

# Analysis of the progress of domestic post-occupancy evaluation (POE) research based on bibliometrics

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**Abstract.** This study aims to examine the status and developmental trends of Chinese Post-Occupancy Evaluation (POE) research literature from 2002 to 2022 using a bibliometric approach. Leveraging the CiteSpace software tool and utilizing the CNKI database as the exploration scope, we conducted visual analyses of publication volume, research institutions, highly cited papers, and keywords in Chinese POE research literature between 2002 and 2022. Through our analysis, we found that Chinese POE research has exhibited a shift from introducing macro-level theories and methods towards specific practical applications over the past 20 years. It also identified issues such as insufficient systemic stability and data granularity. This study, employing bibliometric methods and tools, makes a significant contribution to the field of POE research.

## 1 Introduction

Post-Occupancy Evaluation (POE) is a method used to assess the actual performance of buildings and user satisfaction by conducting on-site research and evaluations of the built environment.1 POE research originated in the 1960s and matured in theoretical and methodological terms during the 1990s.

In China, the research of POE can be traced back to the 1980s. Due to the development of disciplines like environmental psychology and environmental behavior, Chinese scholars began to explore POE. While some researchers did not explicitly term their work as POE, the nature and scope of their studies fell within the realm of POE. In 1982, Chang Huaisheng introduced environmental psychology and began spreading the theory of environmental assessment in China. He systematically introduced the basic principles, operational procedures, and methods of POE in his book *Interior Environment Design and Psychology*. [2] Subsequently, scholars like Kongjian Yu conducted systematic evaluations of natural landscapes from the perspectives of landscape aesthetics, preferences, and sensitivity, publishing numerous papers that focused on comparative analyses and research on various evaluation methods. [3] In 1987, Qinghui Chen explored the establishment of a comprehensive set of evaluation factors, attempting social research methods and statistics-based quantitative analysis in *An Initial Exploration of the Evaluation Method for Urban Living Environment Quality*. [4] Zhengfan Hu and Yulian Lin, building on the

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"Environment-Behavior" theory, conducted evaluation studies of university campus environments and scenic areas using cognitive maps. They explored elements of public environmental imagery, provided guiding recommendations for design, and conducted evaluation research on the sensory quality of campuses using the "Semantic Differential" (SD) method.[5] Many scholars and graduate students have conducted extensive research on public facilities, sports and cultural facilities, and landscape architecture. In 2002, Xiaolei Zhu and Shuoxian Wu published a paper titled *The Influence of Post-Occupancy Evaluation on Architectural Design and Its Significance in China*, which provided a detailed explanation of the meaning of POE, design procedures, and operational processes promoting the use of POE methods and its influence in China [6]. As attention to building environment quality and user experience continues to grow, the application and research of POE in the field of architecture have gained increasing importance.

Despite the ongoing development and deepening of POE research in China, there is a need to review and summarize its progress from various perspectives and methodologies. This study intends to employ a bibliometric research approach. It conduct a retrospective analysis of literature on POE research in the China National Knowledge Infrastructure (CNKI) academic journal The study will visualize publication volume, research institutions, highly cited papers, and keywords to explore research hotspots and development trends in this field.

## **2 Scope and methodology of the study**

### **2.1 Data source**

The research data was sourced from the China National Knowledge Infrastructure (CNKI) academic journal database. In the CNKI database, the search criteria were set to 'Post-Occupancy Evaluation' and 'POE,' and the publication year range was set from 2002 to 2022, resulting in 744 entries. Entries unrelated to the topic of post-occupancy evaluation, such as newspapers, and interviews, were excluded, leaving a total of 717 valid documents. Data collection was completed on August 20, 2023. These documents were imported into CiteSpace in RefWorks format to create a knowledge map.

### **2.2 Research methodology**

CiteSpace is a scientific metric visualization software developed by Professor Chaomei Chen's team at Drexel University in the United States, based on the Java platform.<sup>7</sup> In recent years, it has been widely used in bibliometric analysis.

