should find the most "suitable person" and appropriate method to collect "information". Meanwhile, to avoid the one-sidedness of the study, case studies encourage the use of cross-complement and cross-validation methods. This chapter collects information mainly through the following two sources:

(1) Interview. From 2018 to 2021, the author conducted four semi-structured interviews with the management of the two companies. Each individual interview lasted about one hour. The interviewees included the general counsel of Huawei, senior IP manager of Huawei and the directors of ZTE IP department. In the interview process, according to the role characteristics of different interviewees, the author conducted in-depth communication on issues from the strategic level to the specific implementation level.

(2) Data statistics. PatSnap software was used to obtain the global patent data of ZTE and Huawei. PatSnap is a technology and innovation intelligence SaaS provider. Its global patent database has 170 million pieces of global patent data, covering official patent data from 158 countries/regions, providing accurate, multi-dimensional and visualized patent and R&D intelligence. In February 2020, the researcher entered the key words "Assignee: ZTE & Time, Period: 2000 to 2019"; Assignee: Huawei; Time Period: 2000 to 2019" into the search engine of the patent database to collect the global patent data of ZTE and Huawei. The data on business competitiveness were from the annual reports of ZTE and Huawei.

6.4 Comparisons of IP capabilities and business competitiveness between Huawei and ZTE

6.4.1 A comparison of IP capabilities

This chapter focuses on the relationship between IP capabilities, including patent capabilities and trademark capabilities, and the competitive advantages of the two case enterprises.

According to the disclosed information, data on patent creation and trademark creation can be retrieved through public databases and verified through interview communication. Information on patent commercialization and protection is often highly confidential within companies. Strategic-level information and typical cases can be obtained through interviews. Because ZTE and Huawei are independent brand companies, all their products are marked with their own trademarks. There are no obvious differences in trademarks capabilities. So, the information on trademark commercialization and protection is not compared.

(1) A comparison of patent creation capability

The publication of patent applications is an important indicator of patent creation capability. The data on patent applications publication can be retrieved through PatSnap software. Regarding the territorial distribution of patent applications, the top 15 territories of GDP in 2018 which contributed to 90% of the global GDP were selected as the target territories, and the number of patent applications with WIPO in these territories was indicated (see Figure 6.1).

Distribution of patent applications in global main territories

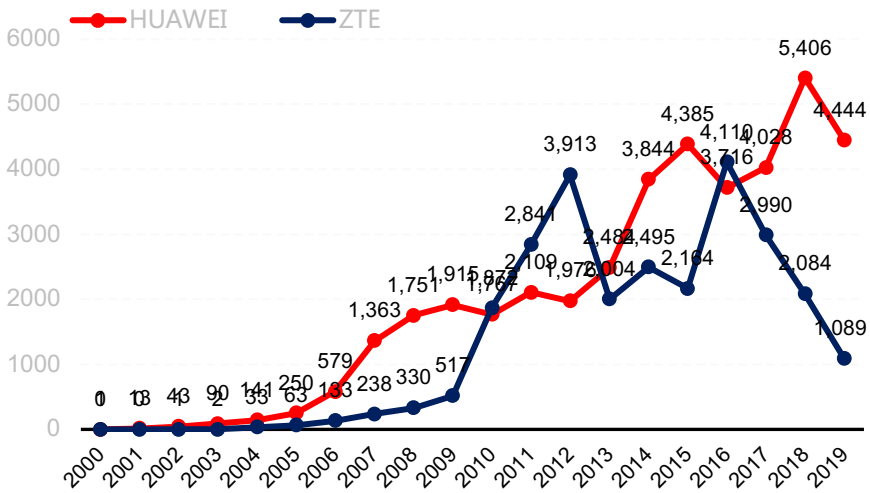

Figure 6.1 A comparison of published patent applications with WIPO from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

Regarding the data of Huawei's worldwide PCT applications filed with WIPO, Huawei ranked No.1 in 2008, No.2 in 2009, No.4 in 2010, No.3 in 2011, No.4 in 2012 and No.3 in 2013; from 2014, Huawei ranked No.1 in PCT applications worldwide in 2014, 2015, 2017 and 2018, and No.2 in 2016. The growth trend of Huawei's PCT applications were highly consistent with the growth of its business competitive advantage.

As shown in Figure 6.2, ZTE had ranked among top five in terms of PCT applications for nine consecutive years since 2010; No. 2 in 2010, and No.1 in 2011, 2012 and 2017. It seems that its performance of PCT patent capability obviously surpassed its business competitiveness.

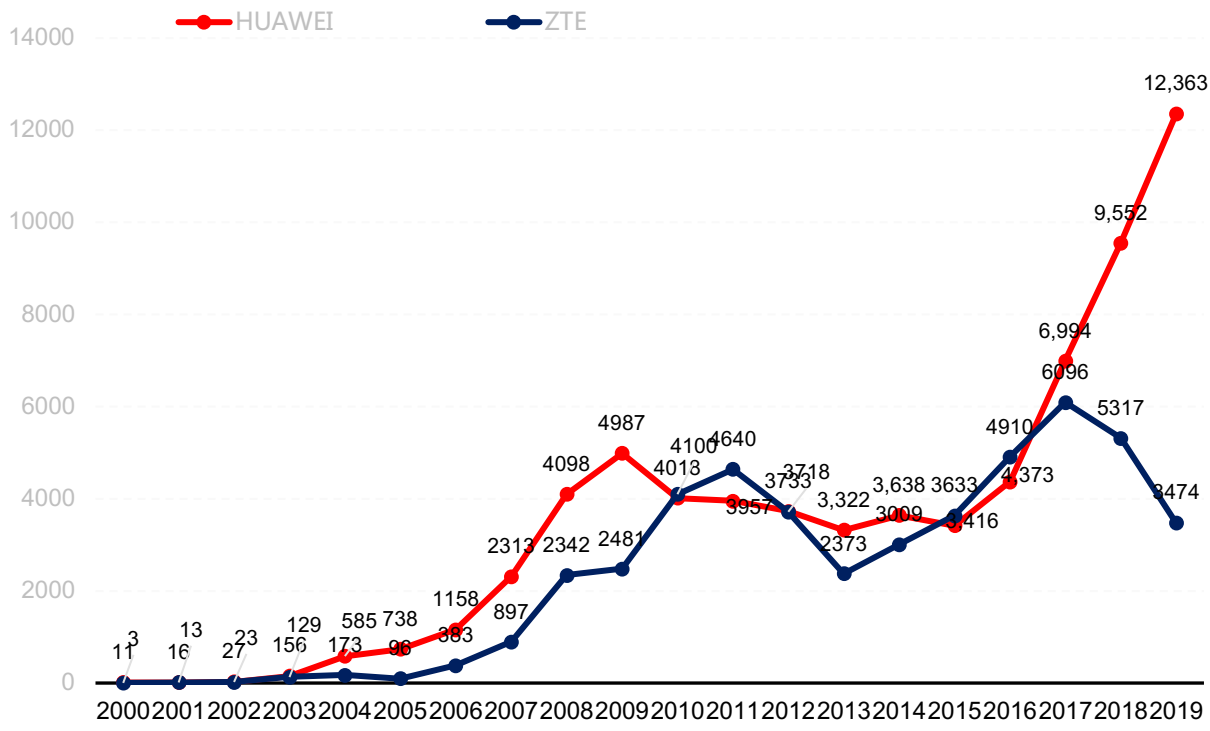

Figure 6.2 A comparison of published patent applications in China from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

The number of patent applications of Huawei showed a trend of steady increase, which was highly in alignment with its business performance.

As to the development tendency of ZTE patent applications in China, from 2005 to 2011, the number of patent applications was steadily increasing, reaching the highest point in 2011, followed by a sharp decline in 2012 and 2013; after a strategic adjustment in 2014, the number showed an increasing trend from 2014 to 2017. However, in 2018 and 2019, the number of published patent applications declined sharply (see Figure 6.3).

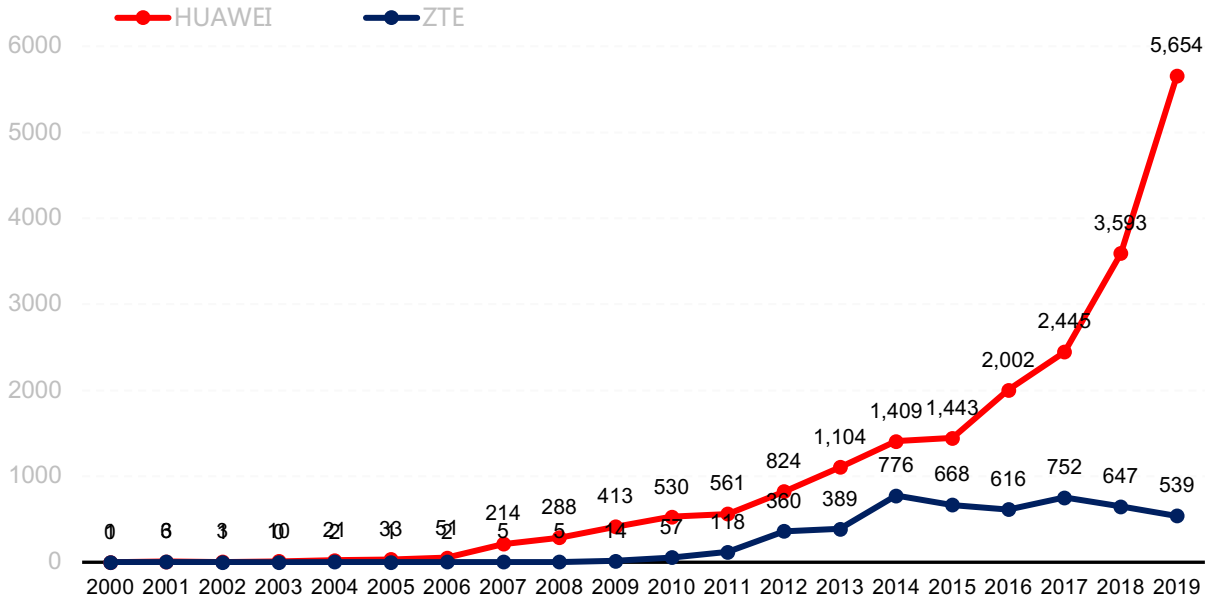

Figure 6.3 A comparison of published patent applications in the U.S. from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

Since 2016, ZTE investigated by the U.S. government. The U.S. Department of Commerce announced its decision to restrict export on ZTE and three affiliated entities for allegedly violating U.S. export controls on Iran in March 2016. U.S. component suppliers are restricted from exporting technology products such as components, software and equipment to ZTE. On May 16, 2019, Huawei was added to the Entity List, alleging that the company engaged in activities contrary to U.S. national security or foreign policy interests. Due to various U.S. policy restrictions, communication facilities and terminal equipment of Huawei and ZTE were not allowed to be imported into the U.S. market. Consequently, the sales revenue of both companies in the U.S. was almost negligible. Nevertheless, both companies had deployed a large number of patents in U.S., and the total number of patent applications of ZTE was 24.05% of that of Huawei in the U.S (see Figure 6.4).

