

Original Paper

Evaluation of the Development Effectiveness of Intellectual Property Operation for Science and Technology-based Small and Medium-sized Enterprises: Based on the Research Data of Qinchuangyuan Innovation Driving Platform

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Abstract

Science and technology-based enterprises promote national economic growth and facilitate scientific and technological innovation. This study takes the development of Intellectual Property (IP) operation of science and technology-based enterprises as the research object and constructs a relevant evaluation index system. It also takes the data of 112 small and medium-sized science and technology-based enterprises within the Qinchuangyuan Innovation Driving Platform as an example, conducts statistical analysis and case analysis, and concludes development strategies. The results of the study provide policy suggestions for further strengthening and promoting the development of intellectual property operation by enhancing the efficiency of the IP operation system and policy services for small and medium-sized enterprises (SMEs) in science and technology, promoting the construction of supporting facilities and improving employee satisfaction; as well as simplifying the IP filing procedures, optimizing the financing environment, and establishing a platform for regular evaluation and information sharing to accelerate the transformation of IP; and at the same time, implementing a mechanism for efficient policy fulfillment

and departmental linkages to enhance the implementation of the policies and form a high-quality business environment that will help SMEs in their development and technological innovation of SMEs.

Keywords

Qinchuangyuan Innovation Driving Platform, science and technology-based enterprises, intellectual property operation

1. Introduction

In the new era, Intellectual Property (IP) has become an essential indicator of an enterprise's or even a region's innovation ability and core competitiveness. For science and technology-based Small and Medium-sized Enterprises (SMEs), the development of intellectual property operation directly affects their survival and growth. As a scientific and technological innovation platform built by Shaanxi Province with the efforts of the whole province, Qinchuangyuan Innovation Driving Platform, the development of its intellectual property operation is undoubtedly of high research value.

The development of intellectual property operation is not a simple transaction and transfer of intellectual property; it is more of an innovation-driven business model, a process of enhancing enterprise value by optimizing the allocation of resources with intellectual property as the core asset. In this process, science and technology-based SMEs need to fully explore and utilize the value of intellectual property to achieve sustainable development of their enterprises.

However, science and technology-based SMEs face many challenges in IP operation, such as policy environment, financing channels, market information, talent reserves, and other troubles, which are essential factors restricting the development of intellectual property operation of science and technology-based SMEs.

Based on this, we conducted in-depth research and analysis to assess the development effectiveness of intellectual property operation of science and technology-based SMEs and to provide references and lessons for science and technology-based SMEs in other regions. We hope that through this study, we can provide strong support for promoting the development of intellectual property operation of science and technology-based SMEs, enhancing their core competitiveness, and promoting the development of the whole innovation-driven platform.

2. Literature Review

In recent years, science and technology-based enterprises have received attention from scholars at home and abroad and have become an essential topic in economics, management, and other disciplines. With the accelerated pace of economic globalization and the rise of innovation-driven platforms, academic research on this topic has gradually expanded in depth and breadth, focusing mainly on the following aspects.

Regarding innovation, Audretsch and Belitski (2020) show that R&D investment and knowledge spillovers significantly affect technology-based firms' scientific and technological output. In terms of

financing, a study by Lee et al. (2015) find that innovative SMEs have more difficulty obtaining financing than mature firms. To address this issue, Colombo et al. (2016) explore the role of the government, noting that government investment can compensate for its shortcomings to a certain extent, especially in early-stage and high-tech areas. In terms of intellectual property, Hsu and Ziedonis (2013) show that patents are not only an indicator of technological innovation but also crucial to the value assessment and competitive advantage of technology-based firms and that an increase in the number of patents can significantly increase firms' valuation, especially in early financing rounds. Meanwhile, Nylund and Cohen (2017) point out that resource integration in a platform model significantly impacts the growth of technology-based firms and can promote the prosperity of innovation and entrepreneurial activities.

Whereas this paper focuses on the intellectual property aspect of the research, Holgersson and Granstrand (2017) explore the relationship between patenting motives, technology strategy, and open innovation. They find that patents are affected by technology characteristics and are closely related to firms' open innovation degrees. A study conducted by Audretsch and Link (2019) emphasizes the crucial role of effective intellectual property management in fostering collaboration and innovation among knowledge-intensive service firms. Whereas, Miozzo et al. (2016) show that the establishment of formal IP protection mechanisms (e.g., patents) may be more effective compared to informal mechanisms (e.g., confidentiality agreements). In addition, Rassenfosse and Fischer (2016) examine the quality and quantity of patent portfolios, which significantly impact access to venture debt financing for technology-based firms. This finding emphasizes IP's signaling role and collateral value in corporate finance. Brem et al. (2017) explore how effective IP management for SMEs remains a challenge.

Current research by scholars on the development of intellectual property operation in technology-based enterprises has yielded fruitful results. However, there are still gaps in understanding and controversial issues to be resolved. For example, how can we better quantify intellectual property development in technology-based enterprises? How can we identify the key factors affecting the development of IP operation in a complex environment? All these issues need further exploration and research. Therefore, this paper will systematically analyze and evaluate the intellectual property development of science and technology-based enterprises based on previous studies through a comprehensive literature review, empirical research, and statistical analysis to contribute to the relevant theories and practices.

3. Methods

The primary purpose of this study is to comprehensively and quantitatively collect the actual situation of science—and technology-based SMEs within Qinchuangyuan innovation platform regarding the development of intellectual property operation. It also aims to propose more practical suggestions for optimizing and enhancing the development of intellectual property operation of science—and technology-based SMEs.

