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Effective Patent Strategies for the Protection of Research Results

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Objective: This study provides strategies of how to effectively convert an invention, created at universities or government-funded research institutes, into a strong patent with the clear understanding of its unique technological characteristics.

Background: Regardless of the amount of research funds available in our country and the decent number of intellectual property rights created using the funds, there was a deficit of more than KRW 6 trillion in the technology trade balance related with intellectual property rights in the year of 2014. One of the reasons was that the vast number of patents that were being produced by universities or by government-funded research institutes were merely performance-based patents, namely, so called "patents for patents". Another reason is that developed technology from research and development could not be transformed into a strong patent right properly due to the lack of related knowledge.

Method: After reviewing various references mentioned on the patent strategies, the definition of a strong patent and the strategies of producing a strong patent for an invention drawn out from research performance will be supplied.

Results: To produce a strong patent right at universities or government funded research institutes, one should use strategies for strong specifications, strategies of product patents and method patents, strategies of patent portfolios, strategies of know-how, strategies of inventions defined by numerical limitation and strategies of parameter inventions for a more strategic approach.

Conclusion: Strong patent rights will be produced with the use of effective patent strategies provided in this study.

Application: It is estimated that the results of this study will aid the establishment of strong patents for inventions developed by research performance at universities or government-funded research institutions.

Keywords: Strong patent, Gold plated patent, Know-how, Invention defined by numerical limitation, Parameter invention

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1. Introduction

Many patents are created by universities or government-funded research institutions each year. The intellectual property rights owned by universities through research activities were some 50,000 from 227 universities in 2012 (Ministry of Education, Science and Technology (MEST) & National Research Foundation of Korea (NRF), 2014). Meanwhile, Korea's R&D ratio vs. GDP in 2012 was 4.03%, not lower than major

countries including the U.S., Japan, China and Germany (MK Business News, 2013). The size of research fund for technology development or the number of intellectual property rights created on the basis of the technology development is not small. Nonetheless, concerning technology trade status, the deficit of intellectual property right-related technology trade balance was over KRW 6 trillion in 2014, and chronic deficit was revealed (KPAA, 2015). Such a phenomenon can be partially attributed to the fact that the technologies developed at universities or government-funded research institutions cannot be created as a strong patent.

The first stage for the research results created by universities or government-funded research institutions to be connected to technology commercialization is converting the developed technologies into property rights. Because universities or government-funded research institutions do not implement their own patent rights in general, they commercialize the technologies indirectly by transferring them to individuals or companies hoping to implement those patents. To enhance technology transfer possibility and the value of transferred technology, stronger original attributes of the obtained patent rights are better. For this reason, a strategic judgment to set patents the most effective is necessary in consideration of the technology characteristics developed by universities or government-funded research institutions.

This study aims to present strategies to obtain strong patents, after studying the patent strategies known in a variety of references, and explaining strong patents. The following specific strategies to obtain strong patents are examined in this study: (1) strategies of strong specifications (2) strategies of product patents and method patents (3) strategies of patent claim portfolios (4) strategies of know-how (5) strategies of inventions defined by numerical limitation and (6) strategies of parameter inventions.

2. What is a Strong Patent?

All inventions cannot always obtain patents. The inventions that can receive patents among inventions need to meet novelty and non-obviousness, which are the legal requirements in the Patent Law (Patent Law Article 29(1) & (2)). In order to satisfy novelty, an invention should be a new thing in which the invention details were not disclosed to the general public. As for non-obviousness, technology level needs to be very high to the extent that a person skilled in the art in the technology field, to which the invention belongs, cannot easily invent from the prior technology. When an invention is acknowledged as a patent by meeting novelty and non-obviousness, an exclusive strong patent right is formed. However, all patents do not always become strong patents. Because the scope of claim rights are interpreted on the basis of registered patent claims, the strength and weakness of a patent right should be judged by examining the patent claims. The patent claim is a major part composing written specifications of claims for an applicant to be protected in line with a certain form.

