Postprint: Analysis of R&D Trends and Characteristics in China's Competitive Intelligence Field Using CiteSpace

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Abstract

[Purpose/Significance] Based on bibliometrics, this study analyzes the development trends and future research prospects of the domestic competitive intelligence field during 2006-2016.

[Method/Process] Using journal data indexed by CNKI as the analytical sample, the research examines dimensions including major research institutions, core authors and their collaborative network relationships, and research hotspots.

[Results/Conclusion] Major research institutions control resources such as core authors and projects, thereby dominating major topics in the competitive intelligence field; the leading role of major institutions should be leveraged to strengthen collaboration among academic groups; against the backdrop of big data, interpersonal intelligence networks, privacy detection and privacy protection in social networks, and knowledge management and knowledge innovation demonstrate certain research prospects.

Full Text

Analysis of R&D Trends and Features in the Field of Competitive Intelligence in China Based on CiteSpace

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Abstract

[Purpose/Significance] Based on bibliometrics, this paper analyzes the development trends and future R&D directions of competitive intelligence research in

China from 2006 to 2016. [**Method/Process**] Using journal data from CNKI as the analytical sample, this study examines the field from multiple dimensions including major research institutions, core authors and their collaborative networks, and research hotspots. [**Result/Conclusion**] The findings indicate that major research institutions control core resources such as key authors and projects, and dominate the main topics in the competitive intelligence field. These leading institutions should play a guiding role and strengthen cooperation among academic groups. Against the backdrop of big data, interpersonal intelligence networks, privacy detection and protection in social networks, and knowledge management and innovation show promising research prospects.

Keywords: competitive intelligence; CiteSpaceIII; R&D trends

Competitive intelligence has long been a focal point in information science research and practice. In recent years, scholars have continuously reviewed research findings from different perspectives. One approach employs bibliometric methods for quantitative analysis of literature in the competitive intelligence field. For instance, Liu Xiaoying used CiteSpace and Ucinet to conduct a comparative analysis of author co-authorship and keyword co-occurrence patterns in competitive intelligence papers from Web of Science and CNKI databases between 2003-2012 [1]. Cao Ling et al. utilized SPSS to perform co-word clustering analysis on CNKI data from 1997-2008, examining the internal relationships among high-frequency terms and creating multidimensional scaling maps to explore domestic research hotspots [2]. Yang Lijun et al. analyzed important disciplinary fields, knowledge bases, research hotspots, and frontiers in foreign competitive intelligence using Web of Science data [3]. Qiu Junping et al. applied informetric methods to statistics from CNKI on "competitive intelligence" from 2002-2006, analyzing prolific authors, author distribution patterns, and the disciplinary distribution of journals publishing in this field [4].

Another approach uses qualitative methods for discussion and review. For example, Huang Ruqun analyzed the progress of theoretical methods in foreign competitive intelligence research, summarizing characteristics from three aspects: research themes, methods, and disciplines [5]. Liu Gaoyong et al. examined the opportunities and challenges facing competitive intelligence in the era of big data, forecasting development trends and research priorities [6]. While quantitative methods offer objective data sources, they lack depth; qualitative analysis, however, depends on researchers' experience and lacks data support. This paper combines bibliometric data with qualitative analysis to explore relevant research in the competitive intelligence field.

Visualizing disciplinary development hotspots and frontiers using CiteSpace represents a current research focus in bibliometrics. Knowledge maps can display the development process and structural relationships of scientific knowledge, expressing scientific development patterns in two-dimensional graphical form based on mathematical equations [7]. Reviewing the competitive intelligence

field and detecting research frontiers through knowledge maps not only effectively reveals change patterns during specific periods but also helps scholars understand research priorities and development trends more quickly and comprehensively [8]. This paper employs CiteSpace to analyze journal data on competitive intelligence from CNKI, aiming to identify major research institutions, core authors and their collaborative networks, and research hotspots in China's competitive intelligence field.

1.1 Data Sources

The data source for this study is the CNKI China Academic Journal Network Publishing Database. The search term was "competitive intelligence," limited to the period 2006-2016, yielding 4,585 records (retrieved on February 13, 2017). After manually removing irrelevant data such as conference announcements and call for papers, 4,432 relevant records were obtained.

