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Multi-source Data-based Technology Industrialization Potential Analysis Methods: A Case Study of Genetic Engineering Vaccine Technology (Postprint)

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Abstract

[Purpose/Significance] Analyzing the industrialization potential of emerging technologies is of significant importance for industrial investment decision-making, forward-looking patent portfolio planning, optimal resource allocation, and technology market development. [Methods/Process] This study systematically reviews existing evaluation methods for technology industrialization potential, based on which a multi-source data-driven analysis framework is constructed. The framework primarily encompasses analysis of the policy environment, industrial technologies, and market conditions, along with an integrated interpretation of industrialization characteristics. The feasibility and effectiveness of the proposed method are validated through a case study of genetic engineering vaccine technology. [Results/Conclusion] The proposed method establishes a panoramic view of the technological domain, integrates heterogeneous data sources, and synthesizes localized features of technology industrialization into comprehensive characteristics. Through mutual verification and complementarity of multi-dimensional analysis results, more informative and reliable industrialization potential assessments can be obtained.

Full Text

Preamble

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Research on Analysis Methods for Technology Industrialization Potential Based on Multi-Source Data: A Case Study of Genetic Engineering Vaccine Technology

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Abstract

[**Purpose/Significance**] Analyzing the industrialization potential of emerging technologies is crucial for industrial investment decisions, forward-looking patent layout, resource optimization, and technology market development. [**Method/Process**] This paper systematically summarizes existing technology industrialization potential assessment methods and constructs a multi-source data-based analysis framework comprising policy environment analysis, industrial technology analysis, market situation analysis, and integrated interpretation of industrialization characteristics. Using genetic engineering vaccine technology as a case study, the feasibility and effectiveness of the proposed method are validated. [**Result/Conclusion**] This method provides a panoramic view of the technology field by integrating multiple data sources, fusing fragmented industrialization characteristics into a holistic profile. Through multi-dimensional analysis with mutual verification and complementation, it yields more valuable results for assessing industrialization potential.

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2. Technology Industrialization Potential Assessment Methods

Industrialization potential refers to the likelihood that a new technology (including products—both hardware and software—and processes) can achieve large-scale production (application) and generate commercial profit [5]. Assessing this potential involves measuring and evaluating this likelihood from technological, market, and industrialization perspectives. The dominant approach uses evaluation indicator systems, which this paper categorizes into two types based on data sources: subjective data-based and objective data-based assessments.

2.1 Subjective Data-Based Industrialization Potential Assessment

Subjective data in technology industrialization potential assessment are primarily obtained through expert scoring, Delphi surveys, and questionnaires. Representative studies using this approach are summarized in Table 1 .

Table 1. Research on Subjective Data-Based Industrialization Potential Assessment

Study	Indicator/Factors
S.Y. Sohn et al. [6]	R&D, management, application, technology transfer, market, policy, commercialization, dissemination, enterprise capability
Huang Lucheng et al. [5,7]	Technology, market, industrialization conditions, compliance, and effect
J. Bai et al. [8]	Technology, environmental effect, resource consumption, social impact, market, industrialization conditions
Zhou Jiyi et al. [9]	Technical indicator potential, market indicator potential, condition potential
Ding Xiuhua et al. [10]	Project performance, demonstration effect, government reference effect
Lu Wenguang et al. [11]	Technology, market, industrialization conditions, compliance, and effect
Gao Xiang et al. [12]	Technology advantage, resource reserve, policy orientation, market demand, expected benefit

Subjective assessment methods can establish multi-layered questionnaire indicators and conduct quantitative estimates considering various factors. Their advantages include comprehensive evaluation, simplicity, and strong intuitiveness. However, they lack objective data support and require evaluators to possess high academic expertise and rich practical experience, making it difficult to ensure authority and accuracy in practice.

2.2 Objective Data-Based Industrialization Potential Assessment

Objective data primarily derive from academic papers, patent literature, and economic data. Representative studies are summarized in Table 2 .

