

Research Article

The Impact of the Evolution of Relationship between Technical Standards and Patents on Technical Innovation

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Abstract: Technical standard competition and patent right contests are two major strategies of enterprise competition; technical standards and patents are traditionally isolated and have conflicts. With the development of the knowledge economy and science and technology, technical standards and patents mutually infiltrate and gradually integrate. This study explores the relationship of evolution from separation to fusion between technical standards and patents, on the basis, first, analyzes the separate impacts on technical innovation of technical standards and patents and then discusses the impacts on technical innovation when technical standards and patents merge together.

Keywords: Conflicts, fusion, patents, technical standards, technical innovation

INTRODUCTION

With the development of science and technology, the speed of technical innovation is significantly faster and faster, knowledge and technology have increasingly become the basis of economic development. Technical standards, in accordance with the view of the European Commission, are one kind of technical norms which are related to some products or some services and are recognized by the majority of producers and users (Zhu and Zhu, 2003). In terms of their nature, as technical norms, technical standards are one kind of public products, they have the features of openness, universal applicability and public welfare. Patents are inventions and creations protected by laws and regulations, they are exclusive rights within limited time, which are authorized by the State Examination and Approval Organs after the inventions and creations passed the examination in accordance with laws. Patents are private rights with the nature of specificity, exclusivity and monopoly. In traditional economic, technical standards and patents almost have no correlation each other. There are contradictions and conflicts between de jure technical standards with public welfare and patents in pursuit of maximizing private interests. But with the depth of research activities in production processes, division of scientific research is getting more and more refined, production processes involve more and more patented technologies, the phenomenon of "patent thickets" has appeared and has become increasingly common. Whether de jure technical standards formulated by public institutions or de facto technical standards formed in market competitions, they are both difficult to steer clear of these increasingly intensive

"patent thickets". Technical standards and patents gradually move towards infiltration and integration from conflict and separation and there appear two trends of technical standard patentization and proprietary technology standardization. In the case of technical standards and patents are separate, technical standards and patents play impacts on technical innovation based on their own characteristics. In the case of technical standards and patents are integrated, technical standards and patents not only play independent impact on technical innovation, but also work together to influence technical innovation. Based on the analysis of the relation's evolution of technical standards and patents from separation to integration, this article analyzes the impacts on technical innovation when technical standards and patents merge together.

MATERIALS

- **The separation of technical standards and patents:** Judging from the traditional attribute of technical standards and patents, technical standards and patents are difficult to integrate. De jure technical standards in traditional economic are one kind of public products in pursuit of openness, universal applicability, which emphasize the interests of social collective and strive to minimize the cost of the social collectives using the standard techniques; patents are one kind of proprietary private products with exclusiveness, which don't allow others to use without being authorized. Patent rights are in pursuit of private interests and strive to maximize the interests of patent holders. Because of the contradictions and conflicts

between “technical standards pursuing public interests” and “patents pursuing private interests”, early standardization organizations do their best to avoid absorbing the patented technology when drafted technical standards. The insufficiency of R & D activities and the low level of R & D in traditional economic lower the coverage of patented technologies in the process of production, thus technical standards are easy to steer clear of patented technologies. Technical standards and patents are almost separate in traditional economic and even opposite and exclusive. The opposition and exclusion of technical standards and patents are mainly reflected in three aspects: the opposition between the public welfare of technical standards and the private interest of patented technologies; the conflict between the free supply of technical standards and the compensation for the use of patented technologies; the conflict between the openness of technical standards and the exclusion of patented technologies.

- The integration of technical standards and patents:** Global competitions of scientific knowledge and technology make the pace of technical innovation grow faster and faster. On the one hand, because patented technologies almost cover the whole process of production, technical achievements spring up and exist in the form of patents, as a result and it's more difficult for technical standards to steer clear of patented technologies, so technical standards have to passively absorb patented technologies in; on the other hand, standard competitions are increasingly becoming the commanding height of technical competitions and more and more patented technologies become de facto technical standards through market competitions, the mutual penetration and gradual integration of technical standards and patents have become the new trend of the development of technical standards and

technology. Patented technologies infiltrating into technical standards changed technical standards' attribute of public products and the private property of technical standards continuously enhance. As the product of the penetration and integration of technical standards and patented technologies, private technical standards not only have the public welfare of technical standards but also possess the private interest of patented technologies, the public welfare is achieved through the platform of technical standards and the free use of non-patent technologies in standards; the private interest is reflected by the compensation for the use of patented technologies and closed exclusion of the core technology in standards. Therefore, in modern economy, de facto technical standards with the attribute of private ownership balance between the public interest and the private interest, the unpaid and the paid, the openness and the exclusion, which ease conflicts and contradictions between technical standards and patented technologies.