A strong patent has wide patent claims. When patent claim scope is narrow, evasive design for detour implementation of the patent is easy. A principle that the more limitations a claim contains, the narrower scope the claim has applies to the degree of patent claims' being wide and narrow (Park, 2003). The principle that the more limitations a claim contains, the narrower scope the claim has means the right scope becomes narrower, as more elements are written in the patent claims (See Table 1). For example, the patent claim becomes narrower, when designing patent claim as "Men living in Seoul among the Korean men", compared to "the Korean men", in other words, when elements are designed to be limited more. Therefore, independent claims need to be composed with the most essential elements in the implementation of an invention, and detailed technical details should use the elements in the dependent claims in writing patent claims. The method to write desirable patent claims should start with understanding the principle that the more limitations a claim contains, the narrower scope the claim has, and writing minimum elements through which an invention can be implemented (Korean Intellectual Property Office (KIPO) & Korea Invention Promotion Association (KIPA), 2011).

The extent of a patent's strength affects the commercial viability of a patent right. A patent-granted invention can be a useless

Table 1. Explanation of the principle that 'the more limitations a claim contains, the narrower scope the claim has'

Element of patent	Example of patent claim	Scope of patent right
a1	Pencil (a1)	Relatively wide
a1 + a2	Pencil (a1) with Eraser (a2)	Relatively medium
a1 + a2 + a3	Pencil (a1) with Eraser (a2), covered with Pencil Protector (a3)	Relatively narrow

patent commercially, or a commercially valuable invention. Here, a commercially valuable invention is the right widely acknowledged of exclusive rights guaranteed by the patent right, and indicates an invention that a competitor has difficulties to achieve the same or the similar purpose or effect without patent infringement. In this regard, a strong patent refers to a patent that a competitor must gain permission from a patent right holder in order to achieve the same or the similar purpose or effect. If detour implementation can be conducted for a patent by evasive design not infringing a patent, the patent cannot be described as a strong patent (Park, 2003). Although, a detour implementation of a patent is possible, the original patent right is viewed as acquiring an effective exclusive right, despite possible detour implementation, when more expenses of detour implementation are required, compared to the implementation expenses of the patent right. The reason is that a detour implementation of a patent right by inputting more money is meaningless. All technology-centered companies hope to have strong patents. When a company is harnessed with a strong patent, competitors will negotiate with the company to obtain the patent's implementation right, giving up detour invention for evasion.

Even though, Korea entered into the top five patent countries' rank from the quantitative aspect of patent application, Korea does not create patents having a high earnings creation possibility. Companies need to obtain many high quality patents becoming creative products fascinating markets. However, Korea lacks strong patents which bringing money (U.S President Obama expressed a strong patent as a gold plated patent) (Hankooki.com, 2012). Such a situation can be confirmed through the size of Korea's technology trade balance deficit. Technology-oriented creative companies try to develop highly valuable inventions, enhance company's competitiveness, and improve corporate value ultimately. However, the patents created by universities or government-funded research institutions do not focus on commercial values in many cases. The researchers at universities or government-funded research institutions proceed with patent application to achieve research performance, despite an invention lacking competitiveness in the commercial aspect. The reason is that the completion of performance is evaluated on the basis of patent application mostly, when research is conducted with government research fund. A professor tends to apply for a patent for a technology developed in a lab to enhance professor's performance, despite no using government research fund. To a company that received technology transfer from universities or government-funded research institutions, the technology needs to meet its own purpose. Also, it is taken for granted that a strong patent acknowledged of exclusive right is hoped for by such a company. On the contrary, if detour implementation for the technology to be transferred to a company is possible, there is no need to receive technology transfer by paying money. Universities or government-funded research institutions are not the institutions that implement developed technologies, but achieve technology commercialization by transferring them to a company. Therefore, there is a need to recognize the technology they hope to be transferred to well in the R&D process. For this reason, universities should be more interested in the creation of strong patents and those having commercial market dissemination power.