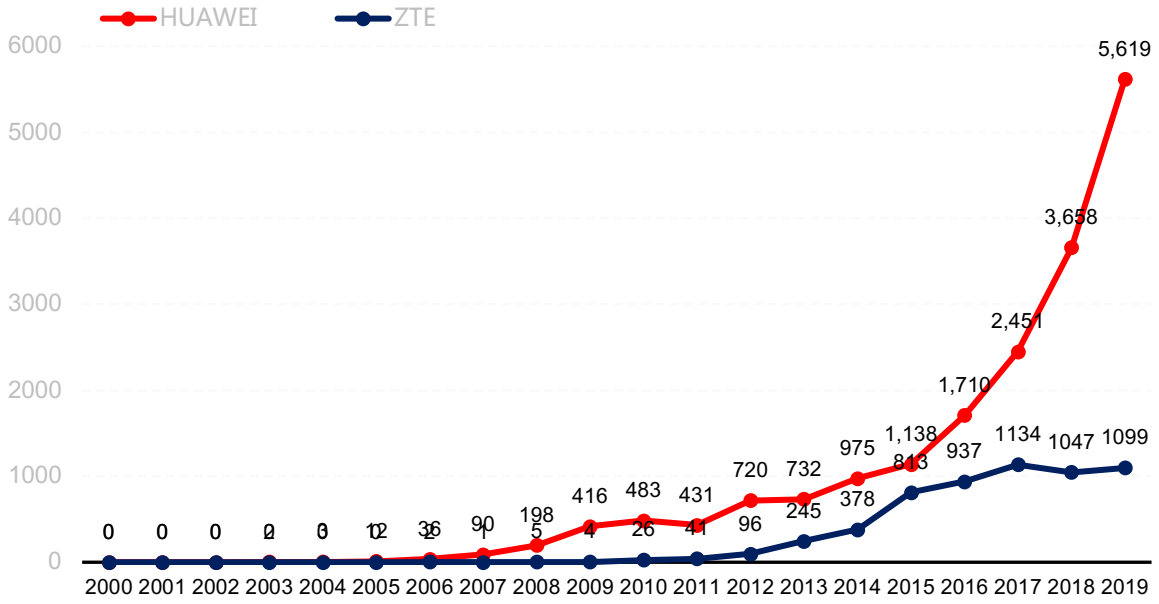

Figure 6.4 A comparison of published patent applications in the EU from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

EU is a big market for both ZTE and Huawei. They both deployed a large number of patents in the EU. As shown in Figure 6.5 below, the total number of patent applications of ZTE was 31.32% of that of Huawei in the EU.

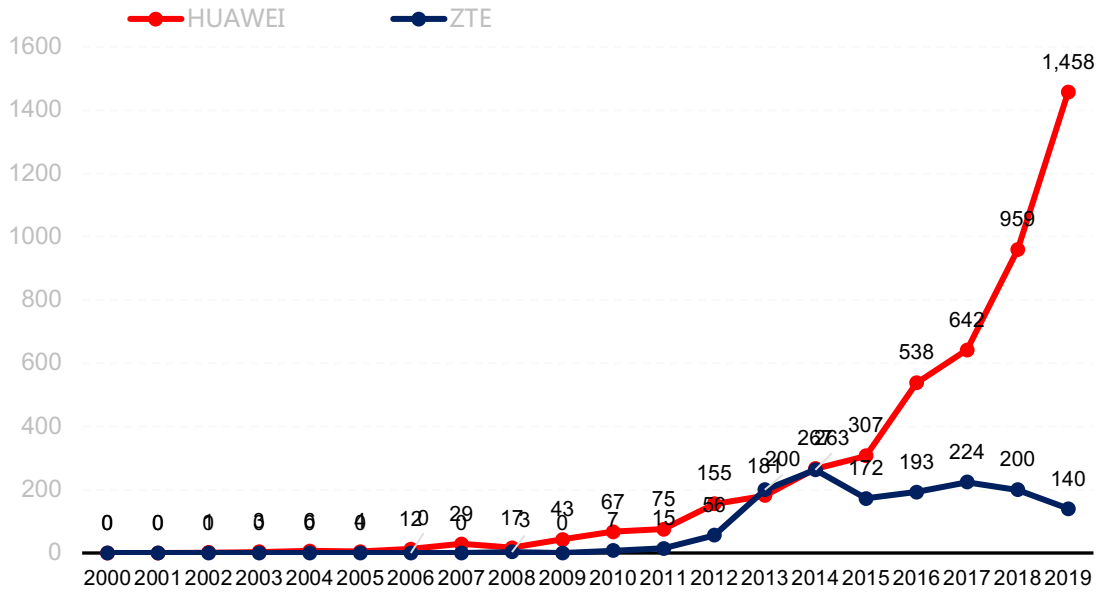

Figure 6.5 A comparison of published patent applications in Japan from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

Japan is one of the main developed countries where most multinational companies make patent distribution. As shown in Figure 6.6, both companies deployed a large number of patents in Japan. The total number of patent applications of ZTE was 30.92% of that of Huawei in Japan.

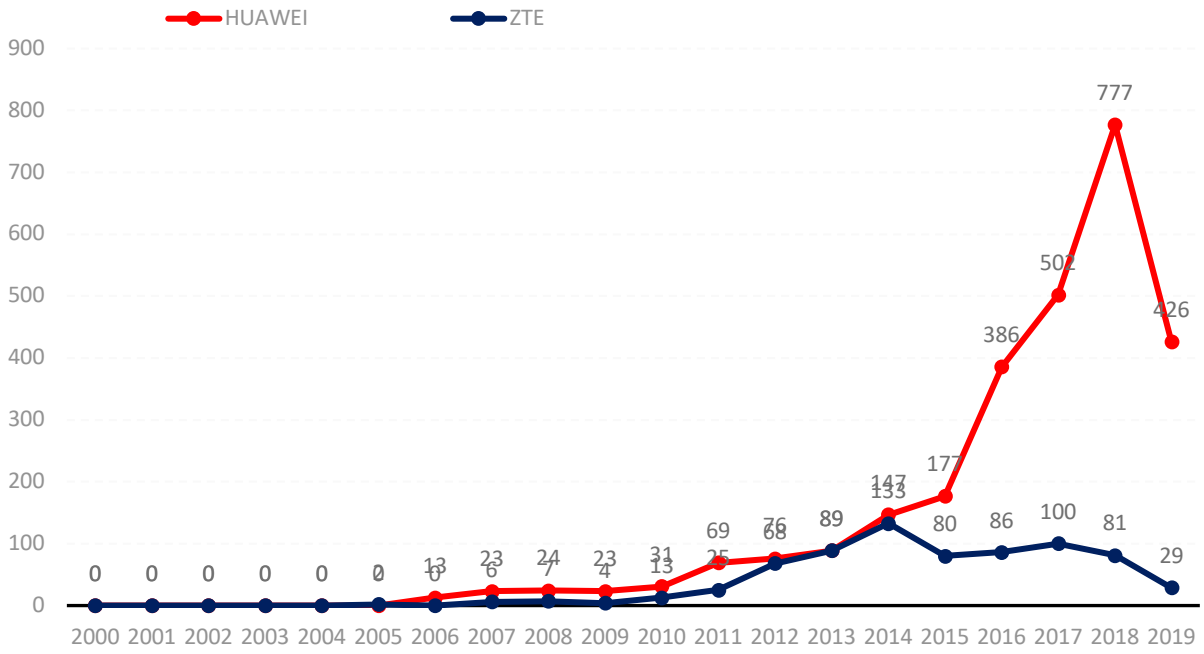

Figure 6.6 A comparison of published patent applications in ROK from 2000 to 2019 by Huawei and ZTE

Source: PatSnap patent database

ROK is one of the main developed countries where most multinational companies make patent distribution. The two case companies both deployed a large number of patents in ROK. The total number of patent applications of ZTE was 26.17% of that of Huawei in ROK. Table 6.1 below shows the published patent application of the two case companies from 2000 to 2019.