METHODOLOGY

Technical standards separated from patents belong to public products, patents separated from technical standards have the attributes of private ownership. Technical standards and patents independently act on technical innovation based on the differences between the public ownership of technical standards and the private ownership of patents, they have different effects on technical innovation. The impacts of the separation of technical standards and patents on technical innovation are shown in Fig. 1:

- The Impacts of Public Standards on Technical Innovation:** The public properties of public welfare, free and openness make public technical standards can play the role of popularizing or

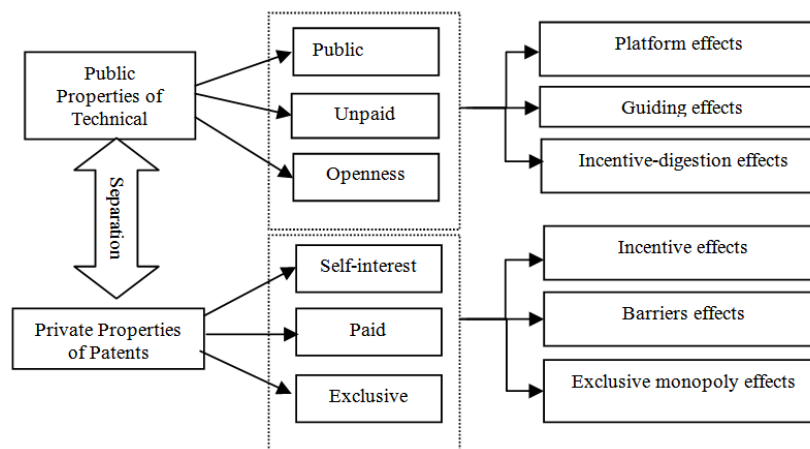


Fig. 1: The impacts of the separation of technical standards and patents on technical innovation

spreading technologies in a broad range and can even benefit the whole economic system. Public technical standards with universal applicability can provide innovation platforms for R&D subjects and can guide the direction of technical innovation. At the same time, too strong externalities of public technical standards will reduce the R&D subjects' of innovation motivation.

Platform effects of technical standards: As public, normative and available information sources, technical standards can provide the basic platform for technical innovation and can give the basic support for the production of new technology. The high degree of openness can make many innovative subjects benefit from public technical standards. Technical standards, as platforms of technical innovation, their effects can be summarized as the following two aspects. First, as mediums of knowledge, technical standards, provide the access to technical information and product information for users of technical standards. Technical standards clearly define the norms of products or services and transform the intangible knowledge into technical instructions in the process of production (Xiong, 2006). This transformation reduces the time and the cost of accumulating technical information for the users of standards. Second, the powerful spillover effects of knowledge and technology under the sharing of technical standards can make each innovative subject get access to the technical foundation provided by technical standards. Consequently, the repeated activities for researching basic technologies can be avoided and the cost of technical innovation can be saved, the cycle of technical innovation can also be shortened.

Guiding effects of technical standards: Actually, technical standards are one kind of technical criteria technologies which are in compliance with these criteria can be accepted by markets more easily. Once a technology is determined to be the industry standard by the statutory bodies, this technology actually becomes the industry norm and industry guideline. Relevant interest subjects can only operate in accordance with the technical standard, or improve and perfect the relevant technology along this technology path. So technical standards set up barriers to market access for technical innovators and limit the direction and the path of technical innovation, then force the R&D subject's innovation to meet the technical standard, avoiding technology R&D activities too dispersed, reducing the disorder of technical research and development. No matter what type of technical standards are, they will limit and constrain the direction and the path of technical innovation at a certain extent, such as minimum quality standards and safety standards, technical requirements on the lowest quality and safety

of products or services will affect the direction of micro-economic subjects' R & D investment (Tao, 2010), because only technical innovations meeting the minimum quality standards and safety standards can be adopted by markets and can realize their economic value. Constraints and restrictions of the path and the direction of technical innovation under technical standards reflect the guiding function of technical standards for technical innovation, technical standards determine the future trend and the developing track of technology.

