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Core Issues of Innovation Achievements' Patentization based on Innovation Types

Yun Liu [1,a,*], Xin Gu [1,2,b] and Hui Shu [3,c]

[1]Business School, Sichuan University, Chengdu 610064, China

[2]Innovation and Entrepreneurship Research Institute of Sichuan University, Chengdu 610064, China

[3]School of Business Administration, Jiangxi University of Finance and Economics, Nanchang 330013, China

[a] 2017325020028@stu.scu.edu.cn, [b] gx6664@sina.com, [c] shuhui701@163.com

*Corresponding author

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Abstract. Innovation achievements which are from original innovation, secondary innovation, and integrated innovation would form different types of patents. The study showed that original innovation achievements formed basic patents and core patents, and secondary innovation achievements formed improved patents and peripheral patents, and integrated innovation formed integrated patents and combined patents. Furthermore, it referred that different innovation achievements' patentization would be confronted with different issues, so we systematically analyzed these issues from technology, management, market, policy and law.

1. Introduction

Intellectual property has become an important resource for countries and enterprises to carry out strategic layout. Patents, as an important part of intellectual property, are the "battle ground" in the field of economy and technology. Driven by the excess profits of patents, enterprises actively deploy patent strategies and devote to innovation achievements' patentization. At present, researches focus on the selection of enterprise patent commercialization mode, cultivation of patent capability, implementation of patent strategy, analysis of patent value, etc. However, as an essential link in the implementation of enterprise patent strategy, the key core issues of patentization of innovative achievements have not been systematically studied. Therefore, starting with three different innovative behaviors: original innovation, secondary innovation and integrated innovation, we propose to analyze these core issues five aspects: technology, market, management, policy and law.

2. Correlation Analysis of Innovation and Patent

Original innovation, secondary innovation and integrated innovation are 3 forms of technology innovation[1]. In terms of original innovation, unprecedented major inventions can constitute original basic and core patents. In terms of secondary innovation, enterprises can obtain complementary and even alternative achievements by improving imported technologies and apply for peripheral and improved patents, which constitute a "patent cluster" rooted in certain basic technologies. In terms of integrated innovation, enterprises can produce innovation achievements by restructuring and optimizing existing technologies and apply for integrated and combinatorial patents. The patents may be built on other core patents and neighboring patents, thus forming " patent network".

In the process of achievements' patentization, technology is a prerequisite, and the length, width and novelty of technology are related to the optimal design of patents[2]. Market is a necessary condition, and its mechanism is related to the patent value' realization. Management is a key condition, which relates to the patent application and operation. Policy is an important condition,

and the patent incentive policy can significantly accelerate patent applications and grants[3]. Law is a guarantee condition, which protects economic interests of owners and promotes the initiative of innovators[4].Therefore, as shown in figure 1, we will systematically analyze the core issues of the three kinds of innovation achievements' patentization from market, management, policy and law. Along with the renewal of innovative products, fundamental and destructive innovative achievements reappear to form basic and core patents. Based on the basic achievements, complementary and improved innovation achievements emerge and form peripheral and improved patents. What's more, innovative achievements derived from restructuring and optimization technologies appear and form integrated and combinatorial patents. The innovation achievements' patentization has started a new cycle, and the core problems in the process of patentization still exist.

