Patent Assets Rapid Evaluation Model based on Market Approach

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Abstract: The OECD estimated that knowledge-based industries in its member countries accounted for nearly half of GDP in 2015, and the share is still rising. The patent assets owned by technology-intensive enterprises in China, as their core value, have also expanded rapidly, and the number of patent applications has increased rapidly. The decision-makers of these enterprises shall regularly check and assess the large amount of patent assets they own, and on the basis of which make decisions on such matters as patent utilization, operation and corporate finance so as to maintain their competitiveness. Under this circumstance, it is a more economical and intuitive choice for the enterprise to assess its own patent level and value by using the existing patent database, extracting the legal, technical quality, economic indicators and relevant market data on patents and importing the patent data into the rapid assessment model to realize asset assessment.

Keywords: Patent; Value; Market; Appraisal

1. Introduction

According to China's State Intellectual Property Office, China has 5,527,183 valid patents in stock at the end of 2016 and is growing at a rate of around 16% a year. The 13th Five-Year Action Plan for Intellectual Property Rights Strategy predicts that by 2020, the number of effective invention patents will increase from 0.56 to 0.7 per CNY100 million of main business revenue in China's manufacturing industry above designated size. Obviously, China's patent quantity has realized the quantity big leap in recent years. In 2019, Shanghai realized the stock exchange of S&T board, which further clarified the value of intellectual property assets to the enterprise's own operation.

However, in such a situation that the number of patents held by enterprises is expanding rapidly and the value of patents is increasingly prominent, the supporting talents in patent operation and patent asset appraisal cannot meet the practical needs of all enterprises due to the high professional requirements of the traditional intangible asset appraisal methods. As a result, enterprises failing to have their patent assets evaluated are operated with problems for many years, and their patent assets are mixed up, making it difficult for their decision-making personnel to identify and utilize their own patent assets. At this point, it will cost a huge amount of time and money to seek for an appraisal institution which is rare to sort out and appraise patent assets item by item.

In view of the increasing importance of China's patent assets in today's economy, the valuation of patent technology will be more frequently encountered in business. On the market, demand for cheaper, faster, and more reliable patent evaluation methods is growing rapidly. In view of this situation, this Circular proposes a method for enterprises to evaluate patent assets value in order to provide sufficient patent assets data support for managers' decision-making.

2. Access to Information Relating to the Value of a Patent

With the further disclosure of China's patent information data, China's patent information database for inventions and utility models has accumulated and disclosed enough basic data. Various patent data service platforms based on this, such as INCOP Pat, Pat Snap Patentics. Orbit and CNIPR, have further processed the data to make it easier to extract the patent data indicators of world patent data, Chinese inventions and utility models. At the same time, China's patent market trading services have also carried out a useful attempt. The intellectual property trading platform began to emerge. And the Chinese Academy of Sciences and universities patent auctions achieved more and more cases of public transactions.

The relevant assessment data herein are based on the INCO Pat and open market trading data, which can be further analyzed and extracted through the platform system to ensure the timeliness of the parameters needed for the assessment.

3. Influencing Factors of Patent Value

By reference to the analytic hierarchy process for patent quality assessment (AHP), the patent value dimension is generally divided into the patent quality technical, legal and economic dimensions. Through the analysis and integration of these three dimensions, we can reasonably reflect the value degree of patent assets to the market and

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themselves. These factors have been discussed in many studies, but there are also many methods to integrate these data values model, but it is difficult to meet the needs of rapid evaluation of results, and the relationship with the specific price is also difficult to form a corresponding relationship. Therefore, the following values of these data for further sorting.

3.1. Technical value of quality indicators and values

Quality technical dimension in patent can get the third level index of subordinates through AHP. The third-class indicators mentioned are respectively the technical advanced α, industry trend β, applicable range γ, protection range δ and the patent recognition degree of the applicant ε. The technical value of quality shall be the sum of the product of the third degree index and the weight.

3.1.1. Technologically advanced

Technological progressiveness is evaluated by the citation index in the world public patent database. The citation index represents the core degree and diffusion degree of the patent to be evaluated. The range of values may be divided into five grades by human nature: citation without reference totaling 1 point, citation once totaling 2 points, citation twice to four times totaling 3 points, citation five to ten times to 4 points and citation more than ten times to 5 points. The higher the score, the higher the technological advancement of the patent to be evaluated.

3.1.2. Industry development trend

The industry development trend is evaluated by the indicator of patent quantity distribution, which represents the overall development of the technology field to which the patent to be evaluated belongs, and the overall technology development indirectly reflects the technology value of the patent in the field at that time. The range may be artificially divided into five grades: 1 point for increment less than 10% of the increment; 2 points for increment more than 10% but less than 30% of the increment; 3 points for increment more than 30% but less than 40% of the increment; 4 points for increment more than 40% but less than 50% of the increment; 5 points for increment more than 50% of the increment. The larger the score, the better the trend of the industry is.

3.1.3. Scope of application

The scope of application is characterized by the product of the level of technology application and the number of the patent classification number to which the patent belongs.