Incentive-digestion effects of technical standards: The R&D subjects are encouraged to engage in the activities of technical innovation only when the innovative private benefits are larger than the private costs. The greater the private benefits of technical innovation and the smaller the private costs of technical innovation are, the stronger the incentive function will be. But for the public technical standards, the existence of public welfare and externality makes the social costs and benefits of technical standards are inconformity to the private's. On the one hand, users of public technical standards who do not pay charges can be free use of technologies contained in standards due to the property of free usability. However, on the other hand, owing the property of open sharing, public technical standards' providers who pay the cost of R&D cannot get deserved return. When comparing and weighing the inequality of the public cost and the private cost, the public benefit and the private benefit, rational individual economic agents will inevitably choose "free ride". That is, choosing not to innovate is the dominant strategy and thus the providers of public technical standards would only be social public institutions, R&D costs will eventually be borne only by social public institutions. As it can be seen, public property right of technical standards cannot produce the incentive effects on technical innovation, free sharing digests the potential incentive effects of technical standard profits on technical innovation as well, even leads to negative incentive effects when occurring "free rider".

- **The impacts of private patents on technical innovation:** Owing to the properties of private interest, non-gratuity and exclusivity, patents can only be used by patents' holders and payers within a limited range. The exclusive possession and the exclusive use of innovation achievements make patents provide sufficient incentives for technical innovation activities, but constrain the application range of patented technologies, which is not favorable to the spreading of patented technologies. The behavior of abusing monopoly under the protection of patents will hamper technical innovation.

Incentive effects of patents: North has said that the continuous efforts of improving technologies can only bring about by establishing sustainably inspiring systems of property rights which can improve the private benefit of technologies (Liu and Liu, 2011). A patent right is a kind of incentive property rights' arrangement which can improve the private benefit of technical innovation, which is the exclusive ownership endowed to technical innovators by laws at a certain period time. Technical innovation produces innovative knowledge and technology products, which are sharable, reusable and low-cost replicative. Without the protection of property rights' system, the achievements of technical innovators will be plagiarized, imitated or copied by others. Innovators will have no incentive to innovate without corresponding income compensation. As a kind of private property rights, patents can be looked as personal properties of technical innovators. The possession and the use of patents improve the private benefit of technical innovators in two aspects: on the one hand, protected exclusive use right brings about monopoly profits which are above the average profits for the holders of patented technologies (Yuan *et al.*, 2010). On the other hand, the authorization of paid use internalizes the spillover effects of technical innovation in the transactions of patents. Monopoly profits of self-use and patent license fees of authorizing others to use not only compensate for patent holders' R&D cost, but also enable them to make huge gains over the R&D cost. The mechanism of benefit compensation and the mechanism of income access under the protection of patent rights provide sufficient incentives and continuous powers for technical innovators.

Barriers effects of patents: The characteristics of private ownership of patented technologies determine their barriers effects on technical innovation, the barriers effects of patents are mainly reflected in two aspects: one is the barrier of market competitions, which is a competitive threshold for non-patent holders constructed by patent holders based on their own technology advantages. Owning a patent means having a market dominant right, other non-patent holders enter the market only by paying fees developing their technologies the same as the patented technology. But because patent institutions require that one invention or one creation can only be granted one patent, thus paying fees is the only channel for non-patent holders to enter the market. Paying fees is a market entry barrier set by patents' holders against other competitors. The other is the barrier of technology diffusion. Patents have a period of protection and a range of use. The protection period of patents postpones the time of dissemination and diffusion of technical innovations, delays the process of marketization and socialization of the achievements of technical innovation; the limit to the range of use and the principle of paid use make

patents only be used in a small limited range of economic subjects, which impedes the spreading and the popularization of the achievements of technical innovation and is not favorable for the achievements of technical innovation to transfer into the whole socio-economic system.

Exclusive monopoly effects of patents: Exclusiveness of patents is essentially a legal monopoly which produces a large incentive effects on technical innovation. However, legal monopoly may induce illegal behavior of abusing monopoly, as a result, which impedes and inhibits technical innovation. As a protection system of property rights to provide incentives for technical innovation, patents must be reasonable and moderate. Patents should not only protect the private interest of patents' holders but also should attach importance to the social and public interest, thus, patent rights have the restriction on the length and the width of protection. The length of protection period is limited. If it is over the length, patents will be terminated, patents' holders obtain monopoly profits and patent licensing fees in legal protection period is legal and legitimate, which is a appropriate incentive on patents' technical innovation; however, if the legal protection period is over, the holders still attempt to exclusively use the patented technology or get a licensing fee, which is an illegal behavior. Such an illegal behavior will hinder technical innovators from realizing and adding the market value of their achievements. The width of patents regulated the scope and the intensity of protection, the moderate scope and the appropriate intensity aim to limit other competitors' behavior of imitating patented technologies and to reduce the damages of imitative technologies to patented technologies, further to protect the competitive advantage and the profitability of patents' holders in patented technologies. But if patents' holders overstep the statutory scope or the statutory intensity of protection and restrict the R&D of weakly similar technologies, which is the behavior of limiting competition because of excessive protection. This behavior will hinder the normal technical innovation behavior and impede the progress of social technology.