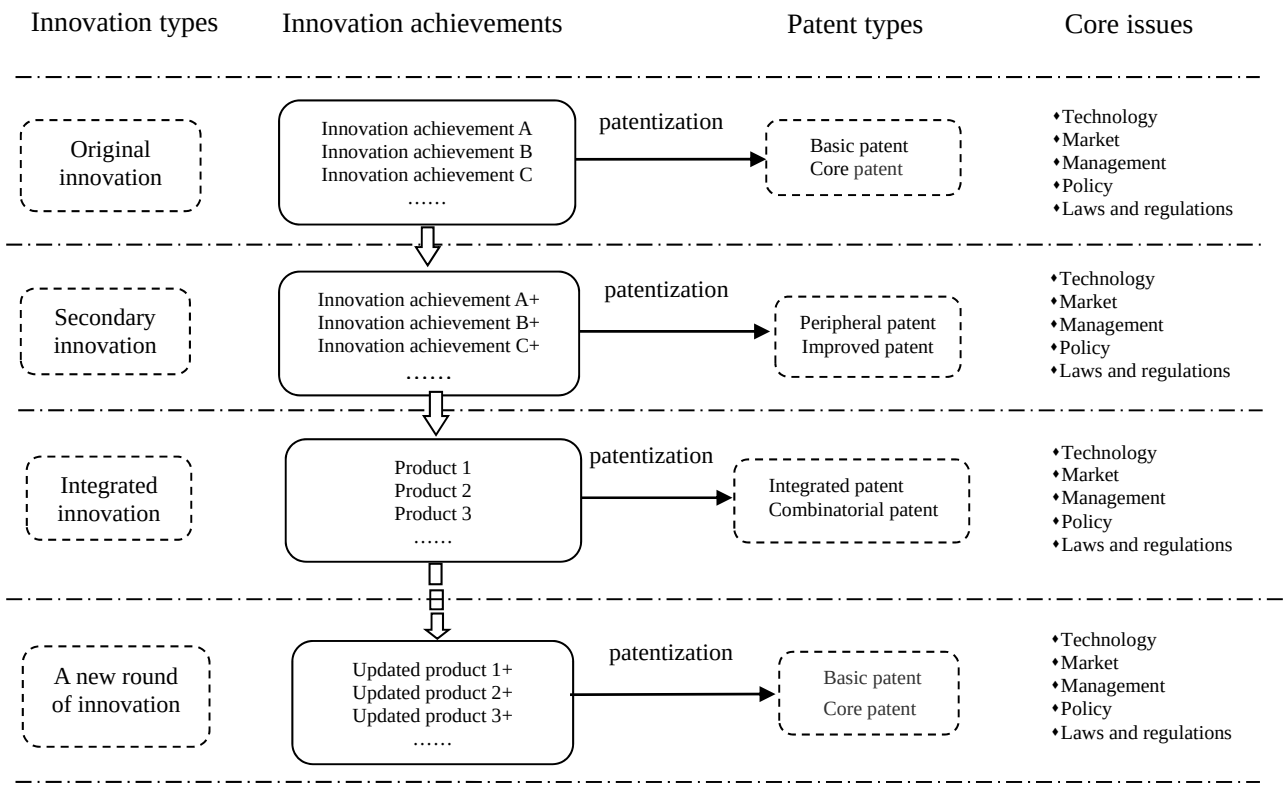

Figure 1. Patentization types and core Issues of innovation achievements

3. Core Issues of Original Innovation Achievements' Patentization

3.1. Core Technical Issues

(1) Technical elements. The original innovation achievement is an unprecedented major invention and discovery, so we should firstly consider whether it can apply for a patent, and examine its novelty, creativity and practicability. In terms of novelty, the original innovation achievement has strong advantages, but it need be strengthened in creativity and practicality. In addition, if the achievement is easy to be cracked by reverse technology, enterprises should prevent being imitated by competitors.

(2) Life cycle of technology. It takes long time to apply for a patent for the original innovation achievement. For example, it usually takes 3-5 years or even longer for an enterprise to ask for an invention patent and obtain authorization. Although patent law grants invention patents a 20-year protection period, the market life cycle of the technology becomes shorter as the technological upgrading accelerates. If the market life cycle is shorter than the authorized approval time, even if the patent application is successful, the achievement is already out of date.

3.2. Core Market Issues

(1) Treatment of patent relations. Although enterprises can apply for valuable basic and core patents for original innovative achievements, they may be "isolated" by peripheral technologies. When an enterprise applies for a basic patent, others have built a small circle of subsidiary patents around it, leading to the failure of the basic patent to enter the market. For instance, an innovative American bicycle planned to enter the Japanese market, it was found that Japanese enterprises had applied for patents in color and appearance, which led to the failure of the application of American patents in Japan. Therefore, in order to avoid that patents formed by original innovation achievements cannot enter the market because they are "suspended" by peripheral patents, it's vital to deal with the relationship with peripheral technologies and build "patent fence" around the basic patents.

(2) Selection of the regional market. Original innovation achievements are new technologies. Enterprises can elect to apply for patents in more countries and regions in order to gain more market in the future. However, considering that the achievements are technologies that have not previously been seen in the market, there is great uncertainty and the market prospect is difficult to predict. Therefore, when selecting the regional market, we should make full use of technology and market forecast, and balance the relationship between expected market returns and investment costs.