Table 6.1 Statistics of published patent applications of ZTE and Huawei from 2000 to 2019

Region	Firm	2000	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	2019
Worldwide	ZTE	0	0	1	2	33	63	133	238	330	517	1,872	2,841	3,913	2,004	2,495	2,164	4,110	2,990	2,084	1,089
	Huawei	1	13	43	90	141	250	579	1,363	1,751	1,915	1,767	2,109	1,976	2,484	3,844	4,385	3,716	4,028	5,406	4,444
China	ZTE	3	13	23	129	173	96	383	897	2342	2481	4100	4640	3718	2373	3009	3633	4910	6096	5317	3474
	Huawei	11	16	27	156	585	738	1158	2313	4098	4987	4018	3957	3733	3,322	3,638	3,416	4,373	6,994	9,552	12,363
U.S.	ZTE	1	3	1	0	2	1	2	5	5	14	57	118	360	389	776	668	616	752	647	539
	Huawei	0	6	3	10	21	33	51	214	288	413	530	561	824	1,104	1,409	1,443	2,002	2,445	3,593	5,654
EU	ZTE	0	0	0	0	0	0	2	1	5	4	26	41	96	245	378	813	937	1134	1047	1099
	Huawei	0	0	0	2	3	12	36	90	198	416	483	431	720	732	975	1,138	1,710	2,451	3,658	5,619
Japan	ZTE	0	0	0	0	0	0	0	0	3	0	7	15	56	200	263	172	193	224	200	140
	Huawei	0	0	1	3	6	4	12	29	17	43	67	75	155	181	267	307	538	642	959	1,458
ROK	ZTE	0	0	0	0	0	2	0	6	7	4	13	25	68	89	133	80	86	100	81	29
	Huawei	0	0	0	0	0	0	13	23	24	23	31	69	76	89	147	177	386	502	777	426
Australia	ZTE	0	0	0	2	26	30	0	0	0	0	5	9	10	24	51	19	24	21	20	9
	Huawei	1	18	44	88	73	7	6	5	25	15	14	12	15	19	61	84	147	150	240	168
Russia	ZTE	0	0	0	0	0	0	0	4	11	9	0	4	2	2	88	49	19	8	33	7
	Huawei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	138	169
INDIA	ZTE	0	0	0	0	0	0	1	14	11	11	32	23	117	150	117	143	248	89	36	89
	Huawei	0	0	0	0	0	2	1	12	17	76	73	68	61	126	121	154	1,293	843	701	1,538
Canada	ZTE	0	0	0	0	1	1	2	2	4	3	6	11	6	4	21	18	17	12	20	6
	Huawei	0	1	0	4	18	32	29	20	12	11	14	15	14	17	52	98	119	151	181	135
Brazil	ZTE	0	0	0	0	0	2	0	2	1	0	0	0	0	2	2	0	25	11	99	338
	Huawei	0	0	1	0	6	5	6	6	1	1	1	12	1	2	15	19	36	112	723	771
Mexico	ZTE	0	0	0	0	0	0	0	0	1	1	0	3	9	40	48	8	6	8	10	1
	Huawei	0	0	0	0	0	0	0	2	1	8	4	5	16	17	28	8	32	51	99	60

Source: PatSnap patent database

(2) Patent commercialization capability comparison

Huawei firmly believes that respecting and protecting IP is a solid foundation for innovation. Through IP licensing or cross-licensing activities, Huawei shares its IP with the world and actively promotes the industrialization of innovation achievements.

The process of patent application and authorization is also a process of technology disclosure. In this way, Huawei contributes its own R&D achievements to the industry and society. Huawei's patents are of great value to the global information industry.

a. Huawei's main patent operation and protection activities

Strategy: Huawei respects the IP rights and trade secrets of third parties. It has formulated a comprehensive IP management and compliance system and strives to ensure its implementation. With a global vision and successful legal practices, Huawei actively provides advice for and input in the development of IP protection legislation, law revision and policy formulation in major jurisdictions around the world. It is committed to the continuous improvement of the IP protection environment.

Cross-licensing: Huawei attaches great importance to protecting its own IPRs and respects the IPRs of others. In history, Huawei reached more than 100 patent license agreements through friendly negotiations (including single-lateral licensing and cross-licensing) with major global ICT companies such as Nokia, Ericsson, Qualcomm, Nortel, Siemens, Alcatel, BT, NTT Docomo, AT&T, Apple and Samsung.

Out-licensing: Huawei's IP licensing revenues exceeded 1.4 billion U.S. dollars in 2015 and have remained above that level since then; and Huawei signed more than ten patent license agreements with multi-national companies in the U.S., Europe and Asia through friendly negotiations.

In-licensing: Huawei has paid more than USD six billion as patent royalty to other companies, of which nearly 80% was paid to U.S. companies.

Patent acquisition: Huawei has also strengthened collaboration with industry partners by participating in patent alliances and patent pools. In 2013, Huawei and other partners jointly bid for Kodak's digital imaging technology patent portfolios at a price of USD 525 million, reducing potential patent litigation disputes in the industry.

Protection: Huawei has launched a series of patent lawsuits against Samsung globally to gain a competitive advantage in the telecommunications industry. Starting from 2011, Huawei and Samsung negotiated on patent cross-licensing for many times, but no substantial progress was made. Over the eight years from 2011 to 2018, the two companies filed more than 40 lawsuits in China and related countries. According to news on February 27, 2018, Samsung and

Huawei, after reaching a settlement agreement on the patent infringement law battle that had been going on for two years, demanded that the Chinese and American courts suspend the processing of related lawsuits.

When the U.S. Ministry of Commerce stated that Huawei was included in the control list, Huawei filed a U.S. IP lawsuit against the U.S. telecommunications operator Verizon with a penalty claim of more than USD one billion covering more than 230 patents of network equipment. It was reported that Verizon was using Huawei equipment through companies that relied on Huawei patents related to core network equipment, IoT technology and wired infrastructure.

Comments: Huawei effectively utilized patent operation and protection capabilities, supported the development of commercial activities, and enhanced commercial competitiveness from both offense and defence perspectives.

b. ZTE's main patent operation and protection activities

Considering the competitive landscape of the telecommunications industry and its own strength, ZTE has planned and formulated a three-step IP strategy, namely the defensive stage (before 2009), the offensive and defensive stage (2009-2013) and the open competition stage (2014 to present). By promoting the implementation and optimization of the IP strategy in the company in a step-by-step manner, ZTE has supported its own "Three-in-One" competition model of business, technology and IP and enabled itself to better compete in the international market.

ZTE's globalisation was accompanied by a succession of IP lawsuits. As of 2009, ZTE had been involved in more than 140 IP lawsuits in the U.S. alone and had been faced with a total of more than 240 IP lawsuits worldwide.

As with ZTE's three-step strategy, at first ZTE's IP was used purely for defensive purposes. After 2009, as the quantity and quality of IP accumulated by ZTE grew, it reached a point where it could compete with the international giants, and this allowed ZTE to strike a delicate balance with them.

ZTE has also been resolute in suppressing challenges from those patent companies and even patent hooligans. From 2011 to 2016, ZTE responded to seven Section 337 investigations initiated by U.S. knowledge patent operating companies TPL, IDCC and Flashpoint for six consecutive years, of which five were fully won; of the remaining two lawsuits, ZTE forced the plaintiff of one lawsuit to withdraw the case; and settled the other at a low cost. Some plaintiffs of these seven lawsuits waived their right to appeal. This is in stark contrast to the IP dilemma of most Chinese companies overseas as regarding the cases related to Section 337 investigations

that have been adjudicated, Chinese companies have lost a surprisingly high percentage of 60%.

Today, ZTE is not only comfortable dealing with IP, but is also able to influence and change unreasonable policies. For example, in the past, IP cases in the U.S. often took 360 days to be heard and cost the respondent USD 3-5 million to complete the process. For this reason, ZTE, together with Google and other manufacturers, launched the 100 Day Pilot Program, urging the US International Trade Commission (ITC) to shorten the trial period to 100 days to significantly reduce the cost for respondents.

In March 2016, ZTE, Sony and Samsung successfully applied the 100 Day Pilot Program in response to a Section 337 investigation by Creative Technology of Singapore and won all the cases.

In 2014, ZTE put forward its M-ICT strategy for the first time and continued to increase its investment in the R&D of emerging technologies such as 5G/4G, chips, cloud computing, big data, big video, and the Internet of Things. In the meantime, ZTE's IP strategy came to the stage of open competition, which refers to the establishment of an open platform to control more initiative in future competition.

ZTE's investment in IoT R&D, for example, welcomed its harvest season. "The UK Intellectual Property Office" published a report in 2015 stating that Asia, Japan and the ROK were leading the way in IoT technology research, with ZTE topping the patent rankings.

In September 2016, ZTE, together with Ericsson, Qualcomm, KPN and InterDigital, jointly launched a new wireless patent licensing platform "Avanci" for global connected cars and smart meters, which will also be applied to other IoT products in the future. This can help avoid the wasteful internal costs and potential stacking of licensing fees that would be incurred if IoT device manufacturers signed licensing agreements with each company individually. This way of patent licensing is referred to as "one-stop shopping" in the business community.

Mr. Hu Yi, ZTE Vice-President and Director of Intellectual Property Department, said:

> "The one-stop licensing model through the Avanci platform will significantly improve IP cost predictability and transparency, meet the rapidly increasing demand from network-linked companies, and enable IoT manufacturing companies to easily access the world's most advanced wireless technologies, shorten time-to-market, rapidly scale up, and focus on promoting new IoT products, thereby accelerating the growth of IoT globally." (Interview: April 25th, 2021)

Today's ZTE is proving itself to be a global expert in IP and is able to leverage on its open competition IP strategy to maximize its business benefits.

6.4.2 A comparison of business performance

X. B. Wu et al. (2020) found out that not only the creation of its organizational routines in detail but also the breaking of routines in most major functional areas. They see Huawei as an ideal case study for the successful implementation of the change of routines and supporting values, as DCs are at the core of the theory of competitive advantage. They reviewed all the major change activities the company has undertaken since 1996 to bring in the best practices from the Western consultants. The insights presented in their book are particularly interesting for researchers in the field of strategy, management and business history (X. B. Wu et al., 2020).