Table 2. Research on Objective Data-Based Industrialization Potential Assessment

Study	Data Source	Indicator/Factors
Y.T. Li et al. [13]	Papers, patents	Technology focus productivity, quality of technology focus, composite index of industry-specific patent technology focus
M. Hirshey et al. [14]	Patent literature	Patent citation index, number of non-patent citations, technology cycle time

Study	Data Source	Indicator/Factors
Zhu Yuexian et al. [15]	Patent literature	Forward citations, non-patent references, IPC classification count, claim count, patent family size, patent age, maintenance at year 8 post-grant
R. Kapoor et al. [16]	Patent literature	Forward citation analysis, patent family size, IPC classification
Wang Jiwu et al. [17]	Economic data, patents	Technology maturity, technology opportunity, technology position
T. Ogawa et al. [18]	Patent literature	Relative industry base, relative technical strength, market attractiveness
Yu Jingjing [19]	Patent literature	Patent relevance

Objective data-based methods offer relatively easy data acquisition and can reflect real R&D and application scenarios, showing good prospects for identifying emerging technologies with industrialization potential. However, these methods rely too heavily on single data sources, focusing on technology attributes while neglecting external policies, legal frameworks, production environments, and dynamic contextual factors, limiting result comprehensiveness.

In summary, technology industrialization is a complex process with multiple components, dynamic interrelationships, and continuous material, energy, and information exchange with the external environment. Assessing industrialization potential requires comprehensive consideration of both intrinsic technology characteristics and external conditions for large-scale production, social development alignment, and potential economic/social impacts [7]. Both subjective and objective data can partially reflect industrialization characteristics, but different data types emphasize different aspects with varying representational capacities. Single-source approaches often fail to produce comprehensive, reliable results. Therefore, this paper proposes a multi-source data-based industrialization potential assessment method, using genetic engineering vaccine technology as a case study for multi-dimensional analysis.

3. Multi-Source Data-Based Industrialization Potential Analysis Method

3.1 Analysis Framework and Approach

Technology industrialization involves numerous influencing factors. Comprehensive assessment requires integrating multiple factors to approximate real scenarios and improve accuracy. Based on literature review, this paper classifies influencing factors into three categories: environmental foundation for technology industrialization, intrinsic innovation characteristics of technology, and returns from technology investment.

First, technology development trends must align with external policy environments to gain government and social resource support, thereby increasing industrialization probability. Second, more mature domain technologies can better meet complex market demands and effectively interface with markets. Third, if technology investment yields good returns with relatively complete large-scale production and sales conditions, the technology has promising industrialization prospects.

Each factor reflects industrialization characteristics from specific angles but has limitations when measuring overall potential. For instance, some technologies may show high innovation levels but lack suitable policy environments or market conditions, resulting in low actual industrialization potential. Thus, single-factor assessment is insufficient. Among the three factors, intrinsic innovation characteristics are the key internal determinant of industrialization success, while environmental foundation and investment returns are external factors with significant influence. In practice, analysis should prioritize intrinsic innovation characteristics while incorporating the other two factors to holistically reveal industrialization features. Multi-dimensional results can mutually verify and complement each other, yielding more comprehensive and accurate assessments.

Selecting appropriate and sufficient objective data to represent each factor is critical. Various data types can reflect these factors, including patent text and statistics for technology characteristics; strategic planning documents, laws/regulations, and news reports for policy environments; and industry information, financial data, product data, and supply-sales data for market conditions. The analysis framework is shown in Figure 1 [Figure 1: see original paper].

3.2 Analysis Content and Methods

The analysis comprises three components: policy environment analysis, industrial technology analysis, and market situation analysis. Each component's objectives align with factor connotations, with corresponding data types and analytical methods selected accordingly. Given content, format, and structural differences across data types, methods are designed to maximize information extraction. Table 3 summarizes the specific content and methods.

