Visual Analysis of the Progress, Hot Spots and Trends of Service Design Research Based on Bibliometrics

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ABSTRACT

In order to better understand and grasp the progress of service design research at home and abroad, we analyzed the distribution of relevant literature output, research hotspots, basic knowledge and frontier trends with the help of CNKI database and Web of Science database as domestic and international data sources, combined with literature clustering and bibliometric methods. The results show that both domestic and foreign service design research is on the rise, and the research hotspots and citation frequencies are higher in foreign countries than in China. Foreign research hotspots mainly shift from quality, model, design, and management to science, technology, and service system, and focus on user needs and experience, and design thinking becomes a new research focus and continues to this day; while domestic research is mainly oriented to social innovation, public culture and technology-driven service design.

Keywords: Service design, Knowledge graphs, Research progress, Visual analysis

INTRODUCTION

Service design was first put forward by Shostack in 1980s (Lynn Shostack, G., 1982). Since then, "service", as a research object with multi-disciplines and multi-fields, is being explored from top to bottom or from bottom to top, and many concepts such as service economy, service marketing, service management, service engineering and service science have been derived (Hu, F., 2019). In the field of design, the formal proposal of service design originated from Total Design written by Hollins in 1991 (Hollins G., 2019). Service design has evolved on the basis of interactive design, and combined with the knowledge of different professional fields such as product design, ethnography, service management and information system (PATRíCIO L., 2013), it has evolved into an interdisciplinary comprehensive research method (Cheng, X., 2020). With the continuous development of service economy and experience economy, a large amount of research literature has emerged in the field of service design at home and abroad, but there are few review articles. Based on

this, through quantitative and systematic combing, we understand the distribution of domestic and foreign research and the current research hotspots, so as to provide effective reference for subsequent research.

RESEARCH DESIGN

Research Methodology

This study adopts the method of Mapping Knowledge Domain (MKD) by Chen Chaomei and other scholars (Chaomei Chen, 2016). With the help of information visualization tools VOSviewer and Citespace, we analyzed the output distribution, research hotspot distribution, basic knowledge and frontier trend of the literature, and draw the corresponding scientific knowledge map to show the research progress of service design at home and abroad.

Data Source

This paper takes the service design research literature collected in CNKI database and Web of Science database in the past 20 years as the sample, and the time span of the study is from 2002 to 2022. In order to ensure the credibility and investigation value of the data sources of this study, the three major citation indexes of SSCI, SCI-Expanded, and A&HCI in the core collection of authoritative database Web of Science were selected as the data sources, and the search formula was set as follows after manual comparison and analysis to remove irrelevant results: TS = ("Service Design" or "Design for Service" or "Design of Service") for the subject search, and the document type was Article. The search results were carefully checked and sorted out, and irrelevant data samples were deleted, and a total of 1018 articles were retrieved. Then it was searched in CNKI database under the same search conditions, and 914 valid sample documents of domestic service design were obtained after sorting out and eliminating.

BIBLIOMETRIC RESULTS AND ANALYSIS OF SERVICE DESIGN

Distribution of Research Outputs

A line graph of the time series change in the volume of domestic and foreign service design publications is shown in Figure 1, which shows that the volume of literature has been on the rise in the last 20 years. The number of foreign publications shows a fluctuating upward trend, rising significantly from 2003 to 2004 and from 2009 to 2011, surging to 102 from 2017 to 2019, and reaching a peak of 133 in 2021. The number of domestic publications showed a continuous increase from 2002 to 2014, and a surge from 2014 to 2015, peaking in 2021.

During the period 2002 to 2022, foreign service design research has focused on management, operations research management, and business, followed by relatively more research in engineering and manufacturing, computer science information systems, engineering industry, art, engineering electronics, telecommunications, and public environmental occupational
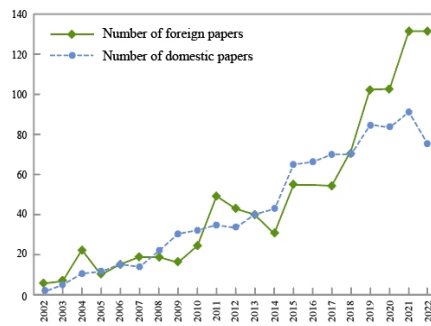
Figure 1: Amount variation of published service design papers as time changes at home and abroad.

health. Among them, management and business are particularly prominent, reflecting the close association between service design and its existence.

The data in the WOS database were classified by country and region, and the knowledge map of the country/region cooperation network was obtained as shown in Figure 2. In terms of partnership networks, the United States and the United Kingdom, China and Canada cooperate more closely, the United Kingdom has the most contact with Scotland and the United States, China has the most cooperation with the United States and Singapore, and Australia has more cooperation with England, Sweden, the United States, China, New Zealand, and Italy in that order. The United Kingdom has the most contacts with Scotland and the United States, China has the most contacts with the United States and Singapore. The top 10 countries/regions are listed in Table 1, and there are more than 40 major countries/regions in the past 20 years and the total number of published articles in the top 10 countries/regions accounts for 93.51% of the total data. Among them, the UK tops the list of countries in terms of the number of publications, in addition to China, the US and Australia, which have also accumulated a large number
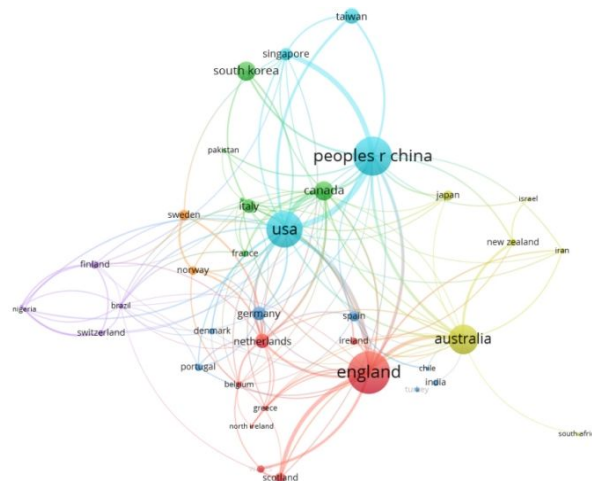

Figure 2: Cooperation distribution map among countries and regions.