A total of 129 valid questionnaires from SEMs are returned, and a total of 112 research questionnaires are available through data screening and cleaning. Through both quantitative and qualitative methods,

the development status of intellectual property operation of science and technology-based SMEs is evaluated and verified, and the study adopts a variety of research methods such as statistical analysis, literature review, and case analysis. The following is an introduction to some of the methods:

(1) Statistical analysis is a research method that uses mathematical and statistical techniques to extract relevant phenomena and laws from data through collection, organization, analysis, and interpretation. This study aims to use descriptive statistical analysis to summarize and describe technology-based SMEs by calculating and presenting various statistical data.

(2) The case analysis method systematically explores a specific issue through the in-depth study of one or more actual cases. By applying the case analysis method, we can study in depth the operation and development of intellectual property of SMEs within the Qinchuangyuan Innovation Driving Platform to further elucidate the reasons and mechanisms behind them.

4. Results

To scientifically and objectively evaluate the development effectiveness of intellectual property operation of science and technology-based SMEs within the Qinchuangyuan Innovation Driving Platform, we conduct a detailed analysis and evaluation from three aspects: analysis of operating income, analysis of the development of intellectual property operation, and problems of intellectual property transformation and operation of SMEs.

4.1 Business Condition Analysis

4.1.1 Stages of Development

The enterprises that have been put into operation have a relatively short establishment time, with over 70% of them established within 3 years. Around 50% of the enterprises concentrated their actual operations in 2022, and as of 2023, the latest operation was recorded for 24 enterprises. In terms of registered capital, approximately 65% of the enterprises have a registered capital below ¥10 million. The median registered capital is ¥17.1 million for these enterprises, while there are also 36 companies with a registered capital exceeding ¥10 million, as detailed in Table 1.

Table 1. Basic Information on Enterprises

	Established			Registered capital		Actual commissioning Time		
	Within 1	1-3	More than 3	≤10	>10	2023	2022	2021
	year	years	years	million	million			
Number of enterprises	15	73	15	67	36	24	56	32
Percentage of enterprises	14.56%	70.87%	14.56%	65.05%	34.95%	21.4%	50%	28.6%

The transition stage, as illustrated in Figure 1, currently constitutes the primary developmental phase of the enterprise, accounting for 46.08% of its progress. This indicates that significant achievements have been made in technology research and development, as well as product/service launch, leading towards the commercialization stage. The marketization stage, encompassing 37.25% of overall progress, represents the second major developmental phase for enterprises. It signifies their efforts to successfully introduce products/services into the market and monetize them. The management stage (towards integrated management) forms a smaller segment within enterprise development, comprising 16.67%. This implies that certain enterprises have transitioned into an all-encompassing management stage with a focus on organizational management, human resources, and other relevant aspects. In summary, enterprises are predominantly situated within the transition and marketization stages presently while concurrently witnessing a gradual trend towards enhancing comprehensive management capabilities.

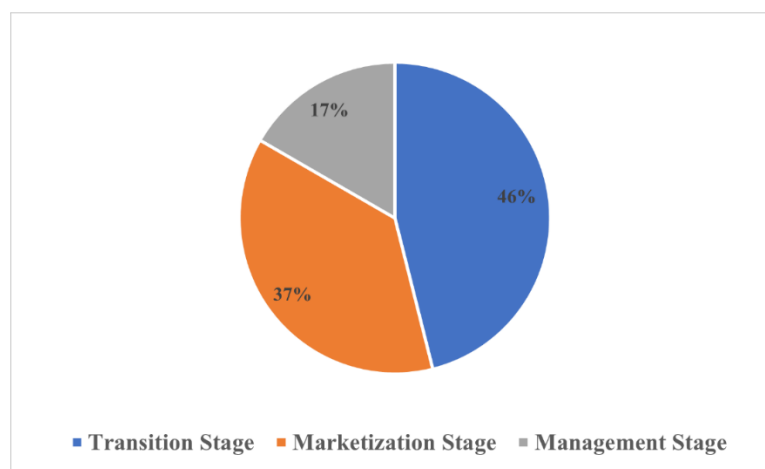


Figure 1. Distribution of Stages of Enterprise Development

4.1.2 Revenue Levels

Among the surveyed enterprises (refer to Table 2), the average operating income in 2022 is projected to reach 5,331,500 yuan, with an anticipated R&D investment of 1,451,700 yuan and an expected annual profit of 104,500 yuan. During the survey and visits conducted, each company was also queried about their projected revenue for 2023. According to statistical data, the average expected revenue is estimated at 11,740,500 yuan with a projected R&D investment of 2,280,900 yuan and an anticipated annual profit of 468,400 yuan - representing a remarkable increase of 348% compared to the profits achieved in 2022. The figures within parentheses represent median values for operating income as well as research and development investment costs. Based on these medians alone it can be inferred that the expected profit for 2023 will surpass that of its preceding year significantly. Furthermore, the proportion of R&D expenditure relative to operating income serves as a crucial indicator in assessing whether an enterprise possesses sustainable R&D capabilities and prospects for future growth. As indicated in Table 2, the range for R&D expenditure remains between 19%-28%, which signifies Qinchuangyuan's consistent

commitment towards sustaining its research efforts while maintaining a relatively stable and sound trajectory towards sustainable development.