Table 3. Specific Analysis Content and Methods

Influencing Factor	Analysis Content	Expected Objective	Data Type	Data Characteristics	Analysis Method
Environmental foundation	Policy environment analysis	Assess policy adaptability, industry changes, social attention	Policies, strategic plans, news	Primarily text, professionally stored, semi-structured	Text content analysis
Intrinsic innovation characteristics	Industrial technology analysis	Identify key technology themes, assess maturity	Patent text, patent statistics	Text/records, professionally stored, structured	Text content analysis
Investment returns	Market situation analysis	Analyze commercialization features, supply-demand entities, market conditions	Industry info, financial data, product data, supply-sales data	Primarily records, partially professionally stored, unstructured	Statistical analysis

3.2.1 Policy Environment Analysis Documents were retrieved from the "Strategic Emerging Industries Database" of the State Council Development Research Center [20] and the "Leadership Decision Support System" of China Macro [21] using "vaccine" as the search term for the period 2013.01.01–2015.12.12, yielding 131 documents (52 in 2013, 47 in 2014, 32 in 2015). These were batch-downloaded. Using the Chinese Academy of Sciences' NLP system (NLPIR), keywords were extracted from titles and full texts, cleaned, and used to construct co-occurrence matrices (214$×214, 163×163, 105×$105). These matrices were imported into UCINET for network visualization, threshold adjustment, and node clustering. Cluster results were interpreted to analyze the policy environment, technology maturity, and development potential.

3.2.2 Industrial Technology Analysis Data were sourced from the Derwent Innovation Index (DII) in the ISI Web of Knowledge platform. Relevant patents were retrieved with a cutoff date of June 2015, yielding 999 Chinese patent applications. Using TDA software [22], TechFocus fields were extracted, cleaned, and analyzed. Based on co-occurrence relationships among theme words, correlation coefficients were calculated to generate a strategic coordinate map showing maturity and development potential of each technology theme. The strategic coordinate map, proposed by J. Law et al. based on co-word analysis, uses centrality and density metrics to represent relationships within and between technology themes [23].

Formulas: - **Density** measures internal connection strength within a technology theme cluster - **Centrality** measures interaction intensity between a theme and others

The strategic coordinate map plots centrality (X-axis) against density (Y-axis). Technology themes in: - **Quadrant I** (high centrality, high density): Core, highly mature themes with strategic importance - **Quadrant II** (high centrality, low density): Core themes with development potential, increasingly mature - **Quadrant III** (low centrality, high density): Peripheral but mature themes, important investment targets but becoming marginalized - **Quadrant IV** (low centrality, low density): Peripheral, immature themes requiring further development

3.2.3 Market Situation Analysis Data were obtained from Wind Economic Database, Chinascope Database, Wanfang Industry Database, and official websites of the State Intellectual Property Office, China Food and Drug Administration, and National Bureau of Statistics. Available data were statistically analyzed to reveal market conditions and industrialization potential from multiple dimensions.

3.2.4 Integrated Industrialization Characteristics Analysis Based on the above results and expert consultation, comprehensive judgments on technology industrialization potential are made by integrating findings across policy, technology, and market dimensions.

4. Industrialization Potential Analysis of Genetic Engineering Vaccine Technology

4.1 Analysis Object Selection

Genetic engineering vaccines (also called genetically engineered vaccines) use recombinant DNA technology to clone and express protective antigen genes, utilizing expressed antigen products or the recombinants themselves as vaccines [24]. The vaccine industry is a high-end biomedical subfield with high technical, capital, and policy barriers [24]. Genetic engineering vaccines constitute a major component of new vaccine types and represent a key development branch in biomedicine. Given their strategic importance to national security and widespread global attention, this paper selects domestic genetic engineering vaccines as a case study to analyze industrialization potential from policy environment, industrial technology, and market situation perspectives.

4.2 Policy Environment Analysis

A total of 131 vaccine-related documents were retrieved from the two databases for 2013–2015. Keyword co-occurrence networks were constructed for each year to reveal policy environment evolution.

4.2.1 2013 Policy Environment Analysis The 2013 keyword co-occurrence network contained 191 nodes (Figure 2 [Figure 2: see original paper]), forming 11 clusters: (1) GMO products, (2) Biopharmaceutical industry development programs and new vaccines, (3) Foreign pharmaceutical enterprises and medical purchasing, (4) New drug R&D, (5) Pharmaceutical standards and supervision related to generic drugs, (6) Anti-cancer counterfeit drugs and drug supervision, (7) Medical institutions and services, (8) Drug catalog and medical reform, (9) Health informatization, (10) Drug testing and public safety, and (11) Biopharmaceutical industry development and biochemical drug manufacturing.

Only clusters 2 and 4 were relevant to genetic engineering vaccines, indicating that 2013's focus was macro-level and lacked specificity, with substantial room for policy environment development in this field.

