

Research on Patent Competitiveness of Agriculture and Forestry Universities Based on Innography (Postprint)

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Abstract

[Purpose/Significance] Patent competitiveness reflects the R&D strength and innovation level of universities. This study analyzes and evaluates the patent competitiveness of agricultural and forestry universities in order to provide references for enhancing their patent competitiveness. [Method/Process] A three-level evaluation index system was developed from two dimensions: actual patent competitiveness and potential patent competitiveness, encompassing 24 indicators such as patent quantity, patent value, and patent intensity. Through standardization and linear weighted averaging, the patent competitiveness of agricultural and forestry universities was evaluated and analyzed. [Results/Conclusions] The analysis results indicate that there are significant gaps in patent competitiveness among agricultural and forestry universities, and they generally suffer from certain shortcomings, such as low proportions of foreign patents, patent implementation rates, and patent survival rates. Based on these findings, relevant countermeasures and suggestions are proposed.

Full Text

Research on Patent Competitiveness of Agricultural and Forestry Universities Based on Innography

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Abstract

[Purpose/Significance] Patent competitiveness reflects a university's research and development strength and innovation level. This study analyzes and evaluates the patent competitiveness of agricultural and forestry universities to provide references for enhancing their patent competitiveness. [Method/Process]

A three-level evaluation index system was developed from the perspectives of realistic and potential patent competitiveness, comprising 24 indicators including patent quantity, patent value, and patent strength. The patent competitiveness of agricultural and forestry universities was evaluated through standardization and linear weighted averaging processing. **[Result/Conclusion]** The results show significant gaps in patent competitiveness among agricultural and forestry universities, with common shortcomings such as low proportions of foreign patents, low patent implementation rates, and low patent survival rates. Based on these findings, relevant countermeasures and suggestions are proposed.

Keywords: Agricultural and forestry universities; Patent competitiveness; Innography; Patent strength

Introduction

Patents, as the core and primary component of intellectual property, have become a focal point of competition in science, technology, and economic fields. University patent competitiveness refers to a university's ability to continuously obtain competitive advantages through patents, primarily manifested in attracting high-quality students and financial support [1]. In recent years, China has continuously increased investment in agricultural science and technology, and universities have attached greater importance to patent application and management. As the cradle for cultivating agricultural and forestry talents and an important source of high-tech achievements in these fields, agricultural and forestry universities have generated a large and rapidly increasing number of patents leveraging their talent and technological advantages, making it necessary to analyze their patent competitiveness.

Previous studies by Ren Wei et al. [2], Zheng Xueyi et al. [3], and Xiang Xin et al. [4] analyzed patent application volumes, trends, types, funding, and distribution of technical fields and disciplines at their respective agricultural universities. Peng Aidong et al. [5] used a word segmentation program to conduct frequency statistics on patent titles from six agricultural institutions, revealing specific technical points. Fan Xiahong [6], Dong Linshui [7], and Liu Minjuan et al. [8] compared and analyzed patent applications, annual trends, grants, survival rates, types, regional distribution, technical fields, and inventors across multiple agricultural and forestry universities. J.D. Foltz et al. [9] used dynamic count data models to explore factors contributing to the success of agricultural and biotechnology patents in universities. Some researchers have also used objective patent evaluation tools in their analyses. Cao Yan [10] used Innography to analyze domestic and foreign patent applications, effective patents, active inventors, and international patent classifications at four universities in Henan Province. He Wei et al. [11], Li Jianting et al. [12], and Chen Jianhong [13] used Innography to analyze application years, country distributions, trends in applications and grants, foreign applications and grants, effective patents, hot fields, inventor status, application regions, transferred patents, and high-value patents at their respective universities, exploring the application of the Innog-

raphy patent analysis system in university patent achievement analysis and scientific innovation capability research. Zhan Yuhua et al. [14] and Zhang Shu et al. [15] selected specific technical cases, used patent strength indicators to mine core patents, and created patent maps including patent litigation lists, technology clustering diagrams, patent technology life cycles, and technical effect diagrams through Innography.

However, existing research on patent competitiveness of agricultural and forestry universities either lacks horizontal comparison or suffers from insufficiently detailed and in-depth analysis. Typically, only indicators such as type distribution, grant rate, and effective maintenance duration are used to evaluate patent quality, which is not scientific or comprehensive enough, and often only qualitative analysis is conducted. This study uses the Innography database to analyze patents from multiple agricultural and forestry universities across different indicators, normalizes the scores of each indicator, and conducts quantitative comparative analysis and evaluation of each university's patent competitiveness through linear weighted averaging, providing references for these universities to further enhance their patent competitiveness.