Table 2. Enterprises' Revenues

Year	Revenues (Unit: Ten Thousand Yuan)	R&D investment	Annual profit	R&D investment percentage
2022	533.15 (64)	145.17 (69.10)	10.45 (0.00)	27.23% (107.96%)
2023 (Expected)	1174.05 (260)	228.09 (180)	46.84 (50)	19.43% (69.23%)

Note. median in parentheses

4.1.3 Size of Personnel

As shown in Table 3, among the researched enterprises, the average number of employees of the enterprises is 37.63, the median number is 18, and the maximum number is 588. The average number of R&D personnel in enterprises is 18.28, the percentage of R&D personnel in the total number of employees is 52.41% on average, the average number of personnel with master's degree (included) or above is 6.62, and the percentage of personnel with postgraduate degree or above reaches 29.11% on average. Among the surveyed enterprises, 33.92% of them have high-level talents. It can be seen that the proportion of R&D personnel in enterprises is relatively high, reflecting the pioneering role of science and technology in science and technology-based enterprises. At the same time, nearly 30% of the enterprises have a postgraduate education or above, reflecting the platform philosophy of absorbing high-quality talents for employment and innovation-driven development.

Table 3. Size of Enterprise Personnel

Number of people	Average value	Upper quartile	Minimum value	Maximum value	Percentage
Total employees	37.63	18	2	588	
R&D personnel	18.28	10	0	400	52.41%
Master's degree or higher personnel	6.62	4	0	50	29.11%

4.1.4 Revenues

According to Figure 2, it can be seen that the following financing methods are used by enterprises introduced by the Qinchuangyuan Innovation Driving Platform: equity financing (21.63%), applying for government programs and grants (22.45%), bank loan (9.39%), and other methods (7.14%). Credit guarantee financing, bond financing, finance leasing, P2P financing, agency business, bill discount, and overseas financing are all relatively low (all below 1.02%), and 41.84% of enterprises have no financing.

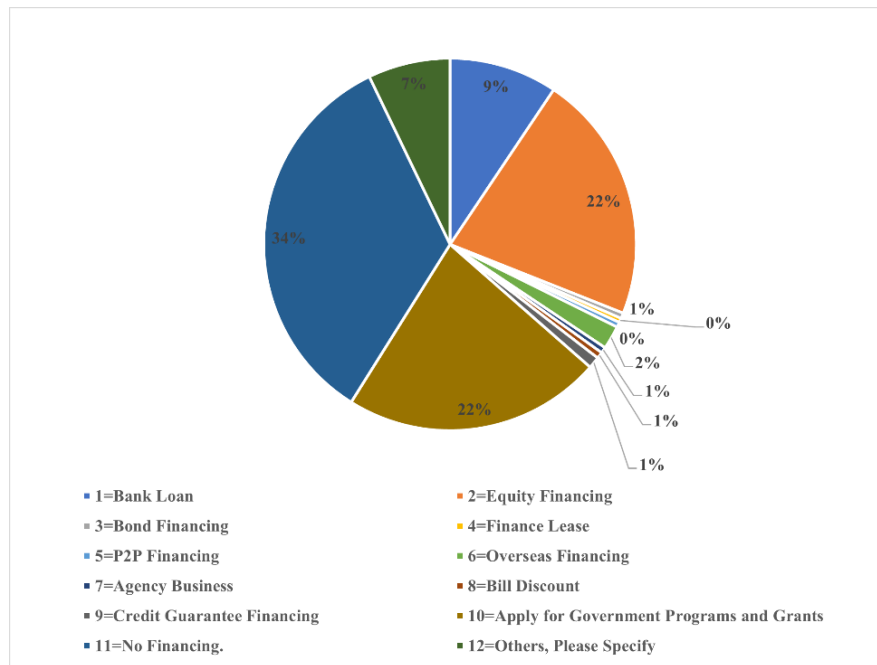


Figure 2. Enterprise Financing Status

Enterprise financing difficulties and obstacles, as depicted in Figure 3, indicate that 32.05% of enterprises attribute their financing challenges primarily to constraints imposed by their own production and operational scale. Additionally, 21.79% of enterprises perceive the loan costs as exorbitant, while 17.95% encounter difficulty meeting financing requirements due to stringent bank guarantees and mortgage criteria. Furthermore, 8.10% refrain from disclosing extensive financial information for confidentiality reasons. Moreover, complex financing procedures, rigorous credit rating assessments, and unaffordable loan policies also contribute to hindrances in corporate funding acquisition. In summary, the impediments faced by enterprises in securing finances encompass enterprise size limitations, high loan expenses, guarantee and mortgage conditions stringency, disclosure obligations pertaining to financial information requisites along with intricate procedural formalities.