3. Original Inventions (Patents) and Subservient Inventions (Patents)

A patent does not create something from nothing that does not exist in the world, but it is mostly created through the process of improving existing technologies existing within the natural law scope. Although, it is not clear what original inventions precisely indicate which patents, they can create many derived technologies with huge dissemination power in general. An original invention

is an essential technology in the technology field, and the implementation of the patent is always necessary to achieve technological purpose. However, despite an original technology, if a weak patent right is set up, where competitors can conduct a detour implementation, it cannot be said as the original invention any more. Although the category of an original technology can change, according to the subjective perspective, original invention can be said to be included in the concept of a strong patent.

A subservient invention means the invention completing the composition of the basic invention (original invention) by adding other elements, while using the entire composition of the basic invention (original invention) without changing such composition. Namely, a subservient intervention has added patentability by adding new technical elements to basic invention's elements, and its implementation is always accompanied by the implementation of basic invention. Here, a subservient invention needs to contain all elements of basic invention, and therefore, whether it can become a subservient invention depends on the writing of patent claims. For instance, when patent A consists of a1, a2 and a3 as basic elements, and makes a1 + a2 + a3 + b by introducing a new element, b, and improved effect is generated, this invention becomes a subservient invention. For another instance (Table 2), when existing patent invention A consists of a1 and a2 elements, patent B consists of b1 and b2 elements, and patent C consists of c1 and c2 elements, the invention of which elements are a1 + a2 + b1 becomes a subservient invention of patent A. The reason is that it contains a1 and a2, which are patent A's elements. The invention of a1 + b1 + c1 that has combined by selecting some of the elements of patents A, B and C is not the subservient invention of existing patent inventions A, B or C, respectively.

Table 2. Examples of subservient inventions

Patent (A, B, C)	Implemented invention	Whether it is subservient invention or not
A (= a1 + a2) B (= b1 + b2) C (= c1 + c2)	a1 + a2 + b1	Subservient invention of patent A
	a1 + b1 + c1	No subservient Inventions of patents A, B or C

An original patent and a subservient patent, which are the prior patents, have subservient relationship, and the subservient patent right holder can implement the subservient patent through receiving the permission of the original patent right holder. The subservient invention patent right holder cannot implement his/her patent invention without the original patent right holder's consent (Patent Law Article 98). Of course, an original patent right holder cannot implement the subservient patent without the permission of a subservient patent right holder, either. In this case, the original patent and subservient patent rights holders can mutually allow the implementation of the patents through cross license in general. Therefore, it is desirable for a patent right holder to obtain an original patent, and if possible, to convert the subservient patent into a right from the portfolio perspective, and to block competitor's obtainment of the subservient patent. Reversely, if a competitor is an original patent right holder, a strategy to develop subservient patent-targeted technology and to convert it into a right, and enhance negotiation power with the original patent right holder is necessary. However, when an invention is made by synthesizing previous technologies, of which patent rights were expired, or the registration of the rights was not carried out, there is no need to obtain the prior patent right holder's consent, even though the patent corresponds to a subservient invention.

4. Strategies for Strong Patents

4.1 Strategies for a strong specification

A strong patent is based on well-written patent claims. Looking at how to write desirable patent claims, the method is as follows:

first, it is desirable to widely write claims for wide scope of right to be set up. When the patent claim is designed to be too narrow, it cannot become a strong patent, although the registration of patent becomes easy, due to no existence of the prior references. When setting up patent claims, it is important not to make scope of patent claims narrow by writing the elements, which are not core elements in the dependent claims, without correlation with the invention. When the elements that are not core essential elements in setting up patent claims are designed as the elements in the independent claims, a competitor can easily conduct detour implementation. For example, when patent A consists of a1, a2 and a3 elements, and these elements are assumed to be essential elements required for invention implementation, the purpose of patent A cannot be achieved with the composition of a1 + a2, a1 + a3, or a2 + a3. It is the case that patent A's patent claims are designed well. However, when the purpose of patent A can be achieved with a1 + a, a1 + a3 or a2 + a3, patent implementation is possible by easily evading invention A's patent right without patent infringement, since the invention A composed of a1 + a2 + a3 omits one of the elements (Lim, 2014). The explanation is revealed in Table 3. In this regard, when patent claims are designed with a1 + a2 + a3 elements, even though patent A's implementation is possible with a1 + a, a1 + a3 or a2 + a3 elements, an error that one's own technology is disclosed to a competitor through patent application may occur.