As mentioned in Chapter 4, position in the industry, revenue, profit and ROI are the main indicators of business competitiveness of an enterprise. However, the data of Huawei's ROA were not disclosed because Huawei is not a public company. So, only position in the industry, revenue and profit were selected as the indicators for comparison between the two companies.

In terms of the position in the industry, Huawei's ranking continued to rise, from No.3 in 2005 to No.2 in 2013 and No.1 in and since 2015. In comparison, ZTE ranked No.4 or No.5 for a few consecutive years (see Figure 6.7 below).

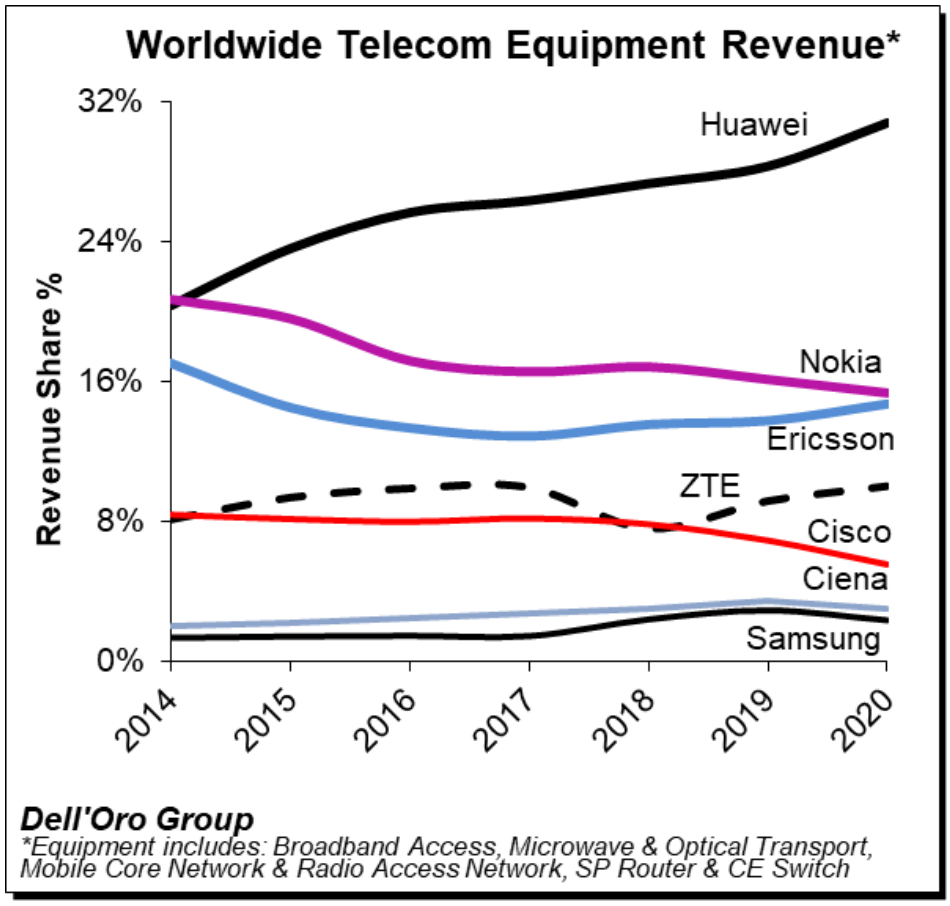

Figure 6.7 Worldwide telecom equipment revenue

Source: Dell'Oro Group (2021)

As to the sales revenue, Huawei maintained a steady revenue growth from 2006 to 2018, with an average annual growth rate of about 22.47%. In comparison, the sales revenue of ZTE continuously increased from 2006 to 2011, followed by a decrease in 2012 and 2013. Specifically, its sales revenue decreased by 2.48% in 2012, and by 10.56% in 2013; from 2014 to 2017, its business performance remained at nearly the same level. Then, in 2018, there was a significant decrease of 21.41% in revenue and a significant loss in profit due to the sanctions from the U.S. government (see Figure 6.8 below).

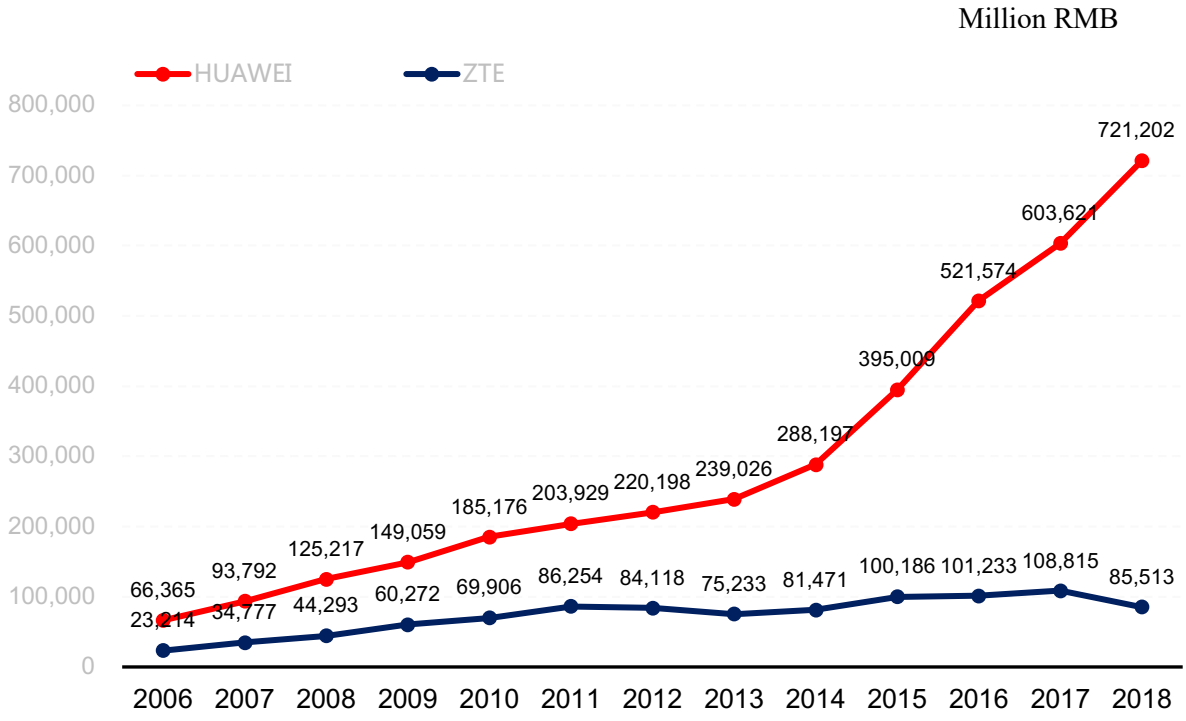

Figure 6.8 A comparison between ZTE and Huawei by sales revenue, 2006-2018 (million RMB)

Source: Annual reports of ZTE and Huawei from 2006 to 2018

In the Chinese market, from 2009 to 2018, the average sales revenue of ZTE was around 29.01% of the average sales revenue of Huawei (see Figure 6.9 below).

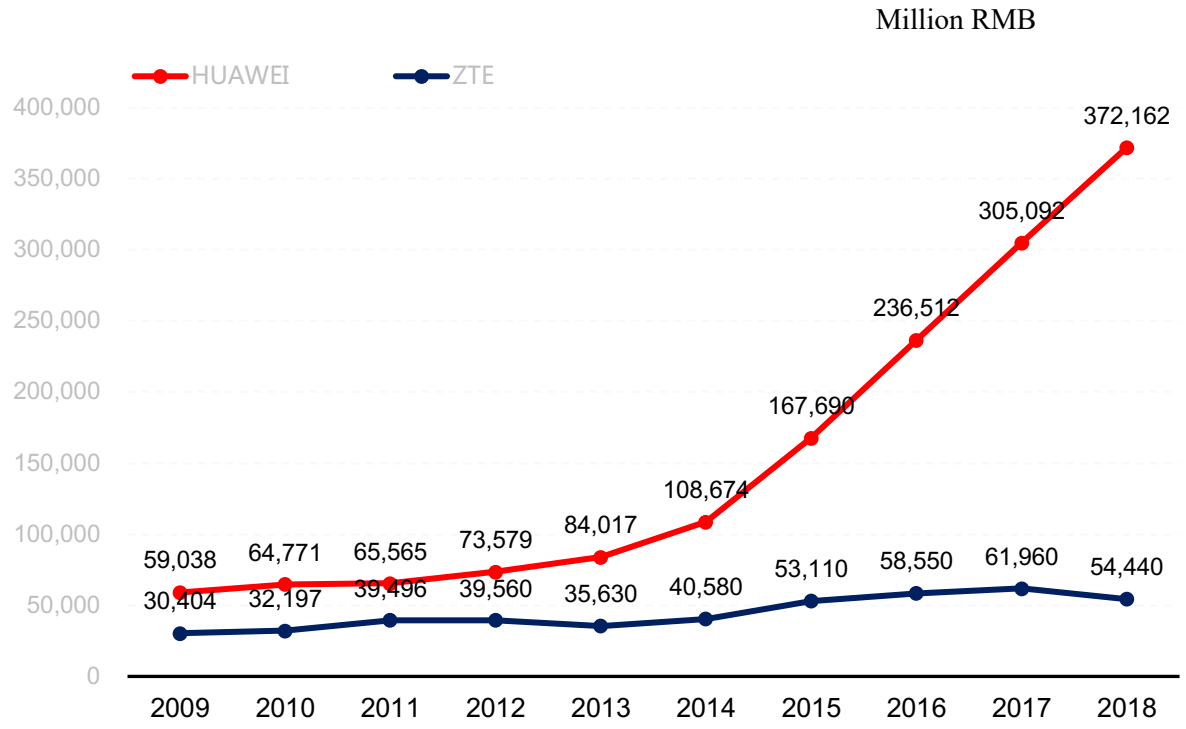

Figure 6.9 A comparison between ZTE and Huawei by revenue in China, 2006-2018 (million RMB)

Source: Annual reports of ZTE and Huawei from 2006 to 2018

From 2009 to 2018, ZTE's average overseas markets sales revenue was 20.48% of that of Huawei (see Figure 6.10 below).