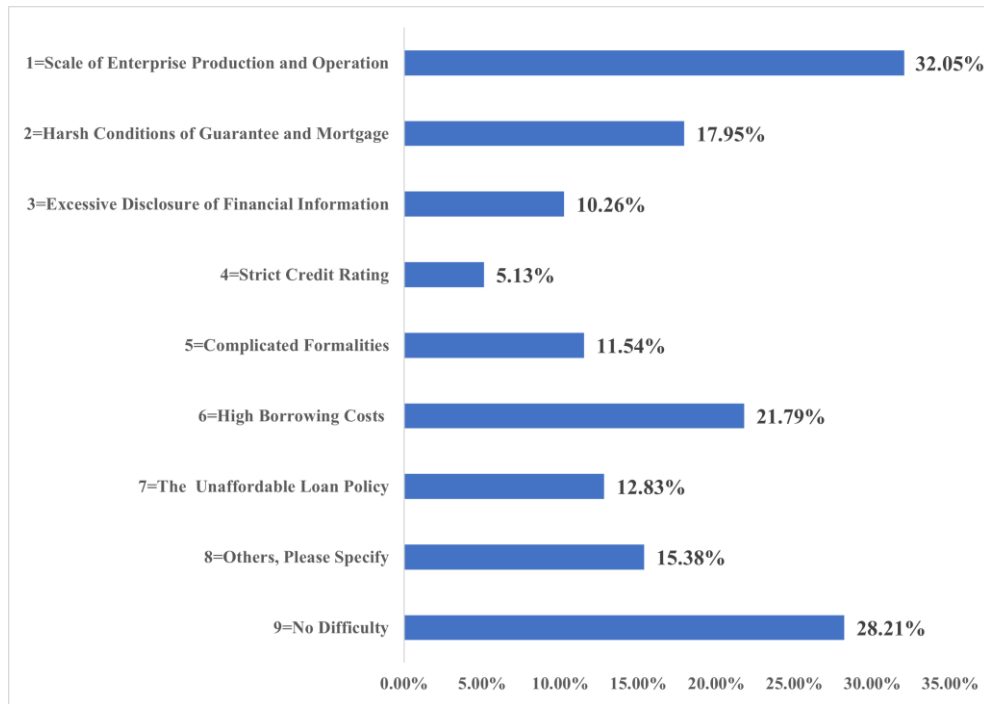


Figure 3. Difficulties or Obstacles Affecting the Financing of Enterprises

4.2 Intellectual Property Operation Analysis

4.2.1 Enterprise Intellectual Property Situation

Regarding intellectual property, as depicted in Table 4, the average quantity of intellectual property held by operating enterprises amounts to 21.25, along with 15.86 pending applications. Among these, there are 2.81 invention patents, 8 practical patents, 1.07 design patents, 9.21 software copyrights, and 0.16 others. The data show that:

Firstly, with the support of Qinchuangyuan Innovation Driving Platform, science and technology enterprises show a vigorous trend of strong transformation ability of scientific and technological achievements, sufficient self-drive transformation ability, and good application and production prospects. Secondly, because Qinchuangyuan Innovation Driving Platform helps enterprises to implement the “Three Reforms” in 2022 and continue to promote the transformation of scientific research achievements in universities, the number of intellectual property claims has increased, but it still takes time and fast review channels to convert the patent claims into authorized patents.

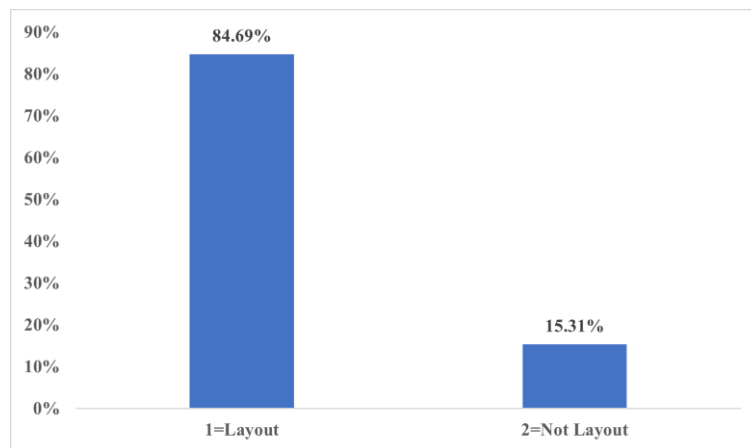
Table 4. Intellectual Property Authorization and Application

Unit: pieces	Invention	Practical	Design	Software	Other	Average
	patent	patent	patent	copyright		
Number of	2.81	8	1.07	9.21	0.16	21.25
authorizations	(2)	(2)	(0)	(2.5)	(0)	
Number of	6.07	5.89	0.68	3.05	0.17	15.86
applications	(2)	(1)	(0)	(0)	(0)	

Note. median in parentheses.

4.2.2 Enterprise Patent Layout

Figure 4 shows that 84.69% of enterprises have already laid out their intellectual property, while 15.31% have not yet done so. It can be seen that most enterprises have realized the importance of intellectual property and carried out relevant layout.

**Figure 4. Layout of Intellectual Property**

In terms of patent layout planning for innovation promotion projects, 67.71% of innovation promotion enterprises preferred to prioritize high value patent applications, which clearly demonstrates the significant importance that enterprises place on technological innovation and their understanding of the pivotal role played by high-value patents in driving enterprise development. The establish quality standard system accounted for 11.46%, indicating that creative enterprises have started to give priority to quality management and the construction of standardization, incorporating them into their intellectual property strategies. Furthermore, trademark layout (5.21%), intellectual property pledge financing (7.29%), and other innovative activities (8.33%) will emerge as crucial components within future enterprise intellectual property strategies.