**Research integration method:**The research involves a comprehensive evaluation, analysis, and synthesis of collected and filtered literature. This approach runs throughout the study and is extensively utilized in the analysis of POE research hotspots, future development trends, and other research phases.

**System analysis method:**The developmental trajectory of domestic Post-Occupancy Evaluation (POE) research can be regarded as a system. Analyzing the essence of the system, its constituent elements, as well as the logical relationships between the system and its elements, allows for an exploration of future development trends.

### 3 Data analysis

#### 3.1 Trend analysis of the volume of publications

The annual publication volume changes obtained from CiteSpace can, to some extent, reflect the research history and quantity fluctuations within the field. Figure 1, the average annual publication volume from 2012 to 2022 exhibits an overall linear upward trend.

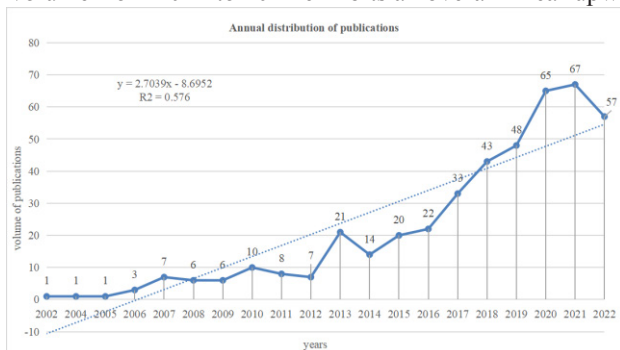


Fig. 1. Statistical chart of POE annual average number of posts.

#### 3.2 Analysis of highly cited literature

Highly cited literature reflects the focal points within a specific research field. Figure 2, the top 10 highly cited publications in the field of Post-Occupancy Evaluation (POE) research are presented. It can be observed that Chinese POE research predominantly focuses on analyzing the characteristics and methods of foreign POE research and how they can be further applied in China.

#### 3.3 Analysis of research hotspots

Combined with the high-frequency keyword list, as shown in Table 1, the data indicates that Post-Occupancy Evaluation (POE) research in China primarily focuses on the following: Research Subjects: Buildings, urban public spaces, landscape architecture, and green buildings. Research Methods: satisfaction assessments, and other methods to gather user feedback. Research Objectives: To provide opportunities for improvements in architecture, propose enhancement strategies, and drive continuous improvement and development in the field of architecture.

Table 1. POE research keyword frequency statistics.

No	Frequency	Centrality	Year	Keyword
1	30	0.11	2003	satisfaction
2	22	0.07	2011	landscape garden
3	22	0.07	2006	architectural planning
4	21	0.06	2019	optimization strategy
5	21	0.03	2013	city park
6	16	0.04	2007	public space
7	15	0.08	2004	user
8	12	0.08	2010	post-assessment
9	11	0.05	2007	built environment
10	10	0.06	2002	architectural design

No	Articles	Authors	Journals	Year	Citation count	Download
1	The impact of post-use evaluation on architectural design and its significance for our country	Zhu Xiaolei, Wu Shuoxian	Architectural Journal	2002	440	3576
2	International Trends in POE Research and Practical Reflections on Introduction to China	Luo Lingling, Lu Wei	Architectural Journal	2004	355	2646
3	Learning from the Past - An Introduction to Post-Use Evaluation (POE) Methods	Han Jing, Hu Shaoxue	Architectural Journal	2006	332	5495
4	Important Research Direction in Architecture - Post-Use Evaluation	Wu Shuoxian	South Architecture	2009	322	3169
5	Post-use evaluation of POE development characteristics in foreign countries and applicability research in China	Zhao Donghan	Acta Scientiarum Naturalium Universitatis Pekinensis	2007	275	3931
6	Domestic and international studies on the development of situation of use evaluation (POE)	Zhao Donghan	Urban Environment Design	2007	258	2518
7	Post-use evaluation (POE) study of greenway system in Zengcheng, Guangdong, China	Wu Juanyu	Chinese Landscape Architecture	2011	164	3714
8	Post-use evaluation of urban open spaces and their environments	Chen Jianhua	Building Science	2007	120	2218
9	A Review of Post-Operation Evaluation (POE) Research in the Built Environment	Yin Xin, Gong Siting, Sun Yimin	Journal of Shandong Jianzhu University	2018	109	2390
10	The significance and methods of introducing post-use evaluation in Chinese landscape design	Ying Jun, Shen Xiao	Journal of Zhejiang A & F University	2009	97	1235

