Research on Visualization of Domestic Architecture Management Information System Based on Knowledge Atlas

Wang Junlin[1], Hu Longwei[1] and Guo Fenglu[1]

[1] Qingdao University of Technology, 266520, Qingdao, Shandong, China

wangjunlin: 314670971@qq.com

Abstract. In order to gain insights into the current research status of management information systems in China's domestic construction sector and find out more industry information, 2023 journal articles from 2003 to 2017 in CNKI were used as basic data for research purposes, and knowledge maps were made through citespace. Through author statistics, journal statistics and data sample system statistics to draw and construct visual graphs to study influential author relationships, and cooperative relationships in the architectural field; And use the keywords to build a timeline view and time zone to analyze the research frontiers and development trends in the field of architecture. The construction of the knowledge map provides an intuitive and convenient way for the research of the building management information system in China.

1. Basic data sources and research methods

1.1 Basic data sources

The basic data of the literature for visual analysis in this paper comes from the CNKI database. The journal data was collected on January 30, 2017 in a topic search. Under the journal's document type, the keyword "Management Information System" was used as the key word. The search included "architecture" as the restriction condition in the abstract. The literature source category was selected as SCI. , EI and CSSCI 3 types, time limited from 2003 to 2017, manual filtering and collation of documents initially searched to exclude irrelevant documents that cannot be accurately identified by the technology, and ultimately 2023 document texts (txt) files As a sample of data.

1.2 Research methods

This paper makes use of the quantitative and qualitative methods as the supplements, using citespace software to visualize the basic literature, and study the frontier hotspots and development trends in the field. The specific steps are: The first is to use keywords of authors, institutions, and periodicals to search for key scientific research authors, related research institutions, journal statistics, and cooperative relationships; second is to use keywords to conduct research hotspots in the current field. Analysis; third is the use of timeline and time zone views combined to study the frontier dynamics in the field.

2. Visual Analysis of Building Management Information System

2.1 Bibliometric analysis

Based on the analysis of 2023 basic data, the management information system of the domestic construction industry has been on an overall upward trend from 2003 to 2017. From 2003 to 2003, the

number was steadily increasing to 202 in 2007, and then there was a slight decline. The overall increase continues to show that experts and scholars in the field of architecture have significantly increased their attention to the field and have a more mature understanding of the application of management information systems, and gradually improved the deficiencies in the field.

Table 1. Statistical table

years	2003	2004	2005	2006	2007	2008	2009
quantity	106	129	135	151	202	179	177
2010	2011	2012	2013	2014	2015	2016	2017
183	210	203	242	386	307	354	295

.

2.2 Research Paper Author Statistics
The authors of the statistical studies on domestic building management information systems used Cite Space's "Author" to collect statistics on the authorship of relevant documents and found that there were 385 authors in the sample data, among which the top 10 authors are listed in Table 1. A further study of important authors found that Professor Ma Zhiliang of Tsinghua University ranked first was the main research area of civil engineering information technology, and Professor Zhang Jianping from Tsinghua University was the second most important research field. For the construction field informatization and building information model BIM, ranked 3rd in the Department of Information Management of Sun Yat-sen University, associate professor Zhang Yang, the main research areas for network information resources management, network information metrology, network information resources evaluation, ranked 6th Prof. Cheng Dazhang of Tongji University is the research direction of intelligent building technology and urban information technology. The seventh place is Prof. Chen Yuan of Information Management College of Wuhan University. The main research areas are project management and network information dissemination. The 8th place is Professor Zhu Wei of Zhejiang University. The main research area is building energy conservation. Wang Bing and Zhao Yuntao, ranked 9th and 10th respectively, belong to the same management information team. The rest of the authors are also related to the construction field, so they can get Research on domestic building management information systems is mainly concentrated in universities.

Table 2. Author statistics

Rank	Author	frequency	Rank	Author	frequency
1	Ma Zhiliang	8	6	Cheng Dazhang	3
2	Zhang Jianping	6	7	Chen Yuan	2
3	Zhang Yang	4	8	Zhu Wei	2
4	Huang Chun	4	9	Wang Bing	2
5	Wei Xinhua	4	10	Zhao Yuntao	2

In the knowledge map, there is a positive correlation between the number of cited documents and the hot issues in the field. However, the number of citations and research content of the papers are not directly linked but are influenced by social relations and journals. And some articles cite literature references in order to refute the point of view of this document. Therefore, there is no direct

connection between the number of cited documents and hot issues. From the key nodes in the map, we can see that there is no direct connection between the number of citations and the centrality of the network. At the same time, there is a high degree of citation for high agency centrality.