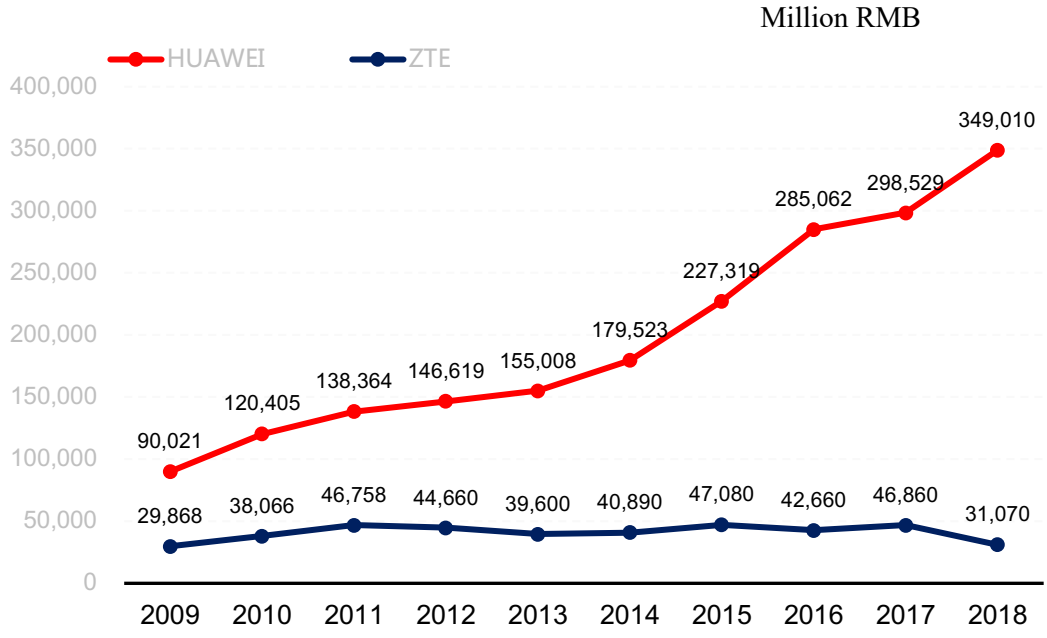

Figure 6.10 A comparison between ZTE and Huawei by revenue overseas, 2006-2018 (million RMB)

Source: Annual reports of ZTE and Huawei from 2006 to 2018

Regarding profit, Huawei maintained a steady growth of both revenue and profit from 2006 to 2018, with the average profit margin being about 10.95%. in comparison, the profit of ZTE

was unstable from 2006 to 2011 with the average rate of profit being 4.89%. There were losses of profit in the years 2012, 2016 and 2018, and the rates of profit growth of other years were around 4% (see Figure 6.11 below).

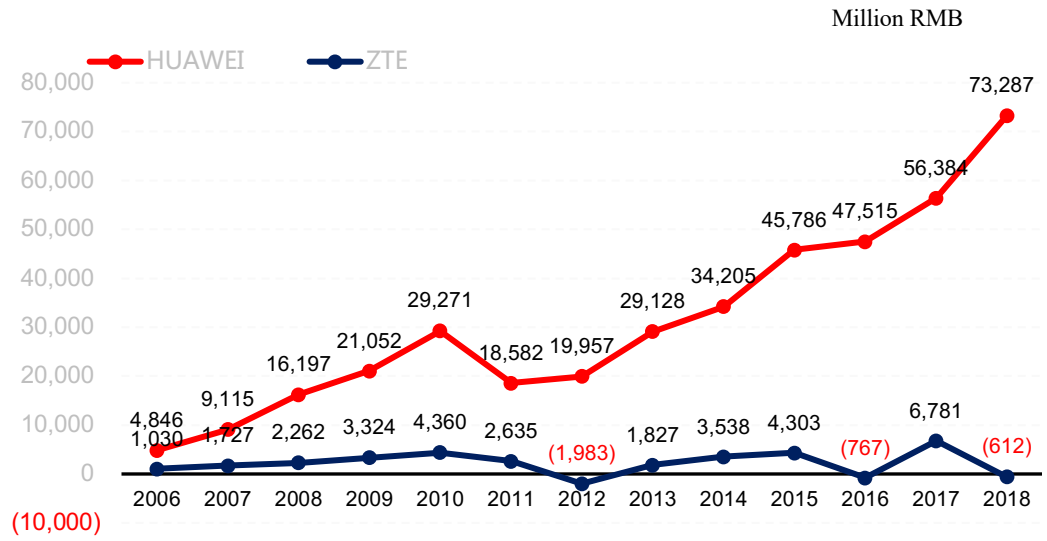

Figure 6.11 A comparison between ZTE and Huawei by profit, 2006-2018 (million RMB)

Source: Annual reports of ZTE and Huawei from 2006 to 2018

6.5 The connection between IP capabilities and competitive advantage of Huawei and ZTE

6.5.1 IP strategy serves the business strategy to develop competitive advantages.

Dr. Song Liuping, Huawei's chief legal counsel, mentioned:

> "The entire management system and structural design of Huawei, including the strategic direction of its operations, the design of innovative capabilities and the design of IP capabilities, are basically centred on our operating goals. There is no so-called independent IP strategy. Instead, all strategies and tactics are designed to secure our survival and development amongst fierce competition." (Interview: July 26th, 2019)

It can be concluded from the Huawei experience that IP strategy should be incorporated into a company's macro business strategy to support the business objectives in different development stages of the company. IP creation capability, IP commercialization capability and IP protection capability should perform their escort, navigation and guidance roles separately to ensure sound business operation and strong business competitiveness (China Intellectual Property Forum, 2017).

1. IP application

Science and technology innovation is the source of IP creation. According to Dr. Song Liuping:

> "Huawei innovation follows two principles: one is to stand on the shoulders of giants to generate innovation, in which case innovation should be based on the global industry context; and the other is to insist on open innovation to integrate the outstanding technical innovation talents around the world to break through core technical issues." (Interview: July 26th, 2019)

Huawei spends no less than 10% of its sales revenue on R&D each year to maintain the necessary innovation capabilities to participate in market competition and build a solid IP creation capability foundation.

Guided by business operation, such factors as inventive step of technical innovation, contribution to market competition, the estimated value of IP assets and ROI should be considered and evaluated by the expert team when formulating patent creation strategies and making patent application decisions.

A sophisticated patent management IT system consisting of inventors, patent engineers, examination experts, patent agents, process management departments and patent review committees should be established to ensure the quality of patent applications.

Implementation standards are essential to patent strategy. Enterprises should actively participate in international standards formulation and provide proposals to international standards.

Interviews with the management were carried out to explore the internal reasons of this phenomenon. According to Mr. Wen Ming from ZTE,

> "Patent applications should be based on R&D activities; innovation capability is the main factor influencing the number of patent applications; and the number of patent applications is mainly affected by the business requirement of the market. The budget for patent applications and maintenance is also a factor to be considered, but its influence is minor as the expense of patent application and maintenance usually accounts for less than 0.5% of the revenue for big companies, and such expense will not be adjusted according to the fluctuations of the revenue. The annual revenue will affect the R&D input and the market strategy, which will mainly affect actual patent applications." (Interview: July 30th, 2019)

Indeed, statistics showed that when the company's overall operating performance improved, the number of its patent applications also increased; when the company's overall operating performance declined, the number of its patent applications also showed a downward trend.

2. Overseas IP application

Results of the interviews with the management revealed that when the firms formulate the strategy of overseas patent application. Mr. Wen Ming of ZTE mentioned that PCT application is the foundation of the overseas patent application strategy; on that basis, the requirement to protect technologies and products and the consideration to compete with competitors with patent portfolios are the main factors involved in the decision process.

Both Huawei and ZTE showed a linear relationship between the number of patent applications and business performance in the overseas markets. From 2009 to 2018, ZTE's average overseas markets sales revenue was 20.48% of that of Huawei; while ZTE's total number of patent applications in the U.S., Europe, Japan and ROK maintained a similar ratio compared with the total number of patent applications of Huawei in these regions. In the U.S., ZTE's total number of patent applications was 24.05% of that of Huawei; in Europe, ZTE's total number of patent applications was 31.32 % of that of Huawei; in Japan, ZTE's total number of patent applications was 30.92% of that of Huawei; and in the ROK, ZTE's total number of patent applications was 26.17% of that of Huawei.

Over the past two decades from 2000 to 2019, the number of published PCT applications of ZTE and Huawei took up 66.69% of their total number of published patent applications; in the ten years from 2009 to 2018, the percentage was 79.01%. PCT applications significantly exceeded the performance of the corresponding sales performance.

From 2009 to 2018, the ratio of ZTE's and Huawei's published PCT patent applications was 79.01%; in the same period, the average sales value of ZTE's overseas market was only 20.48% of the average sales value of Huawei's overseas market. ZTE's average annual sales were only 25.06% of those of Huawei.

From 2009 to 2018, Huawei's PCT applications accounted for 45.29% of its U.S. patent applications, 40.20% of its European patent applications, 10.22% of its Japanese patent applications, and 7.20% of its Korean patent applications.