4.2.2 2014 Policy Environment Analysis The 2014 network contained 140 nodes (Figure 3 [Figure 3: see original paper]), forming 9 clusters: (1) Drug production standards and quality management, (2) Pharmaceutical engineering and industrial transformation, (3) Essential drug catalog and medical insurance payment, (4) Healthcare system and reform, (5) Pharmaceutical industry development and biogenerics, (6) Drug registration and review, (7) Biotechnology and GMO products, (8) Biopharmaceutical companies and diagnostic reagents, and (9) New drug R&D and drug standards.

Clusters 5, 7, 8, and 9 were relevant to genetic engineering vaccines, showing increased attention compared to 2013 and reflecting improved policy systems and social awareness.

4.2.3 2015 Policy Environment Analysis The 2015 network contained 104 nodes (Figure 4 [Figure 4: see original paper]), forming 9 clusters. Seven were in the largest connected component: (1) Biomedicine and hepatitis B vaccine, (2) Scientific innovation and e-commerce, (3) Cardiovascular disease and diabetes, (4) High-performance medical devices and medical insurance payment, (5) Sequencing technology and hepatitis C, (6) Drug procurement and production, (7) Drug pricing, bidding and sales, (8) Innovation capability, and (9) Anti-tumor drugs.

Clusters 1, 5, and 9 showed strong relevance to genetic engineering vaccines. The decreasing number of network nodes from 2013–2015 indicates focused rather than generalized attention, with themes becoming more specific and micro-level. This shows the policy environment is maturing, with favorable R&D and market conditions.

4.3 Industrial Technology Analysis

Data from DII yielded 999 Chinese patent applications. Using TDA, TechFocus fields were extracted and cleaned. After semantic merging guided by domain experts, 282 high-frequency theme words (accounting for 52.2% cumulative frequency) were selected for analysis.

The Blondel community detection algorithm in Gephi was applied with resolution parameter 0.95, yielding 6 technology themes (excluding 3 isolated points). Top 10 theme words by eigenvector centrality for each theme are shown in Table 4 .

Table 4. Technology Themes in Genetic Engineering Vaccine Domain

Theme	Theme Words (Top 10)
1. Nucleic acid vaccine technology	Nucleic acid, SEQ ID, amino acid, antigen protein, sequence encoding, hepatitis C virus, viral vector, signal peptide, stem cell, T cells
2. Gene vaccine technical methods	Expression vector, fusion protein, PCR, recombinant protein, Escherichia coli, PCR product, DNA sequence, recombinant plasmid, target gene/protein
3. Dendritic cell vaccine technology	Host cell, tumor antigen, vaccine composition, mammalian cell, protective antigen, influenza virus, insect cell, human cell, plant cell, rabies virus
4. Immune adjuvant technology	Organic chemistry, therapeutic agent, disulfide bond, fluorescent label, cationic liposome, expression component, detectable label, preferred agent, immunostimulatory substance, recombinant expression
5. Viral vaccine technology	Virus-like particle, antigenic determinant, CpG motif, human papillomavirus, immunostimulatory nucleic acid, Sindbis virus, expression vector, fusion protein, detectable signal
6. Humanized genetic engineering modification	Chimeric/monoclonal antibody, genomic DNA, pharmaceutical composition, active fragment, amino acid residue, antibody fragment, hepatitis B virus, coding region, antigenic determinant, immunostimulatory nucleic acid

Note: Eigenvector centrality calculates node importance based on both neighbor quantity and neighbor importance [25].

Theme Interpretations: 1. **Nucleic acid vaccine technology** includes DNA and RNA vaccines that induce immune responses. Key focuses include adjuvants, expression vector construction, and immune effect evaluation. 2. **Gene vaccine technical methods** encompass DNA recombination, protein fusion, and recombinant expression technologies, commonly called gene cloning [27].

3. **Dendritic cell vaccine technology** involves tumor immunotherapy and protective antigen screening/identification [26]. 4. **Immune adjuvant technology** focuses on safe, effective adjuvants activating dual humoral and cellular immunity, plus in vitro evaluation methods [28]. 5. **Viral vaccine technology** includes adjuvant-modified viral vaccines, virus-like particle-based subunit vaccines, and adjuvant-free recombinant protein vaccines. 6. **Humanized genetic engineering modification** addresses humanization of monoclonal antibodies, immunogenicity issues, and multiple antibody recombination.