1. University Patent Competitiveness Evaluation Method

1.1 Evaluation Indicators and Weights

1.1.1 Design Principles Scientific Principle. Many factors influence university patent competitiveness. The most reflective factors should be selected based on the actual situation of the analysis object, and indicators should be reasonably designed. The acquisition and calculation methods of indicator data should be rigorous.

Systematic Principle. University patent competitiveness indicators should be divided into multiple levels with interconnections and interactions among them. Therefore, designed indicators should have clear hierarchy, well-defined structure, combine “quantity” and “rate,” integrate status and trends, and strive for comprehensiveness.

Objective Principle. Designed indicators should be based on objective data, avoid subjective speculation, and accurately reflect the data without ambiguity.

Comparability Principle. The performance of designed indicators across different samples should have certain discriminability to facilitate horizontal comparison between samples.

Feasibility Principle. Indicator data should be collectible, and after appropriate processing, can be used for quantitative analysis and calculation.

1.1.2 Indicator Selection University patent operations mainly include patent creation, patent maintenance, and patent implementation. In recent years, patent creation has attracted sufficient attention from universities, with annual patent application volumes increasing year by year. However, patent

maintenance and implementation are not optimistic. A large number of patents have become invalid due to non-payment of annual fees, and even among valid patents, most have not been implemented through licensing or transfer, causing significant waste. Given these deficiencies in university patent operations, this study specifically considers patent maintenance and implementation issues when selecting evaluation indicators, designing indicators such as 3-year, 5-year, and 8-year survival rates, patent effectiveness rate, high-strength patent effectiveness rate, and patent implementation rate. Regarding the default strength indicator of patent age in the Innography database (referring to the remaining life until the maximum protection term), since the vast majority of university patents have not been maintained with annual fees until the maximum protection term, this indicator is meaningless for analyzing university patent value and is not adopted. This study comprehensively considers the characteristics of university patents and the features of the Innography database, follows the aforementioned principles of scientificity, systematicity, objectivity, comparability, and feasibility, and establishes university patent competitiveness evaluation indicators (see Table 1).

Evaluating university patent competitiveness should consider not only the currently manifested realistic patent competitiveness but also the potential patent competitiveness for a future period. Realistic patent competitiveness refers to the strength currently demonstrated by universities, which can be divided into quantity indicators, value indicators, and strength indicators. Quantity indicators include invention patent application volume, utility model patent application volume, and invention patent grant rate. Invention patent application volume refers to the number of published invention patent applications from the university that can be retrieved in the database; utility model patent application volume refers to the number of published utility model patent applications from the university that can be retrieved; invention patent grant rate refers to the ratio of granted invention patents to published invention patent applications.

Value indicators include foreign patent proportion, patent implementation rate, 3-year survival rate, 5-year survival rate, 8-year survival rate, patent effectiveness rate, and high-strength patent effectiveness rate. Foreign patent proportion is the ratio of patents applied for abroad by the university to its total patent volume; patent implementation rate refers to the ratio of implemented patents to granted patents [16]. Patent implementation means the patentee or someone permitted by the patentee manufactures, uses, and sells patented products or uses patented methods for production and business purposes. Since universities typically do not directly engage in production activities, patent implementation in this study refers to universities licensing patents to others or transferring patent rights. The N-year survival rate refers to the ratio of patents that have remained valid for N years from the grant date to all patents that have reached N years from the grant date. Patent effectiveness rate refers to the ratio of currently valid patents to the total number of granted patents.

Patent strength is a unique patent evaluation indicator created by the Innog-

raphy database, referencing more than ten patent value indicators including patent citation/cited counts, number of claims, number of application fields, patent litigation, patent PTO length, etc., using a composite indicator algorithm model to screen core patents. Strength indicators in this study include: average patent strength, high-strength patent quantity, high-strength patent proportion, core patent quantity, average number of claims, average citation count, average cited count, average application field count, and average inventor count. Average patent strength is the average strength of each patent from the university; high-strength patents refer to patents with strength greater than or equal to 30 [12-13]; core patents refer to patents with strength greater than or equal to 70. Average number of claims, average citation count, average cited count, average application field count, and average inventor count are reference indicators of patent strength that can reflect the patent value and development strength of universities.