From 2009 to 2018, the proportion of ZTE's PCT applications converted into U.S. patent applications was 17.60%; the proportion of those converted into European patent applications was 18.89%; the proportion of those converted into Japanese patent applications was 5.32%; and the proportion of those converted into Korean patent applications was 2.72%.

Therefore, ZTE was only 38.85% of Huawei regarding the efficiency of converting PCT applications into U.S. patent applications; ZTE was 47% of Huawei in terms of the efficiency of converting PCT applications into European patent applications; as to the efficiency of converting PCT applications into Japanese patent applications, ZTE was 52.05% of Huawei;

and as regards the efficiency of converting PCT patents into Korean patent applications, ZTE was only 37.74% of Huawei.

However, filing a PCT application is a very complicated, costly and labour-intensive job. So, why did ZTE engage in this patent practice? The interviews with enterprise managers of the case companies were aimed at exploring the internal reasons of this phenomenon.

The PCT system is designed to allow each applicant to use the PCT application as a basis and leverage the grace period of 30 months to convert a PCT application into a patent application in each country and to finally strive for authorization. The technology strategy and business strategy are the main factors which will affect the PCT application outcome. The PCT system will provide a 30-month period for firms to decide the technology roadmap. Standards are a key factor that will affect the value of patent in telecommunications. Firms will wait and see which technology will be involved in the standards before selecting candidates from their PCT applications to file applications in specific countries. The PCT system helped ZTE to reserve time and save the expense of patent application. In 2016, ZTE made a strategic decision that it would not need so many PCT applications. Therefore, starting from 2017, its PCT application publications dropped quickly.

According to Mr. Wen Ming of ZTE,

> "Subsidies from the government are a factor that will help reduce the financial pressure of firms, but not the key factor. Firms will not apply for more patents than needed because the expense is covered by the government subsidies." (Interview: July 30th, 2019)

It can be inferred from the comparison of the patent application data and business performance that Huawei has stronger internal IP management capability compared to ZTE, and that Huawei's technological capability and inventive step of patents are better than ZTE.

6.5.2 IP creation capability is an indication of the trend of an enterprise's business competitiveness.

From 2006 to 2018, Huawei maintained a steady growth of its revenue, with an average annual growth rate of about 22.47%; the profit margin also remained stable, averaging about 10.95%; and the company's ranking in the industry continued to rise, from No.3 in 2005 to No.2 in 2013, and to No.1 since 2015. Regarding PCT applications, which refer to its patent applications filed with WIPO, Huawei ranked No.1 in the world in 2008, No.2 in 2009, No.4 in 2010, No.3 in 2011, No.4 in 2012 and No.3 in 2013; it ranked No.1 in PCT applications in the world from 2014 to 2018 except No.2 in 2016.

The trend of increase in Huawei's PCT applications was highly consistent with the growth in its business competitive advantage. Seen from Huawei's patent applications in major economies such as China, the U.S., Europe, Japan and ROK, the number of patent applications in each region exhibited a trend of steady increase, which was highly in alignment with its business performance.

ZTE's sales performance and profits changed from year to year and ranked No.4 to No.5 in the industry. Seen from patent applications, ZTE ranked among the top five in terms of the number of PCT applications for nine consecutive years since 2010; it ranked No.2 in 2010 and No.1 in 2011, 2012 and 2017. Its PCT patent capability seems to have obviously surpassed its business performance. Regarding the development trends of ZTE patent applications in China, from 2005 to 2011, the number of patent applications steadily increased, reaching the highest point in 2011, followed by a sharp decline in 2012 and 2013; after strategic adjustments in 2014, the number showed a trend of increase from 2014 to 2017. However, in 2018 and 2019, the number of patent disclosures declined sharply. Regarding the development trends of ZTE's patent applications with WIPO, from 2005 to 2012, the number of patent applications increased steadily, followed by a sharp decline in 2013, 2014 and 2015; then there was a sudden increase in 2016, which enabled ZTE to rank No. 1 in PCT applications worldwide. Starting from 2017, ZTE's PCT applications deceased year by year. As to the sales revenue of ZTE, it can be seen from the collected data that ZTE's revenue continuously increased from 2006 to 2011, followed by a decrease of 2.48% in 2012 and a decrease of 10.56% in 2013; from 2014 to 2017, ZTE's business performance almost levelled. Then, in 2018, its revenue decreased significantly by 21.41% accompanied by a significant profit loss due to the impact of the sanctions by the U.S. government.

Therefore, ZTE's trend of PCT applications and patent applications in China were highly consistent with its trend of sales performance. When the overall operating performance declined, the number of PCT applications and patent applications in China also showed a downward trend.

6.5.3 IP protection through necessary means is essential for securing commercial interests.

Negotiation and litigation are two ways pursued by Huawei to resolve IP disputes with industry players. Litigation, as a continuation of negotiations, is an independent and fair judicial process that helps solve IP issues while maintaining the discipline of market competition.

In 2003, Huawei was sued by Cisco in the Federal Court of California for patent infringement. It was one of the first patent litigation cases that Huawei was involved in abroad.

Because the patent litigation process in U.S. federal court is complicated, and the damages for the patent infringement was too much for Huawei to afford, Huawei suffered huge pressure in that case. After 1.5-year tough negotiations and litigation process, Huawei and Cisco reached a settlement agreement on the case. Although the patent capability of Cisco in the U.S. was much stronger than Huawei at that time, Huawei did not pay any penalty to Cisco for two reasons. Firstly, Huawei engaged a professional legal team consisting of Chinese managers and U.S. lawyers to deal with the litigation process; and secondly, Huawei owned a strong patent portfolio in China, which was a powerful weapon against Cisco in China. China is the largest market of telecommunication products, which endowed Chinese patents with biggest value. During the Huawei and Cisco patent litigation case, Huawei spent a lot of time and paid considerable legal fees. It acquired useful experience for patent protection which inspired it to build up an advanced IP management system that has led to the improvement of its overall IP capabilities; in the meantime, Huawei was known by the industry worldwide and earned a global reputation during the litigation process, which helped increase its business competitiveness worldwide.

Another patent protection activity of Huawei is a series of Huawei and Samsung patent litigation cases (Contreras, 2019). Huawei and Samsung are the main competitors in the global market. To get the freedom of operation in the market, Huawei and Samsung engaged in several rounds of negotiations regarding patent cross-licensing from 2011, but there was no substantial progress in reaching a settlement agreement. Since then, both parties filed more than 40 patent litigation cases in the global scope. On May 25th, 2016, Huawei filed a patent lawsuit against Samsung in the United States District Court for the Northern District of California and Shenzhen Intermediate Court of China, claiming penalty for patent infringement; in June 2016, Huawei initiated a patent lawsuit against Samsung in Quanzhou Intermediate Court of China, claiming a penalty of RMB 80,500,000 for patent infringement. In July 2016, Samsung filed a series of patent lawsuits against Huawei. In April 2017, Quanzhou Intermediate Court made a judgement of a patent infringement case, supporting an injunction against several Samsung products and a penalty of 80.5 million RMB; On January 11, 2018, Shenzhen Intermediate Court ruled in favour of Huawei. According to the latest market statistics, Samsung ranked No.1 in the global mobile phone market, while Huawei ranked No.2; but in the Chinese market, Huawei ranked No.1, while Samsung ranked No.6 (Team Counterpoint, 2022).

It can thus be seen that litigation is not the last means for dispute resolution. After several rounds of negotiations, Huawei and Samsung finally reached a settlement on patent litigation and patent cross-licensing.

According to Mr. Hu Yi of ZTE:

"ZTE has successfully handled eight U.S. Section 337 investigations. By far, we have not lost any of them, and we should have won all of them. Notably, in several cases, the court ruled in favor of us after the legal process was completed. This is not easy." (Interview: April 25th, 2021)

6.5.4 IP commercialization is an effective means to gain global market access and obtain high commercial returns.

So, how should the patents be commercialized? Shen et al. (2018) investigated the determinants of transaction modes (namely to sell, license or retain) of invention and utility model patents in China. The link between the quality of invention patents and the probability of being licensed is like an inverted U-shaped, while there is no relationship between the quality of utility models and the probability of being traded. According to the study, firms with an economically motivated patent strategy are less likely to sell their invention patents, while firms with an administratively motivated patent strategy are more likely to trade their patents (Shen et al., 2018).

According to Dr Song, there are three ways to realize the value of patents: "The first is indirect economic gain through the monopoly of the right to operate the product; the second is indirect gain through the exchange (cross-licensing) of the right to sell the product without barriers; and the third is direct trading. The third way of obtaining an economic benefit is through a direct transaction in which the owner licenses or assigns his or her IP rights to another person, thereby obtaining the proceeds of the license or assignment directly."

Since 2001, Huawei has signed dozens of patent cross-licensing agreements with major manufacturers and patentees in the industry, such as Qualcomm, Ericsson, Nokia, Nortel and Siemens, with a payment of more than USD 300 million in license fees each year, which demonstrated Huawei's respect for IP and helped to afford the cost technology innovation and the investment in IP.

Enterprises should not be discouraged by royalty payment. Instead, Huawei earned a revenue of more than 100 billion USD each year. Paying royalties is a more efficient way to obtain license for patented technologies from others to launch high-quality and low-priced products quickly and meet the needs of customers and the market in time, thereby generating more sales revenue.

Compared with single-lateral patent licensing, cross-licensing is an economically efficient

way to gain market access as the license fees are much lower than single-lateral patent licensing. Patent cross-licensing between major companies of the industry will promote the widespread use of patented technologies and the rapid development of products and technologies, which will bring huge benefits to the industry.