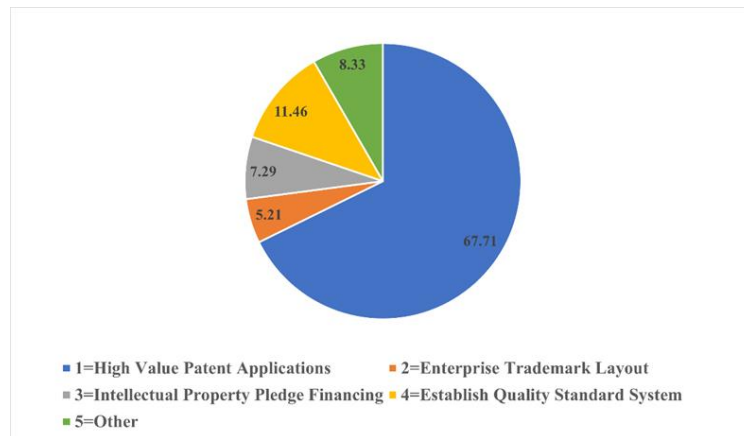


Figure 5. Future Layout of Intellectual Property

4.2.3 Enterprise Patent Conversion into Production

According to Figure 6, the application and implementation of scientific and technological innovations by promotion enterprises have a utilization rate of 77.45%, while the non-utilization rate is 22.55%.

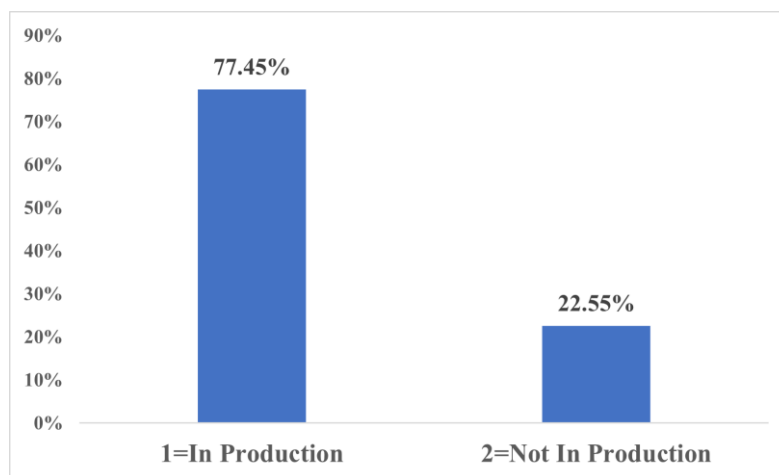


Figure 6. Whether the Patent Is Applied into Production

4.2.4 Pricing or Transfer of Intellectual Property

Based on the agreements signed between enterprises and the Innovation and Promotion Center, 42.11% of enterprises had requirements for pricing or transferring intellectual property, while 57.89% did not have such requirements. Researching and analyzing difficulties encountered during the process of completing pricing or transfer of intellectual property in accordance with agreement requirements, only 3 enterprises (7.5%) reported encountering obstacles mainly due to lack of policy support, lengthy patent transfers from schools, and obstacles faced by schools during transfer processes. It can be concluded that enterprise intellectual property pricing has become relatively common practice, with most universities and project parties able to complete pricing or share transfers according to predetermined requirements.

The problems encountered by enterprises in the transformation of intellectual property are illustrated in Figure 7. It was found that 59.09% of enterprises expressed concerns regarding the lengthy application process for intellectual property, while 26.14% cited insufficient funds as a major obstacle. Additionally, an equal percentage (26.14%) of enterprises believed that the transformation of intellectual property lacked relevant expertise and skills. Furthermore, 10.23% highlighted issues with the system mechanism's lack of smoothness, and 4.55% indicated that technology maturity and marketization were yet to be achieved satisfactorily. Interestingly, another 21.59% identified alternative challenges not covered by these categories specifically mentioned above.

In summary, the obstacles faced during the transformation of intellectual property primarily revolve around time constraints, financial limitations, talent scarcity, technological immaturity or inadequate commercialization readiness, as well as deficiencies within institutional mechanisms.

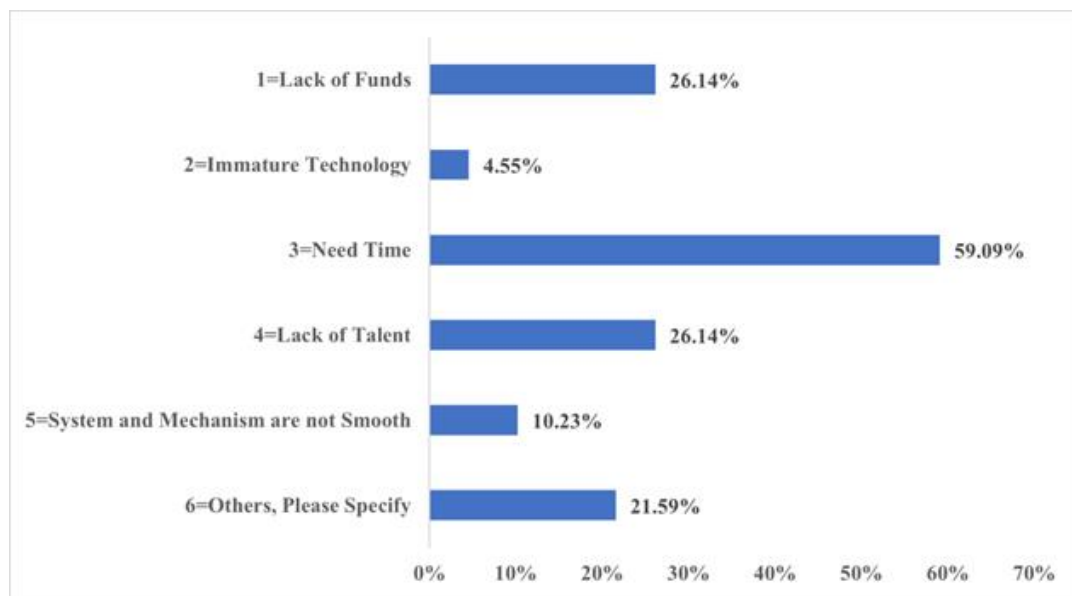


Figure 7. The Problems of Intellectual Property Transformation

4.2.5 Analysis of Business Performance

By studying the impact of the number of authorized intellectual property on the business performance of enterprises, it can be seen that, as shown in Table 5, the number of authorized intellectual property has a positive promoting effect on business income, R&D investment, profit, etc. The more authorized intellectual property, the more conducive to the business development of enterprises.