1.2 Research Methods

This study adopts bibliometric methods, utilizing CiteSpaceIII to create knowledge maps revealing research hotspots in China's competitive intelligence field. CiteSpace [9-10], developed by Dr. Chen Chaomei based on Java, is a software platform for analyzing and visualizing document co-citation networks. Before analysis, CNKI data was converted to CiteSpace-compatible format using the software's built-in conversion program. To comprehensively display the co-citation network, the Pathfinder algorithm was selected in CiteSpace for data analysis and processing. This algorithm treats documents, terms, keywords, and authors as nodes, optimizing the network by pruning less important nodes while retaining critical ones.

2 Analysis of Major Research Institutions

Institutional analysis can identify key research organizations, grasp their research status, and understand the institutional composition within the field. The specific approach combines CiteSpace and Excel 2016 to 统计 major research institutions in competitive intelligence. Data cleaning was performed before analysis—for example, merging publication counts from the Wuhan University Information Resources Research Center (39 papers) with those from the Wuhan University School of Information Management (86 papers) into a single Wuhan University count (125 papers). The cleaned results are shown in [Figure 1: see original paper].

The top 20 institutions published 1,052 articles, accounting for 23.74% of all literature. Wuhan University, Nankai University, and the Institute of Scientific and Technical Information of China ranked top three in publication volume, followed closely by Nanjing University. These four institutions collectively published 456 papers (10.29% of the total), representing the main research force in competitive intelligence.

Among the top 20 institutions, only three are research institutes (Institute of Scientific and Technical Information of China, Chinese Academy of Sciences, and Yunnan Provincial Institute of Science and Technology Information), while the remaining 17 are universities that published 711 papers (79.09% of the top 20 total). This indicates that universities are the primary research institutions, producing most research outputs and playing crucial roles in theoretical research and professional talent cultivation. No enterprises appear in the top 20 because they focus on applied competitive intelligence research with strong commercial and confidential characteristics; publication would compromise their business interests.

3 Core Authors and Collaboration Network Analysis

Author analysis can identify major research groups and collaborative relationships within a field, which is significant for resource sharing, knowledge dissemination, and scientific communication. CiteSpace enables analysis of core authors and their cooperation networks. The parameters were set as: Pruning=Pathfinder, Pruning the merged network, time zone 2006-2016, time slice (Years Per Slice=1), Node Types=Author, displaying top 50 results (Top N per slice=50), with other parameters at default values. After running, the threshold was adjusted (Threshold=13) to select authors with 13 or more publications. The resulting collaboration network is shown in [Figure 2: see original paper]. The color bar at the top represents time; the top-left corner displays version parameters. Node ring colors indicate publication years (corresponding to the color bar), ring thickness/size represents publication volume, and connecting lines indicate collaborative relationships (thicker lines signify stronger collaboration).

[Figure 2: see original paper] reveals that authors such as Wang Zhijin, Peng Jingli, Chen Feng, Wu Xiaowei, Zhao Xiaoyuan, Zhang Yufeng, Huang Xiaobin, and Wang Xiaohui publish papers almost annually, representing core authors in the field. Peng Jingli, Chen Feng, and Zhao Xiaoyuan increased their publication output after 2010, showing rising academic activity in recent years, while Zhou Jiuchang, Liu Minrong, Shao Bo, and Pan Songhua concentrated their publications before 2010, with significantly reduced activity recently. The field has formed author cooperation networks centered on Wang Zhijin (Wang Zhijin, Yan Beini, Chen Jing, Chen Weijun, Xu Fang), Chen Feng (Chen Feng, Zhao Xiaoyuan, Zheng Yanning), Wu Xiaowei (Wu Xiaowei, Li Dan), and Peng Jingli. Collaboration within these groups is relatively close, primarily following mentor-student or colleague patterns, while cooperation between academic groups remains limited. The data from [Figure 2: see original paper] is organized into , where publication volumes correspond to node sizes (larger nodes indicate more publications).

4 Research Hotspot Analysis

Research hotspots represent key issues of widespread concern among scholars during a specific period, reflecting mainstream research directions. Analyzing hotspots helps researchers stay current and grasp disciplinary development trends. Co-word (keyword) mapping combined with burst term detection can analyze research hotspots and their evolution [11]. The parameters were set as: Node Types=Keywords, with other thresholds identical to author analysis. Since "competitive intelligence" as a generalized keyword appeared 2,201 times across 4,432 documents and would affect other results, it was removed from the mapping. The final output is shown in [Figure 3: see original paper]. Nodes with purple circles have centrality greater than 0.1. Centrality measures the proportion of shortest paths between node pairs that pass through a given node. L.C. Freeman noted that centrality measures node influence in networks, with higher values indicating greater influence [12]. Red dots in [Figure 3: see original paper] indicate nodes with sudden frequency increases or decreases during specific periods, corresponding to burst degree. J. Kleinberg's clustering algorithm detects burst values, which reflect scholars' attention levels to specific topics [13].