4.3.2 Technology Maturity Analysis Using cosine index to calculate correlation coefficients and strategic coordinate mapping (Figure 5 [Figure 5: see original paper]), the analysis reveals:

- **Quadrant I**: No themes, indicating no mature core technologies currently exist.
- **Quadrant II**: Two core themes with development potential—nucleic acid vaccine technology and gene vaccine technical methods—both increasingly mature.
- **Quadrant III**: Two mature but peripheral themes—humanized genetic engineering modification and dendritic cell vaccine technology—good industrialization prospects but becoming marginalized.
- **Quadrant IV**: Two immature themes—viral vaccine technology and immune adjuvant technology—requiring further R&D.

4.4 Market Situation Analysis

4.4.1 Commercialization Analysis China implements a vaccine batch release system where CFDA conducts mandatory inspection and review before market release [30]. Batch release quantities thus reflect commercialization scale.

Analysis of 2007–2015 data (Figure 6 [Figure 6: see original paper]) shows genetic engineering vaccines consistently accounted for $<25\%$ of total vaccines, with traditional vaccines dominating. Only five genetic engineering vaccines have been commercialized:

1. Recombinant hepatitis B vaccine (Saccharomyces cerevisiae) - 61.9% of commercialized scale
2. Recombinant hepatitis B vaccine (Hansenula polymorpha) - 22.6%
3. Recombinant hepatitis B vaccine (CHO cell) - 13.6%
4. Recombinant hepatitis E vaccine (E. coli) - $<2\%$
5. Recombinant B-subunit/whole-cell cholera vaccine (enteric-coated capsule) - $<2\%$

The three hepatitis B vaccines have established manufacturing conditions and strong industrialization potential.

4.4.2 Supply-Demand Entity Analysis **Production Entities:** CFDA data show 58 qualified vaccine manufacturers nationally, but only 10 produce genetic engineering vaccines (Table 5), indicating limited production capacity and potential supply shortages, yet creating space for future market applications.

Table 5. Domestic Genetic Engineering Vaccine Manufacturers

No.	Product	Manufacturer
1	Recombinant hepatitis B vaccine (Saccharomyces cerevisiae)	Beijing Tiantan Biological Products Co., Ltd.
2	Recombinant hepatitis B vaccine (Saccharomyces cerevisiae)	Shenzhen Kangtai Biological Products Co., Ltd.
3	Recombinant hepatitis B vaccine (Hansenula polymorpha)	Hualan Biological Vaccine Co., Ltd.
4	Recombinant hepatitis B vaccine (Hansenula polymorpha)	Dalian Hanxin Biological Pharmaceutical Co., Ltd.
5	Recombinant hepatitis B vaccine (Hansenula polymorpha)	Liaoning Chengda Biological Co., Ltd.
6	Recombinant hepatitis B vaccine (CHO cell)	North China Pharmaceutical Jintan Biological Technology Co., Ltd.
7	Recombinant hepatitis B vaccine (CHO cell)	Wuhan Institute of Biological Products Co., Ltd.
8	Recombinant hepatitis E vaccine (E. coli)	Xiamen Innovax Biotech Co., Ltd.
9	Recombinant B-subunit/whole-cell cholera vaccine (enteric-coated capsule)	Shanghai United Cell Biotech Co., Ltd.

Only 4 of these manufacturers hold related patents (Table 6), and only 1 produces genetic engineering vaccines, reflecting low integration of R&D and production.

Table 6. Patent-Holding Enterprises' Production Status

Enterprise	Gene Engineering Vaccine Patents (items)	Gene Engineering Vaccine Production
Liaoning Chengda Biological Co., Ltd.	1	No
Liaoning Yisheng Biological Pharmaceutical Co., Ltd.	1	No
Xiamen Innovax Biotech Co., Ltd.	4	Yes
Changchun BCHT Biotechnology Co., Ltd.	1	No

Sales Entities: CFDA data show 447 vaccine distribution enterprises nationally (average 14 per province). Only 9 provinces have $ $20 enterprises (Table 7), indicating limited sales capacity but large market share per entity, suggesting substantial sales potential for both traditional and genetic engineering vaccines.