Table 3. Types of patent infringement (Korean Intellectual Property Office (KIPO) & Korea Invention Promotion Association (KIPA), 2013)

Patent (A)	Implemented invention	Whether infringed or not
a1 + a2 + a3	a1 + a2 + a3	Infringed (All elements are Identical.)
	a1 + a2 + a3 + a4	Infringed (Element a4 is added.)
	a1 + a2	Non-infringed (Element a3 is deleted.)

Second, solid scope of right should be written. If the scope of right is designed too widely, the possibility of lacking novelty or non-obviousness is high, and difficulties are forecast in the patent registration process. When the patent claims, composed of the only prior art (technology), are written by designing through too much expansion of the scope of right, the reasons of invalidation exist, irrelevant of the decision of refusal or registration in the future patent review process, due to the existence of the prior technology references. Therefore, adequately wide writing is needed in consideration of the prior technology, rather than applying by setting up the wide scope of right. As illustrated in Figure 1, when a1 and a2, which are the prior patent A's elements, are contained in the prior art (technology), and the additional prior elements of a3, a4 and a5 exist as the prior art, it is desirable to design the patent claims of applied invention's independent claims as similar to invention A's composition. When it is designed with narrower scope, a result that sets the scope of right, which can be obtained wider in the patent review stage narrow from

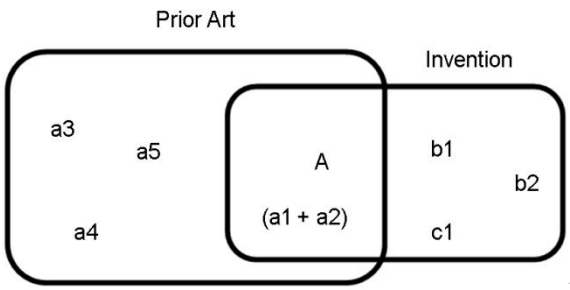

Figure 1. Desirable design for initial claim of independent claim

the start, is caused. Meanwhile, too widely designing tends to become the subject of the decision of refusal, owing to the lack of novelty or non-obviousness. Therefore, a strategy to obtain a registered patent is desirable by combining b1, b2 or c1 elements into dependent claims, when the patent claims are initially designed with a1 + a2, and a reasonable pointing out is received in the patent review stage. To this end, the patent claims need to be designed by describing mutual relationship for connection between elements well with only essential elements through the most desirable literal expressions via good understanding of technology idea of patent invention.

Third, the scope of the right needs to be written stably. To do so, comprehensive terms should be selected in selecting the terms of elements composing patent claims. The terms in a broad sense need to be selected so that competitors cannot select evadable alternative terms, after they identify the patent details. For example, the selection of more comprehensive terms like the absence of elasticity, the absence of energy storage, or transistor, rather than the use of springs, or semiconductor switching device equipped with control electrodes should be considered (KIPO & KIPA, 2011). In this case, the comprehensive terms of patent claims should be backed up diversely through embodiment in the description. Because embodiment plays an important role in the interpretation of patent claims, it is desirable to write the embodiment diversely so that the claimed patent claims can be faithfully backed up (KIPO & KIPA, 2013).

To obtain a strong patent, not only patent claims, but the entire patent specifications containing the patent claims should be written well. Patent specifications can be divided into the description of invention and patent claims. Poor specifications can be the basis of invalidation, even after the establishment of a patent right. Patent claims play a role of the letter of requirements for the right before patent registration, and play a role of the title of the right after patent registration. Meanwhile, the description of invention plays a role of the letter of explanation of the right to an applicant, and plays a role of technological document providing the description of invention to a third party (KIPO & KIPA, 2011). The description of invention needs to be written for a person skilled in the art to easily implement the invention in the technological field to which the invention belongs. This is set forth in the Patent Law, and awards an exclusive right to the person disclosing his/her own technology, and therefore, it is to maximize technological document effect by setting up certain requirements in technology disclosure (KIPO & KIPA, 2011). Because, the description functions as an important basis to change patent claims in the patent review process, it needs to be written clearly and in detail to back up the patent claims (Patent Law Article 42(3)1). In the patent review stage, the amendment of the description or patent claims is not acknowledged, when it deviates from the category of identity in the technological details of the specifications attached to the first application document. It is desirable to write various embodiments to implement technological ideas in terms of the description, and the reason is that patent claims are more clearly backed up through various embodiments. The claims backed up through various embodiments reduce the possibilities of competitor's improved invention, subservient invention, and also evasive design.