According to Mr. Hu Yi of ZTE, "ZTE's overall patent technology reference value has exceeded RMB 45 billion, showing that ZTE ranks in the top echelon of global patent portfolios and is a major player and contributor to global 5G technology research and standards development. The relevant amount reflects a positive feedback from ZTE's continuous investment in R&D and innovation over the years. IP rights are expected to generate RMB 4.5 to six billion in revenue for ZTE from patent licensing over the five-year period from 2021 to 2025."

According to the survey among the sample enterprises with a government-recognised IP management system, patent and trademark applications are mainly motivated by technological innovation and market competition requirement instead of by subsidies from the government. Dr Song also confirmed that.

But according to the overall statistics of patent and trademark applications in China and other parts of the world, some special-purpose entities and individuals apply for lots of patents and trademarks intentionally to get subsidies from the government, which has accelerated the surge in IP applications. The motivations of these special entities and individuals and how their IP application practices influence the IP surge require further study. The government should also adjust IP industry policies in a timely manner. Rather than of purely encouraging the number of patent applications, it must guide enterprises to deploy high-quality IP and improve IP operation and protection capabilities to truly enhance business competitiveness.

6.6 Summary

This chapter takes two representative companies in Shenzhen, ZTE and Huawei, as cases and discusses how their IP capabilities affect their business competitiveness. The differences in the two companies' IP capabilities indicators and the impact of such indicators on their business competitiveness are analysed, and suggestions on how to improve the IP capabilities of the firms to enhance their business competitiveness are put forward. In addition, how Chinese companies could enhance their IP capabilities and improve intentional business competitiveness in the era of globalization is also discussed. Chinese enterprises can draw from the successful experience of Huawei and ZTE to improve their business performance.

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Chapter 7: Conclusions and Prospects

7.1 Research conclusions

This Thesis focuses on the relationship between IP capabilities and business performance of enterprises in the context of globalization and the knowledge era where IP has become the key driver of a country's economic development as well as an important system for business operation and market competition of enterprises. The connection between IP practices and business competitiveness of Chinese enterprises was explored with a proposed a theoretical framework based on a review of existing literature on competitiveness, industry positioning theory, RBV, NBV, KBV and IP as a resource. A working definition of IP was put forward. Patents and trademarks, two main types of IP, were selected for research. Then, a theoretical model of the relationships between IP, IP capabilities and enterprise competitive advantage was built. The model was tested through an empirical study of 156 enterprises with a government-recognised IP management system in Shenzhen in Shenzhen followed by case studies of Huawei and ZTE. The following conclusions can be drawn.

First, empirical evidence and case studies show a positive relationship between an enterprise's IP capabilities and its competitive advantage in the Chinese context, which challenges the conclusion based with existing literature that Chinese enterprises have poor IP capabilities and that Chinese enterprises create a large number of junk patents. This enlightening conclusion further indicates that the business environment, technological innovation and operational capabilities of Chinese enterprises are gradually catching up with those of developed countries.

Second, an enterprise's IP capabilities are formed through the process of integrating its proprietary IP resources to enhance its market competitiveness and improve its operational efficiency. The IP resources are proprietary, and the process is multidimensional. There are significant differences in the IP capabilities of enterprises in different industries, with different histories and cultures, economic strengths, and technological dependencies, especially when enterprises are at different stages of development.

Third, the purpose and goal of IP capabilities building are to serve the main business of an enterprise and enhance its competitive advantage. IP capabilities are also integrated with and

supports the enterprise's business management and other capabilities to enhance its overall competitiveness.

Fourth, the first thing an enterprise should do to build its IP capabilities is to conduct in-depth research into the types and structure of IP as well as the IP needs and trends of its main development, assess the state and level of its IP portfolio, clarify the stage it is at, and define what it can and will do. In other words, the enterprise should formulate an IP strategy.

Fifth, an enterprise's IP strategy and specific IP efforts should be designed to serve its business objectives. In essence, enterprises develop a competitive advantage by integrating their IP capabilities with their R&D, supply chain management, manufacturing, product sales and services, procurement and investment, human resources, legal risk management and other matters. By influencing the seven modules of the internal value chain (finance, legal risk management, human resources management, research and development, supply chain, manufacturing, product sales and services), IP capabilities can produce a three-pronged effect, increasing revenues, reducing costs and controlling risks, thus enhancing the enterprise's competitiveness against the external environment (in the "Five Forces of Competition" model) and enhancing its competitive advantage

(1) In the R&D process, the IP strategy can help enterprises clarify their directions, shorten the R&D cycle, improve the R&D efficiency, and reduce R&D costs. IP can be used to protect R&D achievements, hinder competitors' market competition, and increase market share; IP can also effectively reduce the legal risks in the R&D process.

(2) In the manufacturing process, the competitiveness and brand influence of manufacturing can be increased, and market share expanded through IP portfolio and protection in the case of self-manufacturing; in the case of contract manufacturing, the efficiency of industrial collaboration can be enhanced through effective control of IP risks in the outsourcing chain.

(3) In supply chain management, by effectively controlling the risk of IP infringement from third parties while well managing its own IP assets, the enterprise can effectively achieve a good combination of supply and demand, reduce inventory and cost, and give full play to the competitive advantages of each enterprise in the supply chain, thereby building up its own competitive advantage.

(4) In marketing, IP can enhance the added value of products, reduce production costs and increase the enterprise's competitive advantage at the consumer end; besides, using IP as a barrier against competitors and potential entrants can hinder or exclude competitors from market entry, making marketing activities twice as effective and increasing market share.

(5) In human resource management, IP is closely related to the acquisition and recruitment of human resources, training of human resources, motivation and application of human resources, and post-turnover management. In the acquisition and recruitment of human resources, IP searches can help enterprises identify and verify key technical personnel. In the meantime, it is necessary to effectively prevent IP risks in terms of confidentiality obligations and non-competition agreement; in the training of human resources, the enterprise should promote and implement its systems related to such matters as confidentiality obligations and service invention; in the application of human resources, it is necessary to manage IP output well while using incentive system to promote core technical personnel to produce high-quality invention and innovation; and for employees who left the enterprise, trade secrets and horizontal competition should also be well managed, and IP incentives and renumeration paid, to avoid additional risks.

(6) For the enterprise's financial management and investment, IP itself is the core resource of the enterprise. IP, which is an intangible asset, can be directly converted into cash flow through licensing, transfer and investment in capital. It can also be indirectly converted into cash income through pledge financing and asset securitization.

Sixth, IP, which has the attributes of legal rights and is the core resource of an enterprise, has an impact on the core links in the enterprise's value chain. IP used for investment in capital has to do with whether the capital contribution is adequate; the ownership of IP rights generated in R&D and manufacturing will affect the enterprise's independence in competition; the impact of IP on R&D, manufacturing, supply chain management, marketing, human resources management and financial management will directly affect the sustainable profitability of the enterprise's operation: information on changes in the status of IP rights must be disclosed in a timely manner, and IP-related litigation needs to be responded to and dealt with in a timely manner. IP issues may be numerous during the IPO process, but as long as systematic IP management is carried out, a standardised management system for IP creation capability, IP operation capability and IP protection capability is established, and basic due diligence work is done, the requirements of IP risk management during the IPO process can be met. And legal risk management is also one of the core links in an enterprise's value chain.

7.2 Research limitations

Given the scope and resource constraints, this Thesis has the following limitations.

Firstly, this Thesis lacks an in-depth study of the characteristics of IP as soft resource. IP is

an important soft resource for enterprises to enhance competitiveness in dynamically competitive environment. Due to its scope and focus, this Thesis did not explore the characteristics of IP as a soft resource from institutional and economic viewpoints and did not discuss make use of the soft resource of IP to help enterprises enhance business competitiveness.

Secondly, this Thesis only discussed two types of IP, patents and trademarks for the purpose of convenience and operability. It did not explore other types of IP such as copyrights and know-how.

Thirdly, this Thesis did not consider the interconnections between creation capability, commercialization capability and protection capability in the measurement model of IP capabilities, patent capabilities, trademark capabilities and business competitiveness, nor did it consider the interconnection between IP capabilities and an enterprise's overall management capability.

Fourthly, the sample of the questionnaire survey is limited as it only included enterprises with a government-recognised IP management system in Shenzhen. Enterprises without a government-recognised IP management system in Shenzhen were not explored.

Fifthly, the empirical study mainly focused on the internal resources to explore the connection between IP capabilities and competitiveness. It did not consider the external institutional factors, especially the legal systems, regarding how to use IP capabilities to enhance business competitiveness.

Sixthly, the case companies for the qualitative study only included companies from the telecommunications industry. Companies from other sectors, such as electronic information, biotech and pharmacy, new energy, mechanical and equipment manufacturing, were not included as cases. As a result, the results and conclusions may not be generalised to other sectors.

7.3 Research prospects

With reference to the limitations, further research can be carried out in the following directions.

Firstly, future researchers may further explore about the interconnections between IP creation capability, IP protection capability and IP commercialization capability. IP creation capability, which originated from innovation capability, involves different types of IP distributed in different regions. IP protection capability and IP commercialization capability are demonstrated in business operations. It can be inferred that IP creation is the basement; IP protection is the ways to achieve the target; and IP commercialization is the target. They serve to enhance the competitiveness of an enterprise through different ways.

Secondly, future research may focus on how different IP capabilities may influence specific business activities. The IP protection and commercialization capabilities are demonstrated in these specific activities. The internal mechanism of how IP capabilities may affect the business competitiveness of an enterprise, through specific R&D, manufacturing activities, purchase activities, marketing, HR management and finance management can be further studied.

Thirdly, a series of laws and regulations have been passed in China to strengthen IP protection. Several administrative policies have been issued to improve the quality of patent application and trademark application. And many instructive guidelines have been released by local governments to stimulate IP commercialization. In this context, future researchers may track the follow-up implementation and effects of these legislative documents.