Table 7. Distribution of Vaccine Sales Enterprises

Enterprises per Province	Number of Provinces
20-29	4
10-19	15
<10	12

4.5 Results Discussion

Key findings: 1. **Innovation characteristics**: Six main research themes exist. No mature core technologies currently dominate, indicating broad future R&D space. Nucleic acid vaccine technology and gene vaccine methods are core themes with high development potential. Humanized modification and dendritic cell technologies, though not core, show high maturity and good prospects. Viral vaccine and adjuvant technologies require further development.

2. **Environmental foundation**: Social attention is increasingly focused, with the policy environment maturing. Production standards and drug safety for strategic emerging industries are gaining importance. Specific technologies like hepatitis B vaccines, anti-tumor drugs, and sequencing technologies have become hot topics, providing favorable external conditions.
3. **Investment returns**: Commercialization remains at a low level and early stage but shows strong vitality. Only five genetic engineering vaccines are commercialized, with the three hepatitis B vaccines having the best industrialization foundation. Both production and sales capacities are limited, with low R&D-production integration but broad sales prospects.

In conclusion, China's genetic engineering vaccine field shows rising innovation levels and improving policy environments, but market conditions remain insufficient to support industrialization of multiple technology themes. Among them, nucleic acid vaccine technology, gene vaccine methods, humanized modification, and dendritic cell technologies demonstrate higher maturity and will have good industrialization prospects once market conditions improve.

Domain experts consulted validated these results as reasonable. This multi-angle analysis avoids misjudgment from single-source dependency and provides detailed, referenceable insights for industrialization decision-making.

References

[1] Yu Jiang. How to break through the industrialization of emerging technologies in China [EB/OL]. [2016-10-10]. http://theory.people.com.cn/n/2014/1013/c40531-25820876.html.
[2] Jun SP, Yeom J, Son JK. A study of the method using search traffic to analyze new technology adoption [J]. Technological forecasting & social change, 2014, 81(1): 82-95.
[3] Duchene A, Sen D, Serfes K. Patent licensing and entry deterrence: the role of low royalties [J]. Economica, 2015, 82(S1): 1324-1348.
[4] Mukherjee A. Licensing under convex costs [J]. Journal of empirical finance, 2004, 11(1): 91-107.
[5] Huang Lucheng, Wang Jiwu, Lu Wenguang. Research on evaluation of new technology industrialization potential based on ANP [J]. Science of Science and Management of S.& T., 2007, 28(4): 122-125.
[6] Sohn SY, Moon TH. Structural equation model for predicting technology commercialization success index (TCSI) [J]. Technological forecasting and social change, 2003, 70(9): 885-899.
[7] Huang Lucheng, Wang Jiwu, Lu Wenguang. Evaluation of new technology industrialization potential [J]. Statistics & Decision, 2007(11): 64-65.
[8] Bai J, Wei H. The potential evaluation of new technology industrialization based on the evaluation of the effects of technical environment [EB/OL]. [2016-10-05]. http://www.seiofbluemountain.com/upload/product/200910/2009glhy09a5.pdf.