3.3. Core Management Issues

(1) Information management. It is necessary to clarify the latest technological information through advanced information management, predict the technology development path, and find the blank in the market, so as to avoid duplication of R&D and excessive competition. Enterprises could also grasp the information of patent application and authorization about competitors through patent maps. What's more, enterprises should take measures to protect their technology secrets.

(2) Cost management. Compared to other types of innovation, original innovation has long R&D cycle and high cost. As a basic technology, the original innovation results have a wider scope of application, and the risk of infringement is also greater. Therefore, there may be higher judicial costs. Therefore, enterprises should be committed to accounting management of R&D costs, patent applications and maintenance costs, and litigation costs.

(3) Management Institution settings. In enterprises, the scientific operation of the intellectual property management department is crucial to the effective management of the original innovative achievements. Meanwhile, considering the limitation of capacity and resources, enterprises start to seek external support for joint innovation. The original innovation achievements completed under the cooperation of the alliance should be set up in a clear management mode, such as electing a member or a third party to manage cooperative achievements, or adopting a new management mode.

3.4. Core Policy Issues

(1) Domestic patent policy. The original innovation lays a solid foundation for the subsequent innovation. 70% of the references cited in US corporate patents come from basic research funded by government public funds[5], indicating the importance of patent policy incentives to patent original innovations. Therefore, the government should become the main force to support the original innovation, providing long-term and stable policy to support the original innovation in important fields such as the national economy and national defense security. At the same time, the government should encourage industry associations and intermediary service agencies play an active role in the patent market, so as to streamline administration and institute decentralization.

(2) International Patent Policy. If an enterprise intends to apply for an international patent for its original innovative achievements, it must clarify patent application principles of the applicant country (the invention principle or the application principle), and fully grasp the country's policies about certification, examination, appraisal, and incentives of patents. In addition, enterprises should avoid increasing financial burden by blindly applying for patents, and avoid falling into passivity because they are unfamiliar with foreign patent policies.

3.5. Core Legal Issues

(1) The degree of protection of patent law. Innovative achievements' patentization means disclosure of technological content. As a basic research, the achievements have a wide range of applications and are more likely to be infringed. In order to preserve technology, some enterprises prefer to adopt the form of technology secrets rather than apply for patents. Therefore, whether the patent law can adequately guarantee that innovative achievements are not easily imitated is crucial. However, although the patent law is very important for innovative achievements' protection, we cannot blindly emphasize the patent law, because too strict patent system is not conducive to innovation.

(2) Attribution of patent right. The original innovation process is long and uncertain, so it is particularly important to motivate developers and agree with them in advance on the ownership of future innovation achievements and patents. When enterprises work together, the attribution of patents becomes more complicated because it involves multiple partners. Although "Bayh Dole Act" stipulates the attribution of cooperative patents, it has been more than 30 years since it was revised in 1984, and its content has become more and more ineffective.

4. Core Issues of Secondary Innovation Achievements' Patentization

4.1. Core Technical Issues

(1) Technical elements. Secondary innovation is a re-innovation based on the original technology, which has strong creativity and practicability. It need strengthen novelty, so it should be distinct from the technical content, drawing illustrations, and implementation methods of the imported original patents. Some scholars have proposed that considering that the secondary innovation needs compensation for the 1th innovation, in order to improve the innovation profit, the patent system should conduct the most rigorous review of the novelty of the secondary innovation[6].

(2) Life cycle of technology. Enterprises need pay attention not only to the application cycle, market and legal life cycle of patents, but also to the life cycle of imported technologies. If enterprises blindly introduce technologies in the declining period, even if they optimize and upgrade them, they will not be able to reverse the leap-forward development of technology path and face the elimination of innovative achievements.

4.2. Core Market Issues

(1) Treatment of patent relations. When introducing technologies, enterprises may be constrained by restrictive clauses from transferors, thus affecting their subsequent re-innovation. At the same time, the secondary innovation is the improvement of introducing technologies, which may cause substitution risk. So, it may bring competitive threat to introducing technologies in the same market. Hence, transferors may be unwilling to license their patents, or deliberately increase license fee for protecting their market, creating moral hazard and hindering the achievements' patentization. In addition, when selecting technology, enterprises might be at risk of adverse selection and cannot acquire core technologies.