Table 3. Citation ranking

Reference degree	Author	Rank	Reference degree	Author	Rank
0.02	Zhang Jianping	1	0.01	Li Mingfeng	6
0.02	Chen Yulin	2	0.01	Liu Yan	7
0.02	Wu Dapeng	3	0	Huang Chun	8
0.01	Ma Zhiliang	4	0	Wei Xinhua	9
0.01	Zhang Yang	5	0	Zhao Yuntao	10

2.3 The main research institute

Using CiteSpace's "Institution" to analyze the distribution of sample data for the research institutions, the top 10 are ranked according to frequency from high to low, as shown in Table 2. It can be clearly seen that there is a significant corresponding relationship between the research institutions and the authors. The first place is Tsinghua University with 30 journals; the second place is China Academy of Building Research, with 6 journals; ranking 3rd The second is the China Construction Second Bureau and the number of journals is four. The distribution status of other research institutions is no longer detailed. Through the above studies, it can be seen that the main author's literature has a positive relationship with the organization's publication frequency. The main author of the organization is the main force of the organization's publishing, but it also shows that other researchers in the organization have not been fully utilized, and the institution itself must pay attention to The role of other personnel in the field.

Table4. Institution ranking

Rank	Institution	frequency	Rank	Institution	frequency
1	Tsinghua University	30	6	Wuhan University	4
2	China Academy of Building Research	6	7	Zhejiang University	3

3	China Construction Second Bureau and a company	4	8	China Construction Third Bureau First Construction Engineering Co., Ltd	3
4	Beijing Institute of Architectural Design	4	9	Tianjin Engineering Construction Trading Service Center	3
5	Tongji University	4	10	China Academy of Building Research Institute of Architectural Engineering Software	3

The sudden word is to indicate that the frequency of use has suddenly increased in a certain period of time, and through the analysis of the emergent words, we have studied the frontier dynamics and development trends of the domestic construction field in China. Select the mutation word by keyword type. If other parameters are set unchanged, click Run to get the graph shown in the figure. Using research institutions as research objects, it can be seen that the number of civil engineering majors of Tsinghua University has seen an explosive growth from 2001 to 2005, indicating that since 2001, the Department of Civil Engineering of Tsinghua University has begun to pay attention to the management information system in the construction field. Development and research.
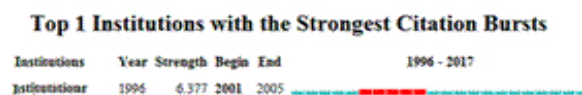

Figure1.Institutions with the Strongest Citation Bursts

3. Research Hotspots and Frontier Analysis of Management Information System in Construction Field

3.1 Research hotspots of management information systems in the field of architecture
Keywords in the article is very general, is the soul of the article, is the overall concentration and refinement of article ideas. Therefore, we can study key issues in a certain area with the help of keywords. Analysis of hot issues in the field of architecture through the frequency of keyword occurrences.

Table5. Keyword ranking

Rank	Keyword	frequency	Rank	Keyword	frequency
1	Informatization	135	6	Building Information Model	80
2	Construction companies	107	7	Information system	70
3	information Technology	86	8	BIM	69
4	MIS	84	9	Building Construction	64
5	Construction project	83	10	Project management	64

After the Cite Space keyword co-occurrence analysis results in the frequency table of all keywords of the basic data, it can be concluded that the top 10 keywords are shown in Table 4. In the CNKI database, "Management Information System" is used as a keyword, and in the abstract, "Architecture" is included as a constraint. Therefore, keywords such as management information system, information system, informatization, and information technology have a higher frequency; Key words analysis can find that the research hotspots in recent years are mainly focused on BIM, construction project management and so on. (Since BIM has the same meaning as the building information model, both the BIM and the building information model in the following text will omit the building information model.)

Table6. Citation ranking

Rank	Reference area	Citation	Rank	Reference area	Citation
1	computer	1.04	6	Construction management	0.69
2	Project general contracting project	1.03	7	construction company	0.54
3	MIS	0.97	8	information Technology	0.52
4	Building Information	0.9	9	application	0.45
5	Development Outline	0.78	10	Tangible Construction Market	0.45