Table 5. The Impact of Intellectual Property on Business Performance

	(1)	(2)	(3)
Dependent variable	Income	R&D investment	Profit
Quantity of intellectual property	3.097** (1.652)	7.667*** (1.602)	1.261*** (0.497)
Constant	481.576*** (162.498)	60.830** (28.492)	18.296*** (4.548)
N	71	67	59
R ²	0.010	0.261	0.005

Note. Standard error in brackets, ***p < 0.01, **p < 0.05, *p < 0.1.

4.2.6 Summary of Intellectual Property Operation Results

Intellectual property plays a pivotal role in enhancing the quantity and quality of high-tech achievements' transformation, serving as the crucial link to convert high-tech into tangible productivity. In this new era, economic competition is essentially a contest of advanced and innovative technologies, with emphasis on the speed, quality, and quantity of transforming these technological breakthroughs. By examining Qinchuangyuan Innovation Driving Platform current status in high-tech achievements, it becomes evident that through effective management of intellectual property, enterprises can unite various stakeholders such as producers, consumers, and promoters during the process of technology transformation. Simultaneously, it enables efficient management across multiple stages of achievement conversion including technical ideation proposals, intellectual property application procedures, and implementation of high-tech advancements from a macro perspective. This comprehensive approach effectively enhances enterprise output while significantly improving input-output efficiency levels. Empirical results presented in Table 5 demonstrate a substantial growth trend in business performance resulting from increased focus on intellectual property.

For the successful commercialization of high-tech achievements in various fields, it is crucial for enterprises to have a comprehensive understanding of the appropriate timing and type of intellectual property applications. The dependence on intellectual property varies across different sectors, with areas like new materials and biomedical research having longer development cycles and higher entry barriers, resulting in relatively less impact from intellectual property management. Data indicates that individual projects in these industries tend to have lower average levels of intellectual property compared to other sectors. However, the value of individual project products remains high, with significantly more invention patents being filed per project. Therefore, it is recommended for enterprises operating in these

industries to primarily focus on applying for first-level intellectual property while also striving to obtain additional industry qualifications to enhance competitiveness.

4.3 Problems of Intellectual Property Transformation and Operation

4.3.1 Urgent Optimization of Intellectual Property Operation

In the current context, science and technology-based SMEs view intellectual property as a crucial indicator of enterprise potential and the strength of scientific and technological innovation. However, there is a tendency to engage in intellectual property applications without fully considering their effectiveness. This phenomenon, which might be described as “Apply for application’s sake”, fails to optimize the utilization of intellectual property. Most projects the Center undertakes are about small and medium-sized enterprises that are still in the initial stages of intellectual property management. Furthermore, most SMEs have not established a department with specific responsibility for intellectual property management within their organizational structure. Regarding human resources, enterprises tend to prioritize scientific and technological expertise, while the recruitment of professionals with expertise in intellectual property is often overlooked. The lack of specialized intellectual property management hinders SMEs’ timely understanding and accurate mastery of intellectual property, which impedes timely maintenance.

Secondly, intellectual property represents not only a proportionate representation of intellectual achievements but also an essential capital for the development of SMEs. For science and technology-based SMEs, protecting intellectual property is essential for transforming innovation achievements into commercial capital, thereby fully realizing their intrinsic value. Presently, the daily operation of intellectual property for small and medium-sized enterprises in China is primarily concerned with the application and maintenance of IP. This is in the nascent stage of IP operation, and further work on the direction of IP application, market transactions, and maintenance has been overlooked. From the perspective of the current intellectual property management practices of science and technology-based SMEs, many of these enterprises adopt a fragmented and narrow approach to intellectual property management. There is a notable lack of integration between intellectual property strategy and enterprise development strategy, and the intellectual property management system cannot provide comprehensive support for the overall growth and advancement of the enterprise.

Furthermore, there is a dearth of reliable intellectual property assessment and appraisal institutions for scientific and technological achievements. Consequently, in commercial transactions, both parties determine the value of scientific and technological achievements by their standards, often resulting in a lack of consensus.

4.3.2 Environment for Intellectual Property Operation Needs Improvement

During this field visit and subsequent research, several enterprises in different regions indicated that the current supporting facilities were incomplete. The most significant issues identified were transportation-related, with many respondents citing inconvenient transportation options as a major obstacle. Additionally, respondents highlighted slow progress in restaurant construction, a lack of diversity in

restaurants, unreasonable property charges, poor network signal, and a lack of talent apartments, staff dormitories, and other facilities as critical challenges. In particular, the lack of supporting facilities in the Airport and Qinhan areas significantly impacts enterprise operation. It hinders the recruitment and employment of personnel, increases enterprise operating and production costs, and challenges enterprise growth and development.