RESULTS AND DISCUSSION

The integration of technical standards and patents has changed technical standards' attribute of public products and patents' characteristic of private property right. After integration, technical standards are no longer pure public products. Meanwhile, patents are no longer pure private property rights. The integration of technical standards and patents acts on technical innovation through digesting the conflict between technical standards and patented technologies. The influences of the integration of technical standards and patents on technical innovation are shown in Fig. 2.

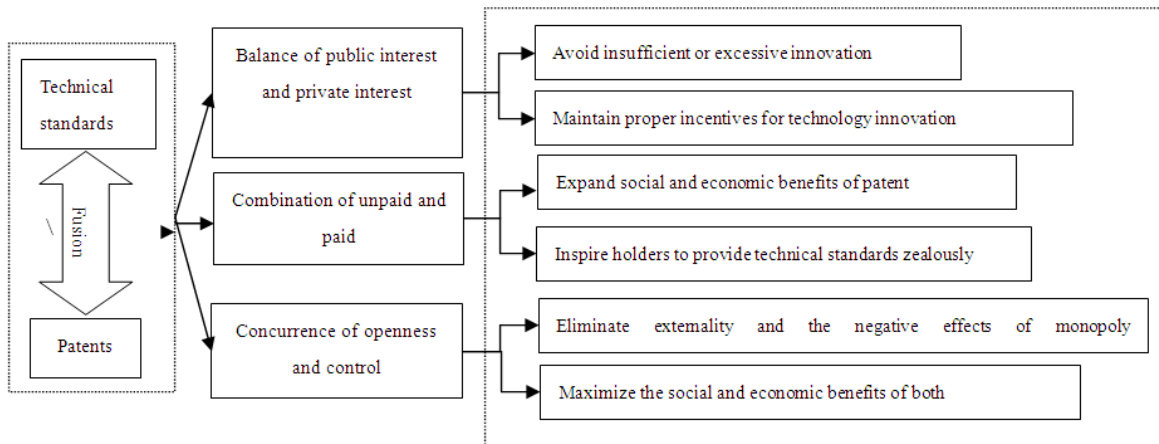


Fig. 2: The impacts of the integration of technical standards and patents on technical innovation

- The impacts of balancing public interest and private interest:** Technical standards integrated by patents increase private interest and reduce public welfare through the involvement of private rights (Zhu, 2006). Patented technologies upgraded to standards increase public welfare and reduce private interest through the intervention of public rights. Over-emphasis on public welfare or on private interest is not benefit for technical innovation. According to the principle of profit maximization, the private marginal revenue should be equal to the private marginal cost of technical innovation. Too much public welfare means that technical innovation's private benefit is less than the social benefit. So under this condition the actual technical innovation is less than what social welfare maximization requires. From the view of the whole society, technical innovation is not sufficient. On the contrary, the excessive private interest means that technical innovation's private benefit is more than the social benefit. There are more technical innovations than the society needs. After the integration of technical standards and patents, public welfare and private interest can both be achieved. The balance of public interest and private interest can avoid insufficient or excessive innovation caused by private incomes more than or less than social gains. In other words, it not only helps to achieve the social and public goals of technical standards, but also maintains the proper incentives for technical innovation activities.
- The impacts of combining paid and unpaid:** Technical standards are shared and free, while patents are exclusive and authorized to use. The private are unwilling to provide unpaid public technical standards which involve lots of basic technologies researched and developed mainly by public institutions. Research and innovation dominated by public institutions are not good for the market mechanism playing the basic role in technical innovation and distort the allocation of

innovation resources. Though the paid patents have protected the benefits of patents' holders and stimulated their enthusiasm of engaging into R&D activities, they restrict the diffusion of the achievements of R&D, increase the cost of the technical achievements' getting into the market and do not contribute to maximizing the social value of patented technologies (Chen, 2010). After the integration of technical standards and patented technologies, the implementation of standards and the authorization of patents have combined together. Non-patented basic technologies involved in technical standards are still open, free to use. But the use of patented technologies included in standards need to be authorized and to pay fees for using. On the one hand, the combination of free use and paid authorization can inspire patents' holders to participate in the competition of technical standards and to provide technical standards. On the other hand, it can expand application scope of patented technologies and increase the social and economic benefits of patented technologies with the help of the authority of technical standards.