**Fig. 2.** Top 10 highly cited literature.

Building upon the co-occurrence network of keywords, a clustering analysis was conducted using the Log-likelihood Rate (LLR) algorithm to group existing information into clusters. This resulted in the formation of 9 distinct cluster groups, namely: "Urban Parks," "Architectural Design," "Public Spaces," "Architectural Planning," "Built Environment," "Satisfaction," "Landscape Architecture," "Indicator Systems," and "Optimization" Figure 3.



**Fig. 3.** Cluster analysis.

In this clustering analysis, the Q-value was 0.8719, and the S-value was 0.9452, indicating high confidence in the clustering. Based on the clustering analysis, domestic Post-Occupancy Evaluation (POE) research can be categorized into the following aspects:

- Building Environment Assessment: This includes aspects such as building orientation and transparency, selection and use of building materials, acoustic properties, and more.

- **User Perception and Satisfaction:** This involves understanding user evaluations of various aspects, including building functionality, exterior appearance, interior layout, functionality, convenience, comfort.

- **Green Building Assessment:** This area focuses on assessing the energy efficiency of buildings through data collection and analysis of energy consumption.

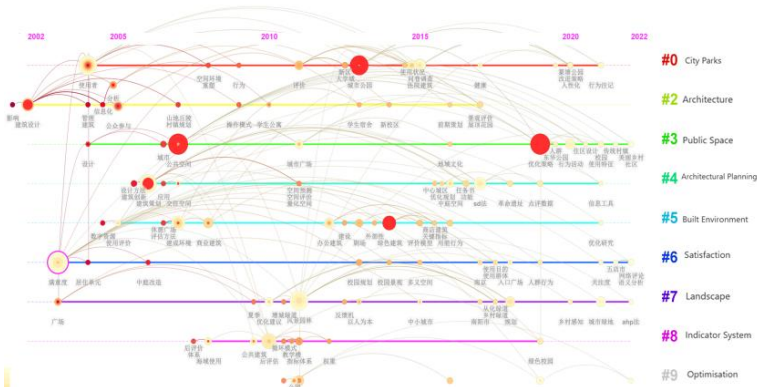
Additionally, Figure 4 ranks clusters by size and provides labels for the nodes within each cluster, reflecting different research perspectives and hot topics within each cluster.

No	Size	Cluster	Mean contour value	Contained node tag words (based on LLR algorithm)
1	24	City Parks	0.941	City Park (13.39); Users (8.79); Improvement Strategies (6.64); Hospital Buildings (6.64); Seal Pond Park (6.64)
2	19	Architecture	0.873	Building design (17.41); Analysis (11.5); Public participation (11.5); Necessity (5.7); Cases (5.7)
3	18	Public Space	1	Public Space (31.74); Optimisation Strategies (11.62); Behavioural Activities (7.71); Community (7.71); Environmental Behaviour (4.2)
4	18	Architectural Planning	0.975	Architectural planning (25.82); sd method (12.7); interaction space (8.42); function (8.42); whole process consulting (8.42)
5	16	Built Environment	0.951	Built Environment (14.41); Use Evaluation (9.54); Green Building (9.5); Theatre (9.54); Commercial Building (9.54)
6	16	Satisfaction	0.983	Satisfaction (35.23); Internet Reviews (8.52); Campus Planning (4.24); Traditional Neighbourhoods (4.24); Urban Wetland Parks (4.24)
7	12	Landscape	0.864	Landscape Architecture (19.44); Optimisation Suggestions (12.27); People-oriented (8.14); Planning (8.14); Renewal (4.05)
8	7	Indicator System	0.985	Indicator system (17.41); Post-assessment (11.5); Sea area use (11.5); System (5.7); Circular model (5.7)
9	6	Optimisation	0.975	Optimisation (12.73); Landscape (12.73); Historic districts (6.29); Sanfangqixiang (6.29); Urban imagery analysis (6.29)