3.2 Research frontier analysis
At the same time, use the "Time Line" and "Time Zone" functions in Cite Space to analyze the frontiers and development trends of the architectural field. The timeline view uses the time of publication as the abscissa and the cluster as the ordinate, which visualizes the historical development of periodical literature. From the timeline graph, we can see that the earliest research on management

information systems was in the fields of logistics and equipment management, and then gradually progressed toward the hospital building, safety management, and design and construction fields, indicating that the future construction field will pay more attention to management information. System construction.
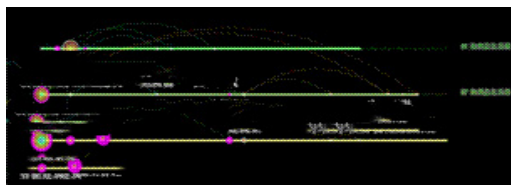

Figure2. Timeline view

The time zone view divides the time zone by the abscissa time, and shows the content by interpreting the development process of knowledge. On the whole, the amount of documents issued in each time zone gradually increased; each time zone was closely related, including time zone 1 and time zone 2, time zone 1 and time zone 3, time zone 2 and time zone 3, and time zone 3 and In the time zone, there is a strong relationship between inheritance (from 2003 to 2017, every two years as a time zone), we can learn about the development of management information systems, and the application of BIM in construction projects has gradually become a mainstream research trend.
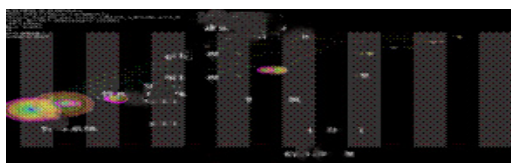

Figure3. Time zone view

4. Conclusion and Suggestions

The Cite Space software is used to analyze the development status of the management information system in the domestic construction field, and the following conclusions are obtained after analyzing the basic journals of the 2023 architectural fields in CNKI through the knowledge map theory. (1) The number of papers has been increasing year by year from 2003 to 2017. From the study authors, the paper has a certain cooperation rate but is not obvious. From the point of view of publishing agencies, important authors and publishing organizations have a significant corresponding relationship, and universities are particularly prominent; From published journals, it focuses on the field of information and construction engineering research. (2) From the point of highlighting the key words, the management information system entered the construction and construction enterprises in 2008, and it gradually began to integrate the informatization of construction companies in 2009. The number of BIM researches increased from 2015 to 2017. (3) Analysis of the timeline and time zone diagrams shows that BIM has initially received the attention of scholars and laid the foundation for subsequent research. Compared with the research of the international construction management information system, the study of China's domestic construction management information system has a certain lag and specificity. BIM and other contents have received universal attention in international research, and China is developing a building management information system for its own characteristics. At the same time, the following points are proposed in response to the problems found in the research process: (1) Learning the lag in emerging technologies abroad. Learning new technologies from abroad requires further improvement of the corresponding learning mechanisms and advancement of learning new technologies. (2) Insufficient quantitative research. At present, the relevant literature research mostly focuses on qualitative analysis, and lacks literature on quantitative analysis such as development and research status. The field of architecture should strengthen research and analysis on these types of review articles. (3) Insufficient application research. The current research focuses on the

development of surface layers such as BIM, and many aspects such as the practical application and promotion of BIM technology still need to be researched and expanded, and the depth and breadth of research need to be improved.

At present, the research of management information system is still relatively abstract. This paper forms a visualized and intuitive knowledge map content for the basic literature information collected from CNKI in 2003-2017. Through Citespace's visual analysis, it is possible to clearly and clearly express the research authors, institutions and their partnerships, and the highlighting time of keywords in the field, such as intuitive understanding, clear research hotspots and frontiers, etc., to provide certain certainty for researchers in the field of architecture to determine future research directions. Reference; and through the summary of the deficiencies in the study to put forward reasonable suggestions for the future of the construction sector to help form a suitable architecture management information system system.

References

[1] Wang Dan,Wu JingJing, 2016, Visualization Research in China Building Safety Analysis Based on Mapping Knowledge Domain, Journal of Engineering Management, vol 30,no.6, pp 43-48

[2] Chen C,Hu Z , Liu S, et al.,2012,Emerging trends in regenerative medicine :Ascientometric analysis in Cite Space vol 12,no.6 ,pp 593-608.

[3] Manderson, A. Jefferies, M. & Brewer, G. ,2015 ,Building information modelling and standardised construction contracts: a content analysis of the GC21 contract. Construction Economics and Building,vol 15,no.3, pp 72-84.

[4] Shibeika, A. & Harty, C. ,2015, Diffusion of digital innovation in construction: a case study of a UK engineering firm. Construction Management and Economics,vol 33,no.5, pp 453-466.

[5] Shou, W. Wang, J. Wang, X. & Chong, H. Y. ,2015 ,A Comparative Review of Building Information Modelling Implementation in Building and Infrastructure Industries. Archives of Computational Methods in Engineering, vol 22,no2, pp 291-308.