4.2 Strategies of product patents and method patents

Invention types can be divided into product inventions and method inventions. A product invention refers to the invention, of which subject is a product, or the invention, where materials become materialized. A method invention refers to the invention that plural activities or phenomena have become materialized time sequentially. The types of product inventions include product invention in a narrow sense that mutually combined elements having the shapes like machines, equipment and devices with article property, and material inventions without article property like compositions, chemicals and medical supplies. Product inventions in a narrow sense also become the protection subject of utility models. Method inventions are divided into manufacturing method inventions producing products, and general method inventions not accompanied by the production of products (Lim, 2014).

Product inventions and method inventions can be classified into invention name and patent claim. Concerning method inventions,

the time element becomes an essential element unlike product inventions. Namely, method inventions are the inventions of which elements are enumerated and combined time sequentially. In comparison with the availability of infringement judgment between product inventions and method inventions, the product inventions can more easily judge the infringement of an infringing person in general. Method inventions are difficult to say that their right protection is clear, although it has been converted into a right. Because, a patent article, an outcome of invention, is mostly sold targeting many and unspecified people in the market in terms of product inventions, a right holder can easily compare the elements of the product suspicious of infringement by buying it with the elements of his/her own patent article. Meanwhile, regarding method inventions, it is not easy to check whether infringement-suspicious article is an infringed article manufactured by infringing the patent right of method inventions. As explained in Figure 2, a variety of methods exist to manufacture the same article. It is difficult to check whether infringement-suspicious product is manufactured by infringing a manufacturing method patent, due to the diversity of manufacturing methods. For this reason, a possibility of whether claims can be designed with a product invention needs to be reviewed, although a method invention was developed in the R&D stage.

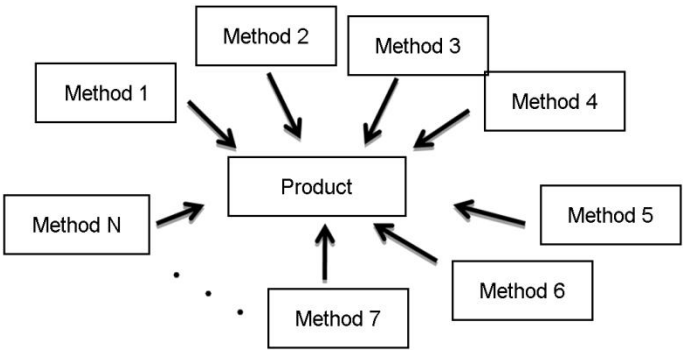

Figure 2. Illustration showing various methods to manufacture the same product

Evasive implementation is relatively easier in terms of method inventions. The reason is that detour implementation is possible, if the sequence of elements enumerated time sequentially changes, when it comes to a method invention. For example, when a patent right is set up with a product composed of 11, a2 and a3 elements in terms of a product invention, the substance of the product does not change, and patent claims are the same, even though the sequence of elements changes with a product composed of a2, a1 and a3. However, when it comes to a method invention, the infringement of the method invention does not occur, when the manufacturing method's claims of a compound containing a3 stage, after the a1 and a2 stages, are implemented in an evasive method of the compound manufacturing method containing a3 stage, after a2 and a1 stages. When implementation is conducted by changing the work stage sequence of the elements enumerated in terms of time sequence, the elements, the substance of invention, are judged to change. Therefore, when implementation is conducted through change of work stage sequence, in the event of writing the claims of a method invention, the patent claims need to be written so that detour implementation cannot be carried out by arranging the sequence of claims' elements differently, after reviewing an evasion possibility.