- The impacts of the coexistence of openness and control:** De facto technical standards, produced from the integration of technical standards and patented technologies, usually take strategies of openness going with control in the process of their promotion and implementation. Openness does not mean technical standards opening completely, but opening the non-patented technologies and non-critical patent technologies of them. Control does not refer to the whole exclusion of patented technologies under the protection of intellectual property rights, but controlling of the key technologies in standards. The strategy of partial openness not only favors the promotion and diffusion of standard technologies and increases the market share and industry influence power of

technical standards, but also keeps the patents' holders from occupying technical standards exclusively and abusing intellectual property rights. Partial control not only protects the interest of the providers of technical standards, making them enjoy a certain amount of revenue when taking the risk and cost engaging in R&D activities and providing technical standards, but also prevents technical standards from becoming public products and thus to trigger the free-rider behavior. Neither completed openness nor completed control of technical standards is optimal for technical innovation. Keeping completely open, as a result, technical standards will be essentially evolved into public products. Strong spillover effects of public products lead to the inconsistency of innovation investment and innovation gains, which make the incentive and motivation taking technical innovation activities insufficient (Li, 2007). Completed control means the market monopoly and the market power of technical standards. Relying on such monopoly and dominance, huge benefits can be gained, which makes the inductive effect of taking R&D activities and substituting technical standards insufficient, thereby weakening the innovation motivation and inducing innovation inert. Proper openness and proper control resulting from the integration of technical standards and patented technologies can not only ensure the control over core technologies in standards, but also maximize the social and economic value of technical standards and patented technologies. Moderate open can partly eliminate the erosion of spillover effect on the incentive of technical innovation; Moderate control can partly defuse the negative effects of the monopoly power on technical innovation.

CONCLUSION AND IMPLICATIONS

In the era of standard competition, the dominance of de facto standards and their importance for the rights to occupy markets determine technical standards containing more and more patented technologies, more and more patented technologies rise to de facto standards through market competition. The penetration and integration of technical standards and patents have become the trend of the times. Concerning about the effects produced by the relation's evolution of technical standards and patents on technical innovation is helpful to promote the interaction among patents, technical standards and technology innovation. From the above study, we can obtain the following two conclusions:

Firstly, public technical standards and private patent rights have both positive and negative effects on technical innovation. In traditional economic era when technical standards and patents were separate, technical

standards' property of pure public products was helpful for the spreading and diffusion of the achievements obtained by technical innovation. But it was not conducive to produce enough private interest to incentive technical innovation. The lack of motivation for private innovation led to insufficient activities of technical research and development in society, which slowed down the progress of technical development. Complete private ownership of patents was beneficial to establishing the incentive mechanism for private innovation, but was not in favor of the diffusion and popularity of the achievements produced by technical innovation. Excessive emphasis on private property rights reduced the rate of technical innovations' transforming into market productions, finally resulting in a mismatch between the technology and the economy to a certain extent.

Secondly, the effective integration of technical standards and patents can overcome the negative impacts of the two on technical innovation. After the integration of technical standards and patents, changes in the attribute of property right help to inhibit the adverse impacts on technical innovation and stimulate their favorable impacts on technical innovation when they are separate. Technical standards absorbing moderate patented technologies and patents rising to technical standards through market competition are the performances of mutual penetration and fusion of technical standards and patents. Effective and reasonable penetration and fusion can not only maintain the proper incentives for technical innovation, but also promote the diffusion and spreading of the achievements of technical innovation.

Therefore, if we want to play the positive impacts of technical standards and patents on technical innovation, we must conform to the trend that the relation of technical standards and patents evolves from separation to fusion, avoid disadvantages and seek advantages; we should guide moderate fusion and reasonable fusion of technical standards and patents. On the one hand, in order to prevent the excessive privatization of technical standards, we should prevent technical standards from absorbing too many patented technologies. On the other hand, after patented technologies rising to technical standards, we should not force them to open critical core technologies in order to avoid their excessive public ownership. We should establish the collaborative mechanisms of technical standards, patents and technical innovation to promote technology patentization, patent standardization, standard industrialization, industry marketization and finally achieve positive interaction among the three.

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