Potential patent competitiveness reflects a university's patent research and development potential for a future period, mainly manifested in the changing trends of newly applied patents in recent years in terms of quantity and strength. Therefore, potential patent competitiveness indicators can be divided into quantity potential indicators and strength potential indicators. Quantity potential indicators include the average annual growth of invention patent applications in the past five years, the average annual growth of utility model patent applications in the past five years, and the invention patent grant rate in the past five years. Strength potential indicators include the average annual high-strength patent applications in the past five years and the proportion of high-strength patents in the past five years. Potential patent competitiveness indicators reflect the speed and quality of patent output by universities in recent years.

1.1.3 Indicator Weights Determining indicator weights is a key link in patent competitiveness evaluation that directly affects the rationality of evaluation results. This study uses expert consultation to determine weights. Five experts engaged in patent research in different fields evaluated the weights of each indicator in Table 1 from their respective perspectives. Different weights were assigned to each expert based on their academic field, professional background, and professional characteristics. The weights evaluated by each expert were weighted and averaged to obtain the final indicator weights (see Table 2).

1.2 Evaluation Model

Since each evaluation indicator has different attributes, dimensions, and magnitudes, it is necessary to standardize the scores of each indicator first. The standardization process is as follows:

$$R_i = \frac{S_i}{\bar{S}_i}$$

where i is a third-level indicator, R_i is the standardized score of a university regarding indicator i , S_i is the original value of a university regarding indicator i , and \bar{S}_i is the average original value of all surveyed universities regarding indicator i . A value of R_i greater than 1 indicates that the university's strength in indicator i is higher than the average of surveyed universities, and vice versa.

The linear weighted average method is used for comprehensive evaluation and analysis of university patent competitiveness. The calculation method is as follows:

$$G = \sum_{i=1}^n (R_i \cdot \omega_i)$$

where $\omega_i = \omega'_j \cdot \omega''_k \cdot \omega'''_i$, G is the patent competitiveness index of a university, R_i is the standardized score of a university regarding indicator i , ω_i is the cumulative weight of third-level indicator i , ω'_j is the weight of the first-level indicator j to which third-level indicator i belongs, ω''_k is the weight of the second-level indicator k to which third-level indicator i belongs, and ω'''_i is the weight of third-level indicator i .

2. Evaluation of Patent Competitiveness of Agricultural and Forestry Universities

2.1 Data Collection Method

The total patent volume of 35 agricultural and forestry universities was retrieved in the Innography database, and the top ten universities by patent volume were selected: China Agricultural University, Northwest A&F University, South China Agricultural University, Nanjing Agricultural University, Sichuan Agricultural University, Huazhong Agricultural University, Fujian Agriculture and Forestry University, Nanjing Forestry University, Northeast Agricultural University, and Beijing Forestry University. Data were collected up to April 17, 2017.

The methods for obtaining each indicator data in the Innography database are as follows: (1) Invention patent application volume: obtained by entering the command “kind_{code}a or kind_{code}a1 or kind_{code}a2”; (2) Utility model patent application volume: obtained by entering the command “kind_{code}u or kind_{code}y”; (3) Invention patent grant rate: Invention patent grant rate = (Invention patent grant volume / Invention application volume) \times 100%. Invention patent grant volume is obtained using the command “kind_{code}b or kind_{code}b1 or kind_{code}b2”; (4) Foreign patent proportion: Foreign patent proportion = [(Total patent volume - China patent volume) / Total patent volume] \times 100%. China patent volume is obtained from the SourceJurisdiction option; (5) Patent effectiveness rate: Patent effectiveness rate = (Effective patent volume / Granted patent volume) \times 100%. Granted patent volume is obtained by