On the other hand, no legislation has been enacted that is specifically oriented towards the scientific and technological innovation of SMEs. Despite this, the Law of the People's Republic of China on Scientific and Technological Progress (from now on referred to as the Law on Scientific and Technological Progress) The legislation above, scheduled for formal implementation in 2022, provides for the provision of tax incentives, fund subsidies, and public services to SMEs. However, it does not address SMEs' fundamental disadvantage in market competition. It remains unclear whether SMEs can achieve long-term development in the context of market competition. Meanwhile, the Law on Scientific and Technological Progress permits localities to establish regulations on scientific and technological innovation that reflect regional characteristics, which may result in increased policy intervention in scientific and technological innovation activities, a reduction in the influence of market forces in the allocation of scientific and technological innovation factors, and potential constraints on the free flow of innovation factors.

4.3.3 The Enterprise Life Cycle Is Short

Most technology-based enterprises are still in the incubation period and face many challenges. Some are developing rapidly, but some are not performing as well as they should be, mainly in the following aspects: Firstly, the growth trend of business revenue and profit is not up to expectations. Since the enterprise has just started, the product or service may not fully open the market, resulting in insufficient orders, slow profit growth, or even possible fluctuations.

Secondly, the enterprise may have excessive costs in all aspects of R&D, production, and sales. For example, R&D costs may be high due to technical difficulties and high talent costs; production costs may be difficult to reduce because the scale effect has not yet been formed, poor supply chain management; sales costs may be kept at a high level due to fierce market competition and difficulty in brand promotion. Thirdly, poor customer channels and unstable clientele. Enterprises may have problems with product or service quality, delivery speed, and technical stability, resulting in insufficient opening of customer channels and no growth in customer sources. 42% of the enterprises have not been financed, and 80% have an annual operating income of less than \$10 million. Due to the lack of synergistic ability of the internal service team and the lack of synergistic guidance of the external resources, the development performance of the enterprises needs to be further improved.

Many SMEs' assets are mainly intangible assets, SMEs' financial and risk management capabilities are weak, and SMEs as a whole are asset-light and have weak creditworthiness, which further reduces the willingness of social capital to invest in SMEs. In the process of transforming scientific and technological achievements, SMEs need a large amount of capital investment, which makes it difficult for most SMEs

to continue to carry out continuous innovation activities, and even if new technologies and new business models emerge, they are often short-lived.

4.3.4 Policy service System to Be Further Improved

The policy service system needs to be further improved, with some notable problems including delays in the disbursement of policy funds and fragmented and inconsistent handling of business problems. Specifically, most enterprises need continuous support from policy funds in the early stages of their business. However, some of the current policy funds are not paid promptly, which increases the operational pressure on enterprises and reduces entrepreneurs' confidence in doing business. In addition, multi-departmental visits and talks with enterprises all year round, and enterprises reflect their problems and demands to multiple management departments, but face the dilemmas of poor coordination among various departments and unmanaged management due to multiple departments, which not only increase the cost of communication for enterprises but also may lead to problems that cannot be substantively solved.

5. Conclusion and Policy Implications

This study combines existing literature with quantitative and case analysis to explore the practices and bottlenecks of science and technology-based SMEs in intellectual property operation. The study comprehensively evaluates the current situation of the development of the operation of intellectual property in science and technology-based SMEs through the analysis of actual data and the presentation of charts and graphs. Ultimately, this paper expects to provide a specific theoretical basis and practical guidance for the intellectual property management of science and technology-based SMEs, further optimize the transformation of scientific and technological achievements, and thus enhance the sustainable development ability of enterprises in the fierce market competition.

5.1 Establishment of Intellectual Property Operation System

To improve the overall transformation rate of scientific and technological achievements of landed projects and to strengthen the intellectual property management of SMEs, we can start from the following aspects: firstly, to establish a service organization or a counterpart for the operation and management of intellectual property of SMEs of science and technology, seize the opportunity of the development of the digital economy, and take the "Internet Plus" as the basis, led by the government, introduce private capital, and provide services for the operation and management of intellectual property of SMEs with a team of experts. Seizing the opportunity of the development of a digital economy based on "Internet Plus", led by the government, introducing private capital, combining with universities and research institutes, and centered on a team of experts, it will provide services for the operation and management of the intellectual property of science and technology-based SMEs. Guided by information technology and breaking through geographical and industrial restrictions, it attracts SMEs, intellectual property service organizations, and patent evaluation organizations to join it, forming a complete intellectual property industry ecological chain and providing systematic services such as intellectual property payment,

transfer, evaluation and trusteeship for science and technology-based SMEs, to enable the enterprises to have an all-round mastery of their intellectual property and to manage their intellectual property effectively.

Secondly, in terms of talent cultivation, institutions of higher learning and scientific research institutes should undertake the extraordinary task of cultivating intellectual property talents to cultivate a group of comprehensive talents qualified in science and technology, management, and operation. In response to the shortage of intellectual property talent, local governments have formulated preferential policies on settlement, taxation, and subsidies for intellectual property talent to provide strong talent support for the intellectual property operation of local science and technology-based small and medium-sized enterprises. Finally, local governments will further promote the construction of IP operation service management systems by refining and implementing supportive policies for IP operation and strengthening support for IP financing, evaluation, and transfer.