4.3 Strategies of patent portfolios

Patent portfolio is a concept protecting rights with a group of several patents, instead of protecting the invented technological idea with one patent. Patent portfolio strategy is more important as technological importance is higher, and converting invention into a right should be propelled through several cases of patent application. It is not easy to protect a patent right of developed

technology with one patent application. One patent application can be rejected with procedural defect or the emergence of the unexpected prior technology. By setting up developed technology as various types of patent rights through patent portfolio, a defense wall against infringement can be efficiently set up, and competitor's evasive strategy can be prevented more strongly. From this perspective, when only one type is applied for patent from a product invention or a method invention, it is desirable to additionally apply for patent in terms of a method invention or a product invention, respectively. If detour implementation is possible through product transformation or method change, competitor's evasive design should be prevented, and the key technology needs to be protected through applying for a derived patent.

The principle of patent portfolio also applies to one patent specification. By designing various patent claims of various categories within one patent specification, an effect of applying for several cases of patents can be gained. In terms of product inventions, patent claim portfolio can be set up in various types including product manufacturing method, product using method or another product manufactured using the product. In terms of method inventions, a product manufactured using the method can be set up as the portfolio of patent claims. Using such a patent portfolio strategy, more efficient response can be carried out against competitors' evasive strategies in order to obtain patent rights on various derived patents.

4.4 Strategies of know-how

Business secret (know-how) refers to a production method, selling method, or technological or managerial information, not publicly known, and useful for business activities retained as a secret with independent economic value by quite an effort (Naver Encyclopedia, 2015). Business secret is called know-how or trade secret as well. When imitating others' technology developed by inputting time, human resources and capital, an imitator can reduce various expenses required to develop the same technology for him/herself. For this reason, competitors try to imitate or refer to the technologies developed by others. An imitator uses a reverse engineering technique as a method of imitating others' technologies. Reverse engineering is a process analyzing the structure or composition of a product, when no design documents exist, namely, it refers to making designs drawings and documentation. It is taken for granted for a technology developer to gain a patent right, which is an exclusive right on the developed technology, in order to prevent from reverse engineering.

Among inventions, however, there are some patented inventions difficult to judge the infringement of a competitor. A patent is to disclose technological details in the patent specifications as the reward of exclusive right in the process of converting an invention into a patent. In this regard, the core know-how of technology is exposed. If a patent right holder cannot confirm his/her patent right infringement, or has a difficulty in proving infringement, although a competitor infringes the patent right through disclosed technological details, it is not always desirable to convert created invention into a patent. Rather than an exclusive patent right, of which infringement cannot be confirmed, know-how that can actually protect developed technology may be desirable (Son, 2002). For example, in the event of a method invention manufacturing steel with quite excellent attributes through heat processing at a certain high temperature, it cannot be easily identified whether competitor's implemented technology in industrial site infringed the implementation contained in the patent claims. Therefore, it may be more effective to protect developed technology with know-how, rather than applying for a patent, when competitor's patent infringement cannot be identified. Therefore, judgment on whether to protect a created invention as know-how is good before applying for a patent should be made.

When it comes to a technology for which reverse engineering is easy, a strategy to convert the developed technology into a patent is always required. If a product is released without obtaining a patent, there is no legal restriction to prevent competitors from copying the product, although they produce a replica through reverse engineering. When reverse engineering is easy, most patented products produced through product invention belong to this category. Even though a patented technology is easy to be utilized in other fields, converting the technology into a patent can prevent a possibility to apply the technology to other fields.

Meanwhile, when an approach, based on the know-how strategy, is necessary, a technology holder of a technology on chemical composition wishes to protect it as know-how. When a chemical composition invention is not analyzed through reverse engineering, protection the invention as know-how needs to be considered. In the event that a developed technology is not converted into a patent, when an analysis is possible through reverse engineering, the right may be stolen by competitors, because the technology can be disclosed, or an opportunity of the prior application can be missed. When an approach, based on the know-how strategy, is necessary, a case that reverse engineering on how a product is produced through the manufacturing method cannot be conducted also applies in relation with the manufacturing method. Concerning such a technology, it may be desirable to protect the technology with know-how, rather than a patent right. The fact that Coca Cola's manufacturing method is still protected by know-how, instead of a patent, is a good example. Table 4 explains the differences between patent and know-how.