entering “kind_{code}b or kind_{{code}}{{b1}} or kind{{code}}{{b2}} or kind{code}c or kind_{code}u or kind_{code}y”, then selecting the Active checkbox to filter effective patents; (6) Patent implementation rate: Patent implementation rate = (Implemented patent volume / Granted patent volume) × 100%. Implemented patents include licensed and transferred patents, retrieved from the CNKI patent analysis tracking system; (7) N-year survival rate: N-year survival rate = (Number of patents remaining valid for N years from grant date / All patents that have reached N years from grant date) × 100%. All granted patents of the university with grant dates and expiration dates (if expired) can be exported to Excel for statistical analysis; (8) Average patent strength: First conduct simple family reduction, then export the patent strength of all reduced patents to Excel, and calculate the average patent strength with Excel’s assistance; (9) High-strength patent quantity and core patent quantity: First conduct simple family reduction, then drag the patent strength slider to 30 to obtain high-strength patent quantity, and to 70 to obtain core patent quantity; (10) High-strength patent proportion: High-strength patent proportion = (High-strength patent quantity / Total patent quantity after family reduction) × 100%; (11) Average number of claims, average citation count, average cited count, average application field count, average inventor count: First conduct simple family reduction, then select the patent strength radar chart in the display options, and multiply the values of each parameter on the radar chart by the corresponding axis weight to obtain each parameter value; (12) Average annual growth of invention (utility model) patent applications in the past five years: Enter “kind_{code}a or kind_{{code}}{{a1}} or kind{{code}}{{a2}}” or “kind{code}u or kind_{code}y” to obtain patent application volumes, then select filing year in the display options to obtain annual application numbers. Average annual growth of invention (utility model) patent applications in the past five years = [2016 invention (utility model) patent application volume - 2012 invention (utility model) patent application volume] / 5; (13) Invention patent grant rate in the past five years: Limit the application time to 2012.1.1-2016.12.31, then calculate the invention patent grant rate using the method in step (3).

2.2 Analysis of Evaluation Indicators

The performance of agricultural and forestry universities on each indicator is shown in Tables 3 to 6 .

Table 3 shows that China Agricultural University leads significantly in both total patent volume and invention patent application volume. The patent volumes of other agricultural and forestry universities decrease sequentially, with small gaps between adjacent universities. Considering that utility model patents are granted upon publication, this study only statistics invention patent grant rates. Overall, the average invention patent grant rate of agricultural and forestry universities is approximately 45%. China Agricultural University has the highest grant rate at 54.68%, while Northeast Agricultural University has the lowest at

35.33%. Sichuan Agricultural University has a large utility model application volume, being the only university with more utility model applications than invention applications.

Table 4 reveals that all agricultural and forestry universities have very low foreign patent proportions, with an average of only 0.78%. This may be due to insufficient emphasis on international patent applications and the complex, expensive procedures involved. Patent implementation rates are also low, averaging only 2.75%, with only Nanjing Agricultural University exceeding 5%. This indicates low conversion of scientific research achievements to practical applications in agricultural and forestry universities, requiring attention from university administrators and inventors.

Regarding patent survival rates, the 3-year, 5-year, and 8-year survival rates decrease significantly in sequence, with averages of only 60.97%, 23.63%, and 5.78% respectively. This shows that large numbers of patents in agricultural and forestry universities are terminated prematurely due to non-payment of annual fees, indicating poor patent maintenance. South China Agricultural University has significantly higher survival rates than the average, demonstrating better patent maintenance.

The average patent effectiveness rate of agricultural and forestry universities is 61.66%, which appears high. However, comprehensive analysis of the 3-year, 5-year, and 8-year survival rate data suggests that the patent effectiveness rate is largely supported by recently granted patents. The number of recently granted patents is very large and all remain valid, resulting in a high overall patent effectiveness rate. Therefore, relying solely on patent effectiveness rate to examine patent maintenance is inaccurate and must be combined with survival rates across different years. For example, Sichuan Agricultural University has a high patent effectiveness rate, suggesting good maintenance, but its patent survival rates are low, with over 70% of patents becoming invalid within three years of grant, indicating that its patent maintenance management warrants attention.

Comparing high-strength patent effectiveness rates with overall patent effectiveness rates reveals that most agricultural and forestry universities maintain high-strength patents better than average patents. To comprehensively analyze patent maintenance, the 3-year, 5-year, and 8-year survival rates, effectiveness rates, and high-strength patent effectiveness rates of each university were normalized and weighted according to indicator weights. The ranking of patent maintenance from best to worst is: South China Agricultural University, Nanjing Forestry University, Nanjing Agricultural University, China Agricultural University, Huazhong Agricultural University, Fujian Agriculture and Forestry University, Beijing Forestry University, Northeast Agricultural University, Sichuan Agricultural University, and Northwest A&F University. Notably, universities with better patent maintenance are often located in economically developed provinces, possibly because they receive more local funding support, which is crucial for patent maintenance that requires substantial expenses.

Table 5 shows that the average patent strength of agricultural and forestry universities is similar, with an average of around 12. Given that patent strength ranges from 0-100, most patents have relatively low strength. China Agricultural University and South China Agricultural University perform significantly better than other universities in high-strength patent quantity and core patent quantity. The average high-strength patent proportion is approximately 11%, with South China Agricultural University, China Agricultural University, and Beijing Forestry University having notably higher proportions.