[9] Zhou Jiyi, Lü Yuejin. Research on evaluation of emerging technology commercialization potential—Grey clustering model based on AHP [J]. Science and Technology Management Research, 2010, 30(24): 48-51.
[10] Ding Xiuhua, Huang Ruihua. Research on evaluation of patent industrialization demonstration projects [J]. Journal of Intelligence, 2011, 30(8): 28-32.
[11] Lu Wenguang, Huang Lucheng. Research on emerging technology characteristics based on industrialization potential evaluation [J]. Science & Technology Progress and Policy, 2011, 28(22): 5-9.
[12] Gao Xiang, Wang Hongqi, Li Yue. Evaluation of stem cell technology industrialization potential based on rough set [J]. China Science and Technology Forum, 2014(6): 56-62.
[13] Li YT, Huang MH, Chen DZ. Positioning and shifting of technology focus for integrated device manufacturers by patent perspectives [J]. Technological forecasting & social change, 2014, 81(1): 363-375.
[14] Hirshey M, Richardson VJ. Are scientific indicators of patent quality useful to investors? [J]. Journal of empirical finance, 2004, 11(1): 91-107.
[15] Zhu Yuexian, Zhang Xian, Li Shuying, et al. Research on evaluation indicators of patent industrialization potential at home and abroad [J]. Library and Information Service, 2015, 59(1): 127-133.
[16] Kapoor R, Karvonen M, Lehtovaara M, et al. Patent value indicators: case of emerging wind energy markets [C]// Technology management for emerging technologies. New York: IEEE, 2012: 1042-1048.
[17] Wang Jiwu, Huang Lucheng, Lu Wenguang. Discussion on the meaning and evaluation method of emerging technology commercialization potential [J]. Science of Science and Management of S.& T., 2008, 29(4): 32-35.
[18] Ogawa T, Kajikawa Y. Assessing the industrial opportunity of academic research with patent relatedness: a case study on polymer electrolyte fuel cells [J]. Technological forecasting & social change, 2015, 90(1): 469-475.
[19] Yu Jingjing. Research on evaluation of high-tech industrialization projects based on patent portfolio analysis [D]. Qingdao: Qingdao University of Science and Technology, 2010.
[20] DRCnet. Vaccine - Strategic Emerging Industries Database [EB/OL]. [2016-04-08]. http://s1.drcnet.com.cn/search/SearchAC.aspx?chnId=4797&&fields=1$^{\{\{1}$1}}^{%u75AB%u82D7&rc
[21] China Macro. Leadership Decision Support System [EB/OL]. [2017-01-04]. http://gov1.macrochina.com.cn/login.html.
[22] TDA. Thomson data analyzer [EB/OL]. [2016-07-14]. http://www.theVantagePoint.com.
[23] Law J, Bauin S, Courtial JP, et al. Policy and the mapping of scientific change: a co-word analysis of research into environmental acidification [J]. Scientometrics, 1988, 14(3/4): 251-264.
[24] Tang Yanlin, Song Guicai, Liang Wenchang. Research progress and application prospects of livestock genetic engineering vaccines [J]. Jilin Animal Husbandry and Veterinary Medicine, 2005(12): 18-20.
[25] Liu Jun. Introduction to Social Network Analysis [M]. Beijing: Social Sciences Academic Press, 2004.
[26] Lu Fengmin, Zhuang Hui. Research progress of nucleic acid vaccines [J]. Chinese Journal of Preventive Medicine, 1995, 29(5): 303-304.

[27] Zhang Yaxu. Review of DNA recombination technology research [J]. Current Biotechnology, 2012, 2(1): 57-63.
[28] Liu Yang, Cao Xuetao. Current status and development trends of immunoadjuvant R&D and clinical translation [J]. Chinese Journal of Cancer Biotherapy, 2014, 21(2): 192-200.
[29] Hu Apei, Zhang Jing, Lei Xiaoping, et al. Review of patent technology theme analysis based on text mining [J]. Journal of Intelligence, 2013, 32(12): 88-93.
[30] SFDA. What is vaccine batch release [EB/OL]. [2017-01-04]. http://www.sda.gov.cn/WS01/CL1762/15030

Author Contributions

Dong Kun: Designed the research framework and wrote the manuscript.
Xu Haiyun: Proposed the research idea and guided manuscript revision.
Wei Ling: Revised the manuscript.
Fang Shu: Supervised manuscript revision.

Study on Analysis Method of Technology Industrialization Potential Based on Multi-Source Data — A Case Study of Engineering Vaccine Technology

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Abstract: [Purpose/significance] Accurate analysis of the industrialization potential of emerging technology is of great significance for investment decisions, patent layout, resource allocation and market development. [Method/process] This paper systematically summarizes existing evaluation methods, then builds a multi-source data-based analysis framework including policy environment, industrial technology, and market situation analysis with integrated interpretation. Feasibility and validity are verified through genetic engineering vaccine technology case analysis. [Result/conclusion] This method provides a panoramic technology field view, integrates multiple data sources, fuses local industrialization characteristics into overall features, and obtains more valuable results through multi-dimensional mutual verification and complementation.

Keywords: industrialization potential; multi-source data; emerging technology; engineering vaccine

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

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