Table 4. Differences between patent and know-how (Lim, 2014)

	Patent	Know-How
Disclosure	Yes	No
Requirement	Patent law article 2(1)	No particular requirement based on law
Patent requirement	Necessary	Non-necessary
Term of protection	Certain term	As long as it is protected as know-how
Range of protection	Written in the claims	Uncertain
Exclusive right	Yes	No

Depending on situation, patent and know-how can be pursued simultaneously. If converting a technology into a patent is possible without disclosing invention's core technology to obtain a patent, it is desirable for patent and know-how to be protected together and used. Especially, in the case of a manufacturing method invention, if converting a meaningful technology into a patent is possible without work conditions for manufacturing method being introduced to patent claims, it is desirable not to disclose work conditions in the patent specifications. As for work conditions, invention's core technology takes up mostly in the manufacturing method patent. Especially, when it comes to a manufacturing patent impossible to check patent infringement, the disclosure of core technology rather causes a result of disclosing know-how. To protect a developed technology in the know-how type of core technology, the following three requirements are needed: First, a non-publicity condition that the technology should not be publicly disclosed is necessary (The Supreme Court of Korea, 2005a). Second, an economic usefulness requirement that know-how needs independent economic value is necessary (The Supreme Court of Korea, 2005b). Third, a secret management requirement that know-how needs to be maintained as trade secret should be met by making a huge effort should be met (The Supreme Court of Korea, 2008). The demerit of know-how is that the protection of know-how becomes difficult, when the secret is lost, and that confidentiality is relatively difficult. However, the merit of know-how is that it can be protected for a long time with low cost without time restriction.

4.5 Strategies of inventions defined by numerical limitation

Inventions defined by numerical limitation refers to inventions making quantitative limitation (numerical value), such as temperature, pressure, composition, velocity and shape size, as the part of elements within the patent claims (Industrial Property Workshop in Toyota Group, 1986). Inventions defined by numerical limitation are created in various technological fields, and mostly they are generated with more improved research results than existing technologies in general. When work variables or process variables in the research process show relatively more excellent results than existing technology in specific numerical values, a patent can

be applied in the improved invention type using the work variables or process variables. The numerical values introduced from inventions defined by numerical limitation show the most remarkable effects in technological effect, compared to existing technologies.

As for inventions defined by numerical limitation, Inventions limiting product's elements numerically can be created in product inventions, and inventions numerically limiting work conditions of elements in method inventions can be created. Concerning product inventions defined by numerical limitation, limitation on the size, shape or structure of elements composing a product is introduced. Regarding method inventions defined by numerical limitation, numerical limitation on the temperature, pressure, velocity and shape size, which are work conditions, is introduced. If the patentability of a developed technology is weak, compared to existing technology, converting a technology into a patent right can be tried by introducing numerical values that can introduced with elements to patent claims. Limiting quantitative limitation that cannot be found in existing inventions with product's elements or obtaining a patent right by limiting with work conditions' variable values can be considered. In such a case, that remarkable effect is shown before and after the boundary value of the numerical limitation should be written in the description for patent registration. When setting up the scope of numerical values for inventions defined by numerical limitation, it is good to set up widely within the effective scope of patent. The reason is that competitors can easily evade the patent, in the case of one numerical value, or the numerical values with narrow scope. Centered on specific variable values introduced to improve existing technology, the values need to be set up within the proper patent claims.