Table 6 presents potential competitiveness indicators. The data cover 2012-2016. Due to the time required for patent publication, some patents applied for in 2016 cannot yet be found in the database, so the calculated average annual patent and invention patent application volumes in recent five years may be lower than actual values. The table shows that South China Agricultural University and Fujian Agriculture and Forestry University have rapid growth in invention patent applications in recent five years, while Sichuan Agricultural University has rapid growth in utility model applications, demonstrating strong potential patent competitiveness in quantity. Some universities show slow or stagnant growth in patent applications in recent five years, mainly due to low development speed and the fact that recently applied patents have not been published and cannot be retrieved from the database, resulting in low calculated growth.

The invention patent grant rates in the past five years are similar across universities, with an average of 33.52%, which is relatively low. This is mainly because invention patent grants typically require several years of examination, and many invention patents applied for in the past five years are still in substantive examination. In terms of average annual high-strength patent applications in recent five years, China Agricultural University leads significantly, demonstrating strong competitive potential in quality.

2.3 Comprehensive Evaluation of Patent Competitiveness

The original values of each indicator in Tables 3 to 6 were substituted into Formula (1) for calculation, yielding the standardized scores of patent competitiveness indicators for each agricultural and forestry university (see Tables 7 to 10).

The weights of each evaluation indicator in Table 2 and the standardized scores in Tables 7 to 10 were substituted into Formula (2) to calculate the patent competitiveness indices of agricultural and forestry universities (see Table 11).

Based on the calculation results in Tables 7 to 11 , the agricultural and forestry universities can be divided into three tiers:

First tier: China Agricultural University and South China Agricultural University, whose patent competitiveness leads significantly. Both universities demonstrate excellent performance in realistic and potential patent competitiveness.

China Agricultural University ranks top in almost all indicators under realistic patent competitiveness and performs well in strength potential indicators under potential patent competitiveness, but poorly in quantity potential indicators, with growth rate of new patents in recent five years below average. South China Agricultural University performs well in most indicators except for low foreign patent proportion and patent implementation rate.

Second tier: Universities with patent competitiveness around average level, including Nanjing Agricultural University, Fujian Agriculture and Forestry University, Nanjing Forestry University, Beijing Forestry University, and Huazhong Agricultural University. These universities either have strong realistic patent competitiveness but weak potential patent competitiveness, or vice versa, or perform mediocly in both. Most indicators of these universities are near average values, with some highlights but also some very low indicators, resulting in non-prominent comprehensive competitiveness. For example, Fujian Agriculture and Forestry University has high growth in invention patent applications in recent five years but low 5-year and 8-year survival rates and core patent quantity. Huazhong Agricultural University performs well in foreign patent proportion, and Nanjing Agricultural University performs well in foreign patent proportion and patent implementation rate, but both perform poorly in patent application growth in recent five years.

Third tier: Universities with patent competitiveness significantly below average, including Sichuan Agricultural University, Northwest A&F University, and Northeast Agricultural University. These universities perform poorly overall, with most indicators below average and some far below average, warranting attention.

Notably, universities with strong potential patent competitiveness are mostly concentrated in economically developed provinces, while provinces in Northeast, Northwest, and Central China have relatively weaker economic strength and net population outflow, which may affect the potential patent competitiveness of universities in these regions. Therefore, these universities should prepare for challenges such as talent loss and funding shortages in patent operations.

3. Countermeasures and Suggestions for Improving Patent Competitiveness

Agricultural and forestry universities generally have low foreign patent proportions, patent implementation rates, and patent survival rates. Therefore, improving patent competitiveness requires not only encouraging faculty and students to apply for more patents but also focusing on improving patent quality and strengthening patent maintenance.

University management departments should conduct publicity and training on foreign patent applications, encourage faculty and students to select valuable patents for foreign applications, and provide policy and funding support to increase the number of foreign patents.

Patent inventors should prioritize the feasibility and economic viability of technology for practical production during design and R&D processes. Management departments of agricultural and forestry universities should actively facilitate patent transfer and licensing, consider patent implementation as an important basis for patent performance evaluation, and establish specialized technology transfer centers to actively seek cooperative enterprises, thereby promoting patent implementation.