**Fig. 4.** POE Keyword clustering grooming.

## 4 Domestic POE research trends

### 4.1 Basic timeline



**Fig. 5.** Timeline mapping.

Based on the timeline graph obtained from CiteSpace Figure 5 and in accordance with earlier literature analysis and feature, the development of domestic Post-Occupancy Evaluation (POE) research in China from 2002 to 2022 can be divided into three phases:

- **Theoretical Establishment and Initial Development (2002-2014):** During this phase, research primarily focused on assessing the technical performance of buildings and spaces. In general, the research during this stage was based on a combination of foreign POE research frameworks and the specific conditions in China.

- **Data accumulation and empirical research. (2015-2018):** With the gradual improvement of the theoretical establishment and the rapid development of the construction field, domestic POE research begins to pay attention to the accumulation of data and empirical research, and the research method is more systematic and scientific. The content of the study covers not only the physical environment of the building, but also the influence of social and cultural factors on the post-use effect.

- **Maturity and Breakthrough Transformation (2019-2022):** With the gradual maturation of POE theory and practice, domestic POE research further expanded. Additionally, government initiatives promoted the practical application of POE research. For example, the *Green Building Evaluation Standards* released in 2019 explicitly emphasized the requirements for building evaluations and encouraged the use of POE methods to assess the actual performance of buildings and user satisfaction.

## 4.2 Research and development trend

- **Research Scope:** In the early stages of Post-Occupancy Evaluation (POE) research in China, the focus was primarily on the establishment of theories and the development of models, particularly concerning how to select theories and construct models. Specific project-based or issue-based research was limited to the usage end, with relatively less emphasis on the relationship between buildings and users. Later on, research began to integrate knowledge and methods from different disciplines, expanding to cover broader aspects.

- **Research Objects:** The evolution of research objects has progressed from primarily focusing on technical performance in the early stages to encompassing various aspects of the building field. Influenced by events like the 2008 Beijing Olympics and the 2010 Shanghai World Expo, China's construction industry has experienced rapid growth. Research objects in POE have been influenced by economic, technological, and social developments. These developments reflect a transition from focusing on space adaptability and comfort to gaining respect for the occupants within the space.

- **Research Methods:** According to the literature data, research methods in Chinese POE studies can be broadly categorized into three groups: theory, theoretical models, and application models. Early research primarily involved the introduction of theories and the development of application models, aimed at creating a research environment for POE and its utilization. With the development of big data and artificial intelligence, dynamic assessments and multi-faceted POE methods are gradually finding application.

## 5 Discussion and conclusions

Post-Occupancy Evaluation (POE) research emphasizes the interaction between building environments and users, holding significant importance in optimizing building environmental performance and user experiences. Through a literature-based analysis using bibliometrics, the following conclusions can be drawn regarding POE research in China:



- Chinese POE research has moved beyond the introductory phase of foreign research paradigms and has entered a relatively in-depth and detailed research phase with distinctive Chinese characteristics.

- The focal points of Chinese POE research have become closely aligned with the nation's developments in the construction industry over the past decade. The research scope has shifted from macro-level theories to micro-level construction projects.

- The systematic theories and models in Chinese POE research are still in the process of stabilization and refinement. the development of persuasive data models and the establishment of detailed data systems are areas that require further attention.

It is worth noting that bibliometric research using tools like CiteSpace can reflect phenomena from a literature perspective, but it may not encompass all research comprehensively. Specifically, POE reports or conclusions from specific building projects, which rely on databases with certain limitations.

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