4.1 Research Priorities Due to severe label overlap in [Figure 3: see original paper], direct interpretation is difficult, requiring key data organization. Nodes with centrality $ $0.3 (purple circles) were compiled into (Research Priorities). Combining [Figure 3: see original paper] and reveals that scholars focused most on three themes during 2006-2016: interpersonal intelligence networks, social networks, and knowledge management.

(1) Interpersonal Intelligence Networks. As one of the most important social relationships, interpersonal connections have become crucial sources for enterprise intelligence. Interpersonal intelligence networks are established to meet organizational information needs and enhance competitiveness [14]. Foreign scholars have conducted extensive research on this topic. M.S. Granovetter conceptualized interpersonal networks as social capital, proposing the strength of weak ties theory—where weak ties create inter-group connections while strong ties maintain intra-group relationships, with weak ties potentially being more valuable [15]. R.S. Burt's structural holes theory [16] and six degrees of separation theory provide theoretical foundations. With rapid internet technology development, interpersonal networks have grown increasingly complex, containing valuable information awaiting discovery. This theme's prominence reflects academic emphasis on interpersonal relationship mining, supported by theoretical foundations and practical demands, indicating strong research prospects.

(2) Social Networks. Since the concept's introduction, social network research has yielded numerous achievements, primarily in application areas including government affairs, social resource allocation, knowledge management, competitive intelligence, and user services [17]. Compared to interpersonal intelligence networks, social networks involve more complex content requiring

broader investigation, including theoretical, application, and ethical dimensions. Luo Yijun et al. noted that research institutions using anonymized social network data may infringe on user privacy, yet China lacks relevant legal protections [18]. Research on privacy leakage and information disclosure remains in its infancy, with real-time monitoring and protection of user privacy representing future trends.

(3) Knowledge Management. Competitive intelligence and knowledge management are two major enterprise operational issues critical for development. Integrating these fields represents a primary concern for domestic and international scholars. Knowledge management concepts are essential when delivering collected competitive intelligence to audiences, and effective integration provides enterprises with competitive advantages [19]. Knowledge management encompasses identification, acquisition, storage, sharing, and innovation, with knowledge innovation being a primary objective 贯穿 the entire process [20]. Many scholars discuss these concepts together. The competitive intelligence field currently lacks research linking knowledge management with knowledge innovation, offering opportunities for further investigation.

4.2 New Research Trends [Figure 4: see original paper] displays the top 20 keywords by burst strength (new research trends), where Strength represents burst degree and red bars indicate hotspot years. “Big data,” “industrial competitive intelligence,” “knowledge mapping,” and “academic research” represent sustained hotspots over the past five years, while themes like “enterprise competitive intelligence” only generated temporary research waves before declining. Research 热度 exhibits strong temporal characteristics, closely related to annual technological innovations and social hotspots.

The centrality and burst analysis reveals that some keywords have high centrality but low burst (e.g., open innovation), while others have high burst but low centrality (e.g., information world). The Sigma (Σ) metric provides weighted comprehensive measurement of both indicators. shows that “big data,” “enterprise competition,” and “knowledge mapping” exhibit high burst, centrality, and Sigma values (nodes with both red dots and purple circles in [Figure 3: see original paper]), representing the most significant research themes during 2006-2016. “Big data” is particularly noteworthy as a recent focus (centrality >0.1) and the hottest trend since 2013 (burst strength 19.78, ranking first).

As big data becomes the defining characteristic of our era, it has fundamentally transformed data usage across industries. Built upon data analysis and information processing, competitive intelligence faces opportunities including elevated status, more valuable intelligence sources, enhanced analytical capabilities, and reduced costs, alongside challenges in data processing capacity and organizational models [6]. “Big data” remaining a hotspot demonstrates researchers’ responsiveness to information organization and processing transformations, with big data-based research becoming mainstream in coming years.