Fourthly, as the levels of economic development in different regions of China differ, the behavioural patterns of business entities in different regions of regions of different development levels are also different. future studies may choose enterprises in inland cities as sample to gain more insights about the overall situation in China.

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Annex A-1: Survey Questionnaire

No.:

Questionnaire on the IP Development of Enterprises with a Government-Recognised IP Management System in Shenzhen

(Research group of Shenzhen intellectual property office)

Acknowledgements

This survey is carried out with a view to understanding the development status of intellectual property (IP) advantage/demonstration of enterprises in Shenzhen at all levels, exploring the role of IP in enterprise development, and providing a reference for the government to nurture the IP advantage/demonstration enterprise policy. Thanks for your cooperation and support.

The questionnaire data and enterprise information will be used for the purpose of this research only and will not disclosed to any third party.

Instructions

Please fill in the questionnaire truthfully and objectively according to the actual situation of your company. If you have any questions, please contact the following person in charge.

Contact person and contact information

Contact person：

Tel.：　　Fax：

Address：

E-mail：

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Questionnaire on the Business Performance and IP Development of Enterprises with a Government-Recognised IP Management System in Shenzhen

Please determine to what extent the following statements match your company's situation and tick the most appropriate options or numbers with "√". **The electronic version of the questionnaire can also replace the most appropriate number with "√" or change the most appropriate option or number to another colour. (the same below)**

Part One: General Information about IP Capabilities

1. The main types of IP in your company:

Type of IP	0= inconformity; 1= conformity	
Patents	0	1
Trademarks	0	1
Technical secrets [1]	0	1
Copyrights	0	1
Others	0	1

2. The main way for your company to acquire IP:

The way to acquire IP	0= inconformity; 1= conformity	
Independent creation	0	1
Licensing [2]	0	1
Transfer [3]	0	1
Merger and acquisition	0	1
Others	0	1

3. The main ways of IP operation in your company:

The ways of IP operation	0= inconformity; 1= conformity	
Self-implementation	0	1
Out-licensing	0	1
Transfer	0	1

Others	0	1

4. In your opinion, the actual situation of the timeliness and effectiveness of China's current solutions to IP disputes:

Ways to resolve disputes over IP rights	1=very low; 2=low; 3=medium; 4=high; 5=very high				
Negotiation	1	2	3	4	5
Administrative procedure	1	2	3	4	5
Litigation	1	2	3	4	5
Arbitration	1	2	3	4	5
Industry self-regulation	1	2	3	4	5

Part Two: Patent Capabilities

5. The status of your company's patent application and acquisition: (Skip this item if your company has not applied for a patent).

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
Total number of domestic patent applications compared with the average level of the same industry in China	1	2	3	4	5
Total number of foreign patent applications compared with the average level of the same industry in China	1	2	3	4	5
The probability of a patent authorization	1	2	3	4	5
The validity of internal patent incentive system to encourage patent application	1	2	3	4	5
Level of internal patent application evaluation mechanism	1	2	3	4	5

6. **The actual situation of patent operation by your company:**

(Skip this item if your company has not applied for a patent.)

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
The ratio of commercialized patents to total patents	1	2	3	4	5
The ratio of patents implemented by your company to total commercialized patents	1	2	3	4	5
The growth rate of sales of patent products in the past three years	1	2	3	4	5
The ratio of sales of patent products to total sales of	1	2	3	4	5

products					

7. **The actual situation of your company's patent protection:**

(Skip this item if your company has not applied for a patent.)

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
Combined protection degree of core patents[7] and peripheral patents[7]	1	2	3	4	5
The degree of establishment and perfection of patent early-warning mechanism	1	2	3	4	5
The degree of familiarity with patent protection approaches and procedures	1	2	3	4	5
The degree of holding infringers legally liable for patent infringement	1	2	3	4	5
Timeliness and validity of patent protection in the current legal system	1	2	3	4	5

Part Three: Trademark Capabilities

8. **The status of your company's trademark registration:**

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
Total number of registered trademarks compared with the average level of the same industry in China	1	2	3	4	5
Regional distribution of registered trademarks compared with the average level of the same industry in China	1	2	3	4	5
The degree of united trademarks[4] meeting the need to prevent trademark dilution	1	2	3	4	5
The degree of defensive trademarks[5] meeting the need to prevent trademark dilution or to advance market development	1	2	3	4	5
The degree of associated trademarks meeting the requirements of different types of goods	1	2	3	4	5
The ability to apply for trademarks in time according to product or market needs	1	2	3	4	5

Part Two: Intellectual Property Utilization Capability

9. **The actual situation of trademark operation by your company:**

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
The ratio of sales of using your own trademark products/services to total sales of products	1	2	3	4	5
The contribution of own trademarks to product or service differentiation	1	2	3	4	5
The market value of own trademarks compared with the average level of the same industry in China	1	2	3	4	5
The popularity and reputation of own trademarks compared with the average industry level in China	1	2	3	4	5
Combined use degree of main trademarks[6] and secondary trademarks[6]	1	2	3	4	5

10. **The actual situation of your company's trademark protection:**

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
The ability to prevent dilution through a combination of main trademarks and secondary trademarks	1	2	3	4	5
The validity of domain name protection associated with a registered trademark or trade name	1	2	3	4	5
The timeliness of responding to others' infringement of trademark exclusive right	1	2	3	4	5
The degree of familiarity with trademark right protection approaches and procedures	1	2	3	4	5
The degree of holding infringers legally liable for patent infringement	1	2	3	4	5

Part Four: Enterprise Performance

11. The estimated position of your company in the domestic industry:

□ Among the last 3 □ In the middle □ Among the Top 3 □ The best

12. The actual situation of your company's performance compared with the industry level in China:

Description	1=very low; 2=low; 3=medium; 4=high; 5=very high				
The average annual sales growth rate in the past three years compared with the average industry level in China	1	2	3	4	5
The average annual return on equity over the past three years compared with the average industry level in China	1	2	3	4	5
The average profit margin in the past three years compared with the average industry level in China	1	2	3	4	5

Part Five: Enterprise Basic Information

13. Your company was founded in___(year)	The year when your company's IP management system was recognised by the government:___(year)
14. Company ownership: □ State-owned or controlled □ Private □Foreign-invested or controlled □ Other	
15. Sector: □ ICT □ Biological and medicinal chemistry □ Energy (oil, coal, electricity, etc.) □ Chemical engineering □ Machinery □ Automobile □ Household appliances □ Metal □ Food & beverage □ Textile and garment □ Building materials □ Wood furniture □ Plastic & Rubber □ Culture and media □ Others, please specify _____	
16. Please list your main product categories (<4 categories)： _____	
17. The focus of your company's innovation is： □ Product innovation □ Technological innovation □ Business model innovation □ Other	
18. The overseas distribution areas of your products or services are available in (multiple choices): □ The U.S. □ Europe □ Japan □ Other	
19. In your opinion, the most effective way to protect the innovation achievement is: □ Intellectual property □ Lead time □ Complementary assets □ Other	

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Annex A-2: Investigation of the Business and IP Development for Shenzhen Enterprises

1. Company's Basic Information

	Year ( )	2014	2015	2016
Total assets (RMB million)				
Sales revenue (RMB million)				
R&D expenditure (RMB million)				
Profit (RMB million)				
Number of Employees (thousand person)				
Number of R&D Personnel (person)				

2. Development of company's Intellectual Property -1

			2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Patent application	The annual total													
	Invention	Domestic												
		Foreign												
	Utility model													
	Industrial Design													
	PCT													
	America													
	Europe													

	Japan												
	Other area												
	Cumulative applications over the years												
Patent authorization	The annual total												
	Invention	Domestic											
		Foreign											
	Utility model												
	Industrial Design												
	PCT												
	America												
	Europe												
	Japan												
	Other area												
	Cumulative authorization over the years					Existing valid patent							

3. Development of company's Intellectual Property -2

		2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Registered	The annual total												

<table>
<tr><td rowspan="5">trademarks</td><td>Domestic registration</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Foreign registration</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Annual registration accumulation</td><td colspan="3">Domestic</td><td colspan="3"></td><td colspan="3">Oversea</td><td colspan="3"></td></tr>
<tr><td>Well-known trademark accumulation</td><td colspan="12"></td></tr>
<tr><td>Famous trademark accumulation</td><td colspan="12"></td></tr>
</table>

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Annex B-1: Case Study: Interview Record

Interviewer: Zhou Lin

Interviewee:

Time:

Location:

Interview questions:

1. How does Huawei protect its intellectual property (IP)? What is its strategy for filing patents? Is there a specific decision-making process?
2. How does Huawei protect its IP in the field of 5G technology? What is its strategy for filing patents?
3. How does Huawei decide on its strategy for overseas patent applications?
4. How does Huawei maintain its existing patent portfolio?
5. How does Huawei design its patent licensing strategy, including out-licensing and accepting licenses from external patent holders?
6. How does Huawei design its IP protection strategy? How does it determine whether to initiate IP lawsuits against other parties?
7. What aspects of your IP creation, protection and commercialization have enhanced your company's core competitiveness?

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Annex B-2: Case Study: Interview Record

Interviewer: Zhou Lin

Interviewee:

Time:

Location:

Interview questions:

1. How does ZTE protect its intellectual property (IP)? What is its strategy for filing patents? Is there a specific decision-making process?
2. How does ZTE protect its IP in the field of 5G technology? What is its strategy for filing patents?
3. How does ZTE decide on its strategy for overseas patent applications?
4. How does ZTE maintain its existing patent portfolio?
5. How does ZTE design its patent licensing strategy, including out-licensing and accepting licenses from external patent holders?
6. How does ZTE design its IP protection strategy? How does it determine whether to initiate IP lawsuits against other parties?
7. What aspects of your IP creation, protection and commercialization have enhanced your company's core competitiveness?