(2) selection of the regional market. When applying for regional protection for secondary innovations, enterprises should balance the market benefits and costs of patents and choose the appropriate regional market. If the achievements are complementary to the imported technologies, enterprises could choose to apply for patents in the same market with imported technologies to obtain existing users. If the achievements will replace the imported technologies, enterprises may encounter patent barriers when they decide to apply for patents in the same market. In order to reduce intellectual property disputes, enterprises should avoid competing in the same market at the start.

4.3. Core Management Issues

(1) Information management. In order to avoid adverse selection risk and moral hazard, enterprises should do a good job of comprehensive information management about introducing technology. For example, they can use the patent map to know whether the introducing technology is a patent, what the protection area is, and how duration of the patent is, whether the patent is bundled with other technologies, whether it has been included in technical standards, so as to identify necessary patents, eliminate garbage and invalid patent.

(2) Cost management. 2th innovation may be locked by 1th innovation patents, thus bringing high patent licensing fee to those who carry out secondary innovation. If the profit of secondary innovation is lower than the licensing fee after applying for patents, considering the R&D cost and the application cost, there is no need for secondary innovation and applying for patents.

(3) Management institution settings. When setting up management institutions, enterprises should: 1) clarify the way of intellectual property management, 2) clearly divide rights, responsibilities and interests, 3) establish intellectual property management system, and 4) formulate reasonable patent strategy, in order to scientifically manage and operate the introducing technology and subsequent re-innovation achievements.

4.4. Core Policy Issues

(1) Domestic patent policy. In order to avoid enterprises falling into the vicious circle of "introduction - backwardness - reintroduction - backwardness", government should strengthen policy guidance and introduce basic and common technologies from abroad. As with original innovation, the government should make full use of the assistance of trade associations, encouraging the third party to formulate public policies to solve patent problems, and it also can take measures to optimize the functions of intermediaries in technology evaluation, patent agency, legal consultation and value accounting[7].

(2) International patent policy. Firstly, when introducing foreign advanced technologies, enterprises need to fully understand the patent policy of the country where the technologies are imported. Secondly, enterprises should clearly know the patent review mechanism, patent value evaluation mechanism, patent compulsory search policy, and patent mediation policy of the applicant country, so as to prevent the failure caused by unfamiliarity with foreign policies.

4.5. Core Legal Issues

(1) The degree of protection of patent law. The law is a "double-edged sword" for the secondary innovative achievements' patentization. On the one hand, strict laws are conducive to protecting innovative achievements and encouraging enterprises to apply for patents. On the other hand, too strict laws may cause enterprises to encounter patent barriers frequently, which is not conducive to follow-up innovation. At present, the breadth of patent protection in backward countries is generally lower than that in developed countries. Therefore, advanced countries have been asking backward countries to improve their patent protection standards[8].

(2) Attribution of patent right. Not only does secondary innovation encourage internal R&D personals and stipulate the ownership of achievements and patents through contracts, but also it requires transferors to elucidate the intellectual property rights and disposition rights of importers in the transfer period. These measures can avoid the risk of subsequent rip-offs such as higher licensing fee or stricter restrictions to reduce later infringement disputes.

5. Core Issues of Integrated Innovation Achievements' Patentization

5.1. Core Technical Issues

(1) Technical elements. Integrated innovation is the selection, reorganization and optimization of existing technologies to achieve better functions, so it has better practicability and creativity, and should strengthen novelty. Integrated innovation also needs to screen various technologies, so it is necessary to pay attention to the adverse selection risk caused by information asymmetry. In

addition, integrated innovation is built on existing technologies. Although innovation "standing on the shoulders of giants" is easier to succeed, the failure of predecessors may also leave a "shadow of giants" [9], which is not conducive to follow-up innovation.

(2) Life cycle of technology. Integrative innovation is the integration of innovation processes related to the product life cycle and enterprise life cycle, which achieved by concurrent engineering. In the process of patentization, the market and statutory life cycle of sub-technologies should be considered comprehensively. Especially in the turbulent period when technology is about to achieve leapfrog development, the market life cycle of some sub-technologies may be shortened rapidly. In this case, integrated innovation may be trapped in these technologies, resulting in ineffective innovation and patent uselessness.

5.2. Core Market Issues

(1) Treatment of patent relations. The real value of patents does not lie in individual, but in individual combination, and the individual patent competition is evolving into the combinative patent competition[10]. Integrated innovation is a kind of combinative innovation which are oriented to the needs of industrialization and involve many factors. In order to realize integrated innovation and patentization smoothly and avoid excessive competition, enterprises must deal with the relationship among public technologies, patents, proprietary technologies and copyright protection, etc.