Given that the vast majority of patents in agricultural and forestry universities become invalid before reaching the protection term due to non-payment of annual fees, university management departments should establish special funds for patent maintenance and develop scientific and effective patent value evaluation mechanisms to screen high-value patents for key maintenance to save expenses.

Patent competitiveness evaluation is a complex process. This study developed a three-level evaluation index system from the perspectives of realistic and potential patent competitiveness, analyzed the patent situations of various agricultural and forestry universities from aspects of patent quantity, value, and strength, and conducted comprehensive analysis of each university's patent competitiveness through standardization and linear weighted averaging. The evaluation index system and method constructed in this study are simple to calculate, highly operable, suitable for both qualitative and quantitative analysis, highly targeted for university patent analysis, and can significantly reflect problems in university patent maintenance and implementation. Relevant universities can obtain references from various indicator values in this study, identify shortcomings, and make targeted investments to improve patent competitiveness.

References

- [1] Wan Xiaoli, Fan Xiurong. Research on Patent Competitiveness of “985 Universities” [J]. *Journal of South China University of Technology (Social Science Edition)*, 2014(4): 21-28.
- [2] Ren Wei, Zhang Honglian, Niu Shuang, et al. Review and Reflection on Patent Development of China Agricultural University [J]. *Management of Agricultural Science and Technology*, 2006, 25(5): 47-49.
- [3] Zheng Xueyi, Ni Huiqun, Liu Yixin, et al. Analysis of Patent Development Status of South China Agricultural University [J]. *Modern Agricultural Science and Technology*, 2015(11): 339-341, 347.
- [4] Xiang Xin, Yang Hua, Ye Sumei, et al. Empirical Analysis of Authorized Patents in Agricultural Universities—Taking Sichuan Agricultural University as an Example [J]. *Management of Agricultural Science and Technology*, 2015, 34(5): 57-60.
- [5] Peng Aidong, Zhu Xiaocong. Empirical Research on Patent Analysis Based on Patent Map—Taking Patent Applications from 6 Agricultural Universities as Examples [J]. *Jiangxi Agricultural Journal*, 2010, 22(6): 188-193.

- [6] Fan Xiahong, Pan Wei. Analysis of Patent Development Status in Agricultural Universities [J]. Library and Information Service Network Journal, 2012(3): 57-66.
- [7] Dong Linshui, Song Aiyun. Dynamic Development Trends and Technical Field Distribution Patterns of Domestic Patent Applications in China's Agricultural Universities [J]. China Invention & Patent, 2013(12): 36-39.
- [8] Liu Minjuan, Yuan Xue, Wang Ting, et al. Comparative Study on Scientific and Technological Output Capabilities of Crop Science Disciplines in Major Agricultural Institutions in China [J]. Biotechnology Bulletin, 2015(12): 262-267.
- [9] FOLTZ JD, KIM K, BARHAM B. A dynamic analysis of university agricultural biotechnology patent production [J]. American journal of agricultural economics, 2003, 85(1): 187-197.
- [10] Cao Yan. Empirical Research on University Patent Analysis Based on Innography System [J]. Library and Information Service, 2014(10): 61-64.
- [11] He Wei, Zhang Baiqiu, Tian Xinling, et al. Patent Analysis of Jilin University Based on Innography Platform [J]. Information Science, 2014, 32(8): 144-147, 156.
- [12] Li Jianting, Liu Mingli, Hu Juan. Analysis of University Patent Achievements and Research on Scientific and Technological Innovation Capability Based on Innography—Taking Beijing University of Technology as an Example [J]. Modern Information, 2014, 34(7): 104-110.
- [13] Chen Jianhong. Research on University Patent Intelligence Analysis Based on Innography Platform [J]. Library and Information Service, 2013, 57(S2): 201-203.
- [14] Zhan Yuhua, Pan Leying, Cheng Aiping. Patent Intelligence Analysis Using Innography—Taking OLED as an Example [J]. Library and Information Service, 2013, 57(18): 104-108.
- [15] Zhang Shu, Zhang Fu, Xu Huiqing, Dai Enmei, et al. Research on Core Patent Mining, Competition Early Warning, and Strategic Layout Based on Innography Platform [J]. Library and Information Service, 2013, 57(19): 127-133.
- [16] Xiao Guohua, Wang Chun, Jiang He, et al. Design and Construction of Patent Analysis and Evaluation Index System [J]. Library and Information Service, 2008, 52(3): 96-99.

Note: Figure translations are in progress. See original paper for figures.

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