The lack of novelty and non-obviousness can be a problem in the Inventions defined by numerical limitation, compared to existing technologies. When patent claims are the same as existing numerical value scope, or are overlapped, duplicate, or encountered with previous numerical scope, the lack of non-obviousness can be pointed out in the patent review process. Therefore, patent claims should be set up in comparison with the prior technology (art). If numerical value scope is unclear, or a numerical value is clear, when it comes to inventions defined by numerical limitation, it cannot be acknowledged as such an invention. When the lack of novelty or non-obviousness is pointed out in the invention applied for a patent, compared to the prior art, amendment is needed to overcome it. When patent claims are amended for novelty or non-obviousness, the amendment of claims can be acknowledged in the case of reducing numerical value scope. However, the amendment cannot be acknowledged in the event of changing or expanding the numerical value scope to a new scope. The reason is that a new matter is judged to be added through the introduction of a new matter, when amendment is made through an addition of new matters under the Patent Law (Patent Law Article 51(1)).

4.6 Strategies of parameter inventions

A parameter invention is a type of an invention defined by numerical limitation (Nakamodo, 2002). Generally, it indicates an invention specified by chemical or physical characteristics (Jun, 1998). Parameter inventions are to obtain inventions defined by numerical limitation by adopting variable values specifying chemical or physical characteristics not used in the technology field concerned as the elements of patent claims. Here, parameter as an expression type of patent claims can be used for product inventions or manufacturing method inventions. Because, the elements composing the patent claims of parameter inventions were not presented as the elements in the existing prior references, they can meet the requirements of novelty or non-obviousness, although they were existing technologies (art). For example, the patent claims were designed with the degree of flexibility and air permeability as elements previously in relation with functional weaving materials technology. However, a patent is applied for, after setting up patent claims with the mean value of the cross sectional area composing fabric under a certain stress, instead of flexibility or air permeability (for instance) in parameter inventions. In such a case, technical description of flexibility or air permeability are presented in the prior references, that is, technological documents or patent documents; however, the description on the mean value of thread's cross sectional area cannot be found. Therefore, a possibility to be formed as a new patent right in the patent review process is high. The reason is that the judgment of patentability is to decide novelty and non-obviousness

through the comparison of elements in the patent-applied inventions and the prior references. If a parameter invention can obtain the patent right, it can be a strategy effective to a patent applicant, since patent claims can be obtained widely.

5. Conclusion

Patent rights created by research performance at universities or government-funded research institutions are transferred to mainly companies, and therefore, technology commercialization is performed. The companies trying to adopt technologies from universities or government-funded research institutions evaluate the commercial viability, as they receive technology transfer. In the evaluation of commercial viability, the exclusiveness of technology is an important determinant. Therefore, strong patents with high exclusiveness should be obtained for universities or government-funded research institutions to develop technologies that companies wish to receive their transfer. The following strategic approach is needed to obtain strong patents:

First, strong specifications need to be written. Strong specifications need to set up patent claims strongly on the developed technology, and the description of invention should back them up. The invention created through strong specifications can become a strong patent approaching the concept of the original patent.

Second, it is difficult to obtain an exclusive right through which entire developed technology can be protected with one patent application in the case of an original patent having the high importance of technology. Therefore, competitor's detour implementation possibility needs to be excluded by obtaining patent portfolio according to the importance of technology.

Third, the characteristics of a product patent and a method patent should be understood well upon writing patent claims. The infringement of a method patent is relatively more difficult to prove, compared to a product patent. From this standpoint, the obtainment of a product patent needs to be more focused on, rather than a method patent, if possible. If a product patent and a method patent can be simultaneously obtained, the rights in both categories should be obtained. In one patent application, various types of patent claims including a method to use a product diversely, another product manufactured using the product concerned, or a product manufactured using the method concerned need to be considered.

Fourth, it is not desirable to convert all developed technologies into patents. When proving competitor's infringement on the developed technology is difficult, whether to apply for a patent should be considered. When competitor's infringement is not confirmed, a recognition that competitor can implement the disclosed technology concerned through the publication of patent application or publication of patent registration in the patent application process should be made. And, it should be considered whether it is better to protect the developed technology as know-how, instead of patent, according to the developed technology's characteristics.

Fifth, if a technology needs right obtainment, there is a need to check the possibilities of inventions defined by numerical limitation and parameter inventions. When the non-obviousness of technology lacks, the patent right as inventions defined by numerical limitation and parameter inventions can be pursued, after securing technological significance or critical significance of the numerical values by extracting the work conditions or elements contained in the developed technology.

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