(2) selection of the regional market. Integrated innovation should also consider the relationship between revenue and cost when choosing regional market to apply for patents. As sub-technologies already have a certain user base in the market, integrated achievements are more likely to succeed in these markets because of better function. Therefore, enterprises can decide to apply for patents in the same region to seize the market, but like secondary innovation, the technology content of integrated achievements must be distinct from the original sub-patents.

5.3. Core Management Issues

(1) Information management. Integrated innovation faces higher adverse selection and moral risks because it involves many sub-technologies. It is necessary to find out the characteristics and processes of these sub-technologies through information management, to know whether they involve patents or proprietary technologies, whether these technologies exist in the patent pool and whether they are included in the technical standards. Enterprises should bypass these technologies and find alternative technologies. If not, they need obtain licensing agreements to reduce subsequent infringement.

(2) Cost management. Integrated achievements' patentization should also notice the costs of patent R&D, application, maintenance and litigation. Integrated achievements are the combination and optimization of existing technologies. If multiple patents and proprietary technologies are involved, more licensing fee may be required.

(3) Management institution settings. Integrative innovation involves not only the integration of multiple technologies and knowledge, but also the integration of multiple agents. Enterprises also need to clarify the establishment of management institutions and the division of powers and responsibilities, establish a flexible and efficient coordination mechanism, and plan a reasonable patent strategy. If enterprises and sub-technology owners reach alliance cooperation, how to build alliance management agencies to operate all technologies in a unified manner is extremely crucial.

5.4. Core Policy Issues

(1) Domestic patent policy. Priority development areas of technology, the channels of government-industry-university-research cooperation, and the construction of technology integration platform involved in government policies will have different effects on the technology selection and resource access of enterprise integrated innovation. And integrated achievements' patentization cannot be separated from the assistance of industry associations and the promotion of intermediary agencies.

(2) International Patent Policy. If an enterprise integrates technology globally, it may involve many foreign patents, which make patentization more complicated. Therefore, it is necessary for an enterprise to know foreign patent policies, carefully select the application country and master the country's patent policies and regulations in the process of international patentization.

5.5. Core Legal Issues

(1) The degree of protection of patent law. Patent system involves three aspects: duration (length), scope (width) and novelty (height), which identify the intensity of patent protection. Therefore, integrated innovation should take these aspects of the sub-patents into account comprehensively, and design the optimal patent protection mode according to its own technological conditions, such as choosing combination of appropriate width, long-term and high novelty or choosing combination of short-term and low novelty[11].

(2) Attribution of patent right. Integrative innovation may be accomplished in one enterprise or through cooperation among multiple enterprises. Cooperative innovation can achieve technological synergy in different fields and reduce R&D costs, but it also faces the problem about the ownership of achievements and patents. Therefore, when signing cooperative R&D or technology transfer agreements, enterprises should make prior agreements on sharing technology risks, conserving technological secrets and handling disputes to reduce property disputes. In addition, integrated innovation may also face the problem of patent jungle during patentization.

6. Summary

In terms of technology, original innovation should strengthen creativity and practicability; secondary innovation should increase novelty and pay attention to technology selection; and integrated innovation should strengthen novelty and notice technology restructuring. In terms of market, original innovation need deal with the relationship with peripheral technologies; secondary innovation need deal with the relationship with imported technologies; and integrated innovation need deal with the relationship with single sub-technologies. All of them need balance the relationship between patent revenue and cost to determine the appropriate market. In terms of management, original innovation must actively seek the technology blank area; secondary innovation must comprehensively grasp the imported technologies; and integrated innovation must effectively integrate the existing technologies. All of them must notice cost management and formulate scientific patent strategy. In terms of policy, original innovation needs further strengthen policy support; secondary innovation needs policies to help enterprises avoid falling into the vicious circle of "introduction-backwardness-reintroduction-backwardness"; and integrated innovation needs policies about establishing integration platform. All of them need to be familiar with international patent policy when implementing international patentization. In terms of laws and regulations, primitive innovation emphasizes high intensity of patent protection to avoid being violated; secondary innovation and integrated innovation emphasizes handling infringement disputes. All of them have to agree in advance with internal R&D personnel and external partners on the ownership of achievements and patents.

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