5.2 Upgrading Support Facilities and Services

It should lead and join hands with the park, relevant departments, and other parties to invest in a comprehensive upgrade of transportation, catering, accommodation, and other infrastructure, especially in areas such as the airport and Qinhan, to increase investment. The details are as follows:

- (1) Transportation convenience enhancement: Increase or optimize public transportation routes, such as buses and subways, while encouraging and supporting the development of new transportation modes, such as shared bicycles and shared cars, to solve the problem of employee commuting.
- (2) Improvement of catering facilities: Promote the progress of restaurant construction and introduce more high-quality catering brands to enrich catering types and meet the diversified catering needs of employees.
- (3) Rationalization of property expenses: establish an open and transparent accounting mechanism for property expenses, accept the supervision of enterprises and employees, and ensure the reasonableness and fairness of property charges.
- (4) Network signal coverage: optimize and expand network coverage, ensure a smooth network within and around the enterprise, count the enterprise's special water and electricity network needs, and gradually coordinate management.
- (5) Accommodation improvement: Increase the construction of talent apartments and staff dormitories to provide a comfortable and safe accommodation environment to attract and retain talent.

According to the actual degree of development of local SMEs and the composition of the industrial structure, formulate localized and regionalized Regulations on the Promotion of Science and Technology-based SMEs, stipulate in detail the preferential policies and support measures for science and technology-based SMEs in the administrative region, and set up a "One-stop" service department, to consolidate the functions of the government about the services for SMEs and improve the efficiency of services for the convenience of SMEs. It has set up a "One-stop" service department to integrate the functions of government services for SMEs, improve service efficiency, and provide convenience for SMEs.

At the same time, it will keep abreast of the problems that exist in the development of SMEs in the region so that relevant policies can be introduced promptly to promote the development of SMEs in the region, improve the government's service functions, promote technological innovation and intellectual property protection, provide a comprehensive guarantee for the future development of SMEs, improve the business environment, and promote the utilization and diffusion of the achievements of SMEs in scientific and technological innovation.

5.3 Optimize Intellectual Property Declaration Procedures

It is suggested that a green approval channel be established for the declaration of intellectual property of science and technology-based SMEs on the ground, simplifying the application procedures for intellectual property of science and technology-based SMEs and improving the efficiency of the application so that intellectual property can be quickly transformed into enterprise capital so that enterprises can pledge and guarantee intellectual property and broaden the financing channels for enterprises to obtain loans and investments. Encourage financial institutions to carry out financing businesses targeting SMEs' intellectual property and technological achievements, appropriately lower the threshold of loans to SMEs, and promote the docking between science and technology-based SMEs and financial service organizations. Establish a government-led system of scientific and technological financial services for SMEs with the participation of scientific and technological assessment agencies and financial institutions, whereby professionals assess the status of intellectual property of scientific and technological SMEs, their market prospects and financing needs, and through a series of financial policies and tax incentives, guide the participation of social capital in the process of developing scientific and technological SMEs, to realize the effective connection of intellectual property, scientific and technological innovations and financial investments, and alleviate the financing pressure on scientific and technological SMEs. To alleviate the financing pressure of science and technology-based SMEs, we have built a science and technology financial support system that helps science and technology-based SMEs realize sustainable development.

They are establishing a unified information platform for releasing policies, training, financing, and other support measures, collecting the needs and feedback of enterprises, and realizing information sharing and interaction between enterprises, the government, and institutions. For the cultivation and incubation of enterprises in Qinchuangyuan, it establishes a system to follow up on the progress of scientific and technological achievements transformation and an evaluation system to find out the degree of success of enterprise development and achievements transformation, the existence of silt points, and give targeted support and services in different categories. At the same time, it conducts accurate profiling of enterprises, forms enterprise cultivation group management, regularly evaluates the development performance of enterprises, and effectively supervises and monitors them.

According to the characteristics and development stage of the enterprise, formulate appropriate assessment indicators, such as operating income growth rate, profitability, cost control ability, and customer satisfaction, and quantify and assign weights to the assessment indicators to form a complete

set of assessment system, which can be used to assess the enterprise's business performance comprehensively. According to a specific time cycle (e.g., quarterly, half-yearly, or yearly), assess the technology-based enterprises to understand their business performance and development status; continuously follow up the assessment results and pay attention to the development dynamics and changing trends of the enterprises, to identify problems promptly and provide corresponding support and assistance.

5.4 Enhance the Efficiency of Policy Realization

Based on the inefficiency of policy fulfillment, insufficient coordination among provinces, municipalities, and districts, and varying degrees of fulfillment, it is recommended to clarify the responsible parties and enhance the efficiency of policy implementation concerning different policy directions. To check the shortcomings of the business environment, focus on building an efficient and convenient policy service platform and provide all-around support and guidance by integrating resources and optimizing processes. At the same time, it actively pursues digital transformation, utilizes advanced technology and data-driven decision-making to enhance the precision and effectiveness of policy formulation and implementation, monitors the arrival and management of policy funds for each enterprise, and implements a ledger system to grasp first-hand information on enterprise development.

For enterprise visits to multiple docking, it is recommended to form a problem distribution and flow mechanism oriented to the type of problem, enterprise services, cultivation, management, and supervision to form a network of management, data, a table, progress, construction, operation, support, service one step transfer, increase efficiency, and truly enhance enterprise satisfaction and business environment. For the regional enterprise attraction landing, it is recommended that the relevant landing department of the General Window and each new city and park establish the need to establish the enterprise site allocation and construction progress to follow up on the delivery of the site of the whole process of the work of the collaborative mechanism. Each new city should strengthen the internal and peripheral supporting construction of the carrier of industrial parks in the region to ensure that enterprises can be attracted, stay, and do well.

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