5 Conclusion

This paper reveals the research status of competitive intelligence from three perspectives: research institutions, core authors and collaboration networks, and research hotspots, yielding practically significant findings. The analysis concludes that: (1) Institutions like Wuhan University and Nankai University represent major research forces, controlling core resources including key researchers and projects; (2) Core authors such as Wang Zhijin and Chen Feng have relatively simple collaboration patterns, primarily mentor-student or colleague relationships, lacking inter-group cooperation; (3) Interpersonal intelligence networks, social networks, and knowledge management were research priorities during 2006-2016, with big data being both a hotspot and priority. Future research should deeply mine interpersonal intelligence networks, focus on privacy detection and protection in social networks, and further investigate knowledge management and innovation within the big data context.

References

[1] Liu Xiaoying. Comparative Analysis of Knowledge Mapping in Competitive Intelligence Research in Library and Information Science at Home and Abroad [J]. Journal of Library and Information Science in Agriculture, 2015, 27(5): 55-59.
[2] Cao Ling, Yang Jing, Xia Yan. Co-word Clustering Analysis of Domestic Competitive Intelligence Research Papers [J]. Information Science, 2010 (6): 923-925.
[3] Yang Lijun, Wei Xiaofeng. Visual Analysis of Foreign Competitive Intelligence Research Hotspots, Frontiers and Trends [J]. Library and Information Service, 2011, 55(20): 62-66.
[4] Qiu Junping, Su Jinyan. Bibliometric Analysis of Competitive Intelligence Research in China [J]. Information Science, 2008 (12): 1761-1765.
[5] Huang Ruqun. Review of Foreign Competitive Intelligence Research from 2000-2010 [J]. Information Science, 2014, 32(3): 156-161.
[6] Liu Gaoyong, Wang Huiling, Wu Jinhong. Analysis of Development Trends of Competitive Intelligence in the Big Data Era [J]. Library and Information Knowledge, 2013(2): 105-111.
[7] Chen Yue, Liu Zeyuan. The Quiet Rise of Scientific Knowledge Mapping [J]. Studies in Science of Science, 2005, 23(2): 149-154.
[8] Qiu Junping, Lü Hong. International Library and Information Science Research Hotspots, Frontiers and Knowledge Base in Recent Five Years—Visual Analysis Based on Knowledge Mapping of 17 Foreign Journals [J]. Library and Information Knowledge, 2013(3): 4-15.
[9] Chen C. Searching for Intellectual Turning Points: Progressive Knowledge Domain Visualization [J]. Proceedings of the National Academy of Sciences, 2004, 101(S1): 5303-5310.
[10] Chen C. CiteSpace II: Detecting and Visualizing Emerging Trends and Transient Patterns in Scientific Literature [J]. Journal of the American Society for

Information Science and Technology, 2006, 57(3): 359-377.
[11] Chen Yue, Chen Chaomei, Liu Zeyuan, et al. The Methodological Functions of CiteSpace Mapping [J]. Studies in Science of Science, 2015, 33(2): 242-253.
[12] Freeman L C. Centrality in Social Networks: Conceptual Clarification [J]. Social Networks, 1979(1): 215-239.
[13] Kleinberg J. An Impossibility Theorem for Clustering [J]. Advances in Neural Information Processing Systems, 2002(15): 463-470.
[14] Bao Changhuo, Li Yan, Wang Xiuling, et al. Interpersonal Intelligence Network [J]. Information Theory and Practice, 2006, 29(2): 129-141.
[15] Granovetter M S. The Strength of Weak Ties [J]. American Journal of Sociology, 1973, 78(6): 1360-1380.
[16] Burt R S. Structural Holes: The Social Structure of Competition [J]. Cambridge: Harvard Business School Press, 1992.
[17] Jin Wei, Du Shiqing. Review of Domestic Social Network Theory Application Achievements in Recent Years [J]. Public Communication of Science & Technology, 2014(7): 226-228+210.
[18] Luo Yijun, Liu Qiang, Wang Yu. Review of Social Network Privacy Protection Research [J]. Application Research of Computers, 2010, 27(10): 3601-3604.
[19] Su Xinning, Ren Hao, Wu Chunyu, et al. Organizational Knowledge Management [M]. Beijing: National Defense Industry Press, 2004.
[20] Wang Yan, Bi Lihua. Review and Prospect of Knowledge Management and Knowledge Innovation Research [J]. Library and Information Service, 2011 (S2): 343-347.

Author Contributions:
Hou Xinxin: Responsible for data collection and analysis, and paper writing;
Wei Feng: Responsible for revising the paper framework and finalizing the manuscript.

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