The applicable level of technical problems shall be the maximum height of the level of classification number of the patent to be evaluated, and the range may be artificially divided into three levels: 1 point for those without classification number of lower level, 2 points for those with classification number of lower level two, and 3 points for those with classification number of lower level three or above.

The number of patent classification numbers may be artificially divided into three grades: 1 point for classification numbers 1-2, 2 points for classification numbers 3-4 and 3 points for classification numbers more than 5.

3.1.4. Extent of protection

The scope of protection can be measured by the degree of weight layout and the degree of sovereignty. The former uses the number of the claims of the patent right published in the database for authorization of a patent for invention to form the ordinal percentage of the number of the claims of the patent right, which is counted in the database for authorization of a patent for invention in China. The latter uses the number of the verb (s) formed by dividing words or the number of the semantic group (s) roughly separated by a semicolon as an indicator, which is counted in the database for authorization of a patent for invention in China to form the ordinal percentage of the number of the claims of the patent right. The final median value of the protection scope shall be calculated by multiplying the respective weights of 50% and summing the two values. The median value of 10% and less shall be calculated as 1 point, the median value of 10% to 30% and less shall be calculated as 2 points, the median value of 30% to 50% and less shall be calculated as 3 points, the median value of 50% to 70% and less shall be calculated as 4 points and the median value of more than 70% shall be calculated as 5 points.

3.1.5. Degree of recognition of the patent by the applicant

The three indicators, namely, the number of patents of the same patent family, the number of inventors and the degree of patent application, indicate the degree to which the applicant may recognize the assessed patent. The value of the applicant's own recognition of the patent is represented by the mean of the three fourth-level indexes: the number of the patent family, the inventor and the patent application.

The scope of value selection for the degree of the number of patents of the same family can be divided into three grades: three or more regions are divided into 3 points, two regions are divided into 2 points, and only domestic is divided into 1 point.

The inventors' degree of number can be divided into three grades by number of inventors: 3 points for 3 inventors or above, 2 points for two inventors ,1 point for one inventor.

The value of patent application shall be determined by the total number of times of transfer, license and pledge. The range of value may be divided into three grades: 3

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points for two or more times, 2 points for one time and 1 point for 0 time.

3.1.6. Integration of values of quality and technical value indicators

Quality and Technical Value Indicator = Technical Advanced α * 39% + Industry Development Trend β * 20% + Scope of Application γ * $(9\% / 3 * 5)$ + Scope of Protection δ * 20% + Applicant's own degree of recognition of the patent ε* $(12\% / 3 * 5)$. Final value range is.

3.2. Legal risk indicator and value

The dimensionality of legal risk indicators in patents can be further determined by hierarchical analysis. The tertiary indices mentioned in the preceding paragraph include the index of stability ζ, the index of determinability on patent infringement η and the index of the residual protection period of patent θ.

3.2.1. Stability

Stability is characterized by the combination of creative evaluation a, litigation and review history b, and exhaustive comprehensiveness c.

Innovativeness is a necessary condition for the existence of patent assets value. The creativity and novelty of Article 22 of the Patent Law in China have been judged in patent examination. So in practice, it can be represented by the legal state of the patent. Upon valuation of the patent rights, the value of complete rights shall be deemed as 0.5; the value of partial rights deemed to be obtained for announcement of patent shall be deemed as 0.25; and the value of non-announcement status shall be deemed as 0.

Litigation and reexamination history shall be based on the unified calculation of the times of invalid failure, successful reexamination, and application for litigation and preservation, and the number of times of failure shall be reduced to zero and divided by 0.6, 0.8 and 1 on one, two, three or more occasions.

Exhaustive degree of comprehensiveness, that is, the extent to which a patented technical solution is described in detail. On the basis of meeting Article 26 of the Patent Law in China, it can be evaluated by the index of specification embodiments. The calculation value of the patents to be assessed (the total number of words for embodiments/the total number of words required by the rights) shall be placed in the database for authorizing Chinese invention patents to form the ranking percentage X; the quantity of the embodiments of the description to be assessed shall be placed in the database for authorizing Chinese invention patents to form the ranking percentage Y; and the quantity of the appended drawings and appendixes shall be placed in the database for authorizing Chi-

nese invention patents to form the ranking percentage Z; Through the calculation of $20\% \, X + 20\% \, Y + 10\% \, Z$, the exhaustive degree of comprehensiveness is worth. Finally, the stability shall be calculated by $(a + c) * b$, and the calculated value shall be within the range of $[0,1)$.

3.2.2. Patent infringement determinable

Patent infringement can be judged by the type of patent. The patent is divided into three types, namely, hardware structure, software module, testing and method, and application, which can be extracted from the IPC classification number of the patent to be assessed and the keywords of "module" (corresponding to software module), "test" or "experiment" (test type), "application" or "purpose" (corresponding to application type), "process" or "method" (method type) in the claims of the patent to be assessed for the purpose of identification. The scores of hardware structure, software module, test and method, and application class were set to 1, 0.7, 0.4 respectively.

3.2.3. Indicator of remaining term of protection of patent

The expression of remaining protection period of a patent is construed as the remaining protection period.