Table 1. Top ten countries/regions of published papers in number.

No.	Country / Region	Number of articles published	Total citations in the literature	No.	Country / Region	Number of articles published	Total citations in the literature
1	England	197	3948	6	Canada	65	1032
2	China	172	2090	7	Taiwan	47	638
3	Australia	120	1728	8	Netherlands	44	1417
4	USA	159	3397	9	Germany	41	863
5	South Korea	66	432	10	Italy	40	894

of researches in this field and ranked in the top five in terms of the number of papers.

There are 203 major research institutions in the field of service design research in the past 20 years, and the top five service design research institutions are University of Sydney, University of Toronto, University of London, Nanyang Technology University, and University of Melbourne (Table 2). The ranking of domestic institutions in terms of CNKI publications (top 5) is shown in Table 3. Jiangnan University is in the leading position in China (57), while Hunan University (37), Tsinghua University (35), Guangdong University of Technology (25), and Guangzhou Academy of Fine Arts (22) in the 2nd-5th positions respectively.

A total of 3,997 foreign scholars have contributed in the field related to service design. The most productive foreign authors in the field of service design are listed in Table 4, which lists the six most productive authors. Among them, Shimomura, Yoshiki is the most productive, followed by Lee,

Table 2. Top five foreign institutions of published paper in number.

Institutions	Number of articles published	Total citations in the literature
University of Sydney	20	350
University of Toronto	17	316
University College London	17	367
Nanyang Technology University	17	384
University of Melbourne	17	612

Table 3. Top five domestic institutions of published paper in number.

Institutions	Number of articles published
JiangnanUniversity	57
Hunan University	37
Tsinghua University	35
Guangdong University of Technology	25
Guangzhou Academy of Fine Arts	22

Table 4. The most productive foreign & domestic author of service design.

Domestic / Foreign	Author	Number of articles published	Institutions	Research area
Foreign	Shimomura, Yoshiki	8	Tokyo Metropolitan University	Service engineering
	Lee, Ching-hung	7	National Yang Ming Chiao Tung University	Intelligent System Design
	Chen, Chun-hsien	6	Nanyang Technological	Product Design and Developmen
	Meng, Qiang	6	National University of Singapore	Operations Research & Management Science
	Patricio, Lia	5	Universidade do Porto	Health Care Sciences & Services
	Verma, Rohit	5	University of Cambridge	Operations Research & Management Science
Domestic	Ding Xiong	15	Guangzhou Academy of Fine Arts	Service innovation and touch point design
	Xu Yanzhang	13	Tianjin Normal University	Cultural Arts Management and Service Design
	Gong Miaosen	12	Jiangnan University	Social Innovation and Service Design
	Zhang Linghao	11	Jiangnan University	User Experience Design
	Xin Xiangyang	10	Tongji University	Interaction and Experience Design

Ching-hung., Chen, Chun-hsien., Meng, Qiang., Patricio, Lia., Verma, Rohit. A total of 1,715 domestic scholars have researched in the field of service design, among which Ding Xiong of Guangzhou Academy of Fine Arts has the highest number of publications, while Xu Yanzhang of Tianjin Normal University, Gong Miaosen and Zhang Linghao of Jiangnan University, and Xin Xiangyang of Tongji University are in the 2nd-5th place in terms of productivity.

Research Hotspots

In VOSviewer, the keywords in the metadata title and abstracts of the literature were analyzed by arithmetic, and the threshold value was set to 5. A total of 247 out of 4908 terms were detected to meet the threshold value, and the keyword co-occurrence mapping of foreign service design research literature was generated as shown in Figure 3. 6 clusters could be found by clustering the keyword co-occurrence network. Cluster 1: Service design based on innovative management, which is clustered by keywords such as management, innovation and system. Cluster 2: Product-service system design, clustered by the keywords product design, product-service system, quality function deployment, product development, etc. Cluster 3: Service computing, clustered by keywords such as model, quality, optimization, network design, etc. Cluster 4: Healthcare service design, clustered by keywords such as care, health, and experience. Cluster 5: User-centered service design, clustered by the keywords satisfaction, behavior, service quality, etc. Cluster 6: Service

Figure 3: The cluster diagram of keywords in service design research abroad.

design methods, clustered by keywords such as co-design and participatory design.

The keyword co-occurrence mapping of domestic service design research literature generated in VOSviewer with the same conditions is shown in Figure 4, and six main clusters can be found by clustering the keyword co-occurrence network. Cluster 1: Service design methods, which are clustered by the keywords of user experience, collaborative design, and value co-creation. Cluster 2: Product service system design, clustered by product service system, product service design, product design, sustainable design, etc. Cluster 3: User-