3.2.4. Integration of values of legal risk indicators

Legal risk index = stability ζ * determinable nature of patent infringement η* residual patent protection term index θ, the final value of which shall be $[0,20]$.

3.3. Market value adjustment indicator and value

Market value adjustment indicators shall be obtained through adjustment of effective transaction prices to the aforesaid quality and technical value indicators, legal risk indicators, market scale, government incentives and tax reduced value, industry average profit margin.

3.3.1. Effective transaction price

Generally speaking, the effective transaction price is calculated by the weighted average of three or more approximate or related auction cases. However, due to the difference in market activities in various fields, it may be obtained after field adjustment based on only one transaction case. More unpopular areas of technology can also be evaluated by the income method to get a more accurate value that is closest to the patent price, and use it as an effective transaction price. Under special circumstances, for example, if there are a large number of replaceable patents under the category of patents subject to testing and there are no transaction cases, the effective transaction price may be measured at the cost of patents.

3.3.2. Market size

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The Form of Reference for Industrial Classification of China's National Economic Activities (2018) shall match with the main IPC category number of the patent to be evaluated, and the total market output value of the technology field of the patent to be evaluated shall be calculated in combination with the data provided by the National Bureau of Statistics.

3.3.3. Government awards and deductions value

The value of the incentives and reductions is determined in accordance with the policy provided by the local policy of the owner.

3.3.4. Industry average profit margin

Obtained through the Statistics Bureau or based on empirical estimates of the right holder.

3.3.5. Calculation of market value adjustment indicator

$$V'b = (Vb - H)/L \qquad (1)$$

In: $V'b$ is the price at which the price of the effective transaction is adjusted, Vb is the price of the effective transaction and L is the legal risk indicator.

$$E = (V'b/Qb)/(IV * m/Qtotal) \qquad (2)$$

In: E is the market value adjustment indicator, Qb is the patent quality (i.e., the quality Technology Value Indicator T) of the valid transaction, qbtotal is the quality of the patents in the technology sector or in the overall industry for which they have been effectively traded (i.e., the Quality Technology Value Indicator T plus), IV is the total value of the industry or industry for which the Patented Technology was traded in the previous year, m is the profit margin that corresponds to the industry or industry for the Patented Technology in the previous year, and H is the value of governmental awards and reductions.

Note, the standard essential patent is not transferred in general, and may be raised correspondingly in case of any transfer.

4. Patent Assets Rapid Evaluation Model Construction

$$V = \{[B * (Q/Qtotal) * IV * m * (E * p) * yt + S]/M - D1\} - B * (Q/Qtotal) * IV * m * (E * p) * D2 \qquad (3)$$

In the formula, "V" refers to the value of the patent to be evaluated, "Q" refers to the quality of the patent to be evaluated (i.e. value of quality technology indicator T), "Qtotal" refers to the quality of the patent in the technical field or industry as a whole (i.e. value of quality technology indicator T total), "E" refers to the market value adjustment indicator, "p" refers to the coefficient of correlation between the patent to be evaluated and the reference value in the technical field, "IV" refers to the total output value of the industry which corresponds to the patent in

the previous year, "m" refers to the profit rate of the patent in the previous year over the industry or industry which corresponds to the patent technology achievement, "yt" refers to the realization factor of the patent technology achievement in the year t, "S" refers to the circulation cost, "M" refers to the number of persons who have the right to own the patent, "B" refers to the degree of importance of being included in the standard, "D1" refers to the license fee for the patent on which a patent is dependent, and "D2" refers to the risk of fees for the patent on which a patent is dependent.

Specifically, the correlation coefficient of a patent to be assessed and the reference value in the technical field can be determined by the gap across categories in the Reference Table of Industrial Classification of China's National Economic Activities (2018).

The realization factor of the patented technical achievements in year t shall be generally the intermediate fee charged on a pro rata basis in the current year (if any).

The circulation cost shall generally be the inventor's fee incurred at the time of assignment or authorization and the intermediary handling fee and registration fee for the fixed price. Generally, the inventor's fee shall be patent remuneration rate (minimum): 2% * the remaining right term or 10% (Article 78 of the Detailed Rules for the Patent Law of the PRC), whichever is lower (if any).

The number of entitlements shall be based on the duplicate copy recorded in the patent register (if any).

The expenses on the patent that depend on shall be directly included if expressly notified; in the absence of explicit notification, the expenses may be found by referring to the patent on which the patent is to be evaluated or measured by the risk ratio. The measurement method shall be to add up the Class X documents, Class Y documents and Class R documents with a weight of 0.5 listed during the examination process and calculate their value at (1-the ranking percentage of the overall database) (if any).

5. Conclusion

This is a rapid patent asset assessment model developed based on legal, technical and economic indicators and relevant market data. For this method, this paper first discusses the selection of influencing factors of this method. Then, a feasible and concrete evaluation model is formed. Although the model can't reduce the workload and cost of ordinary patent assets valuation, it provides a good data base for the database to extract data to form a rapid market valuation. As a result, it provides a fast and inexpensive shortcut for patent holders to assess patents and reduces the decision-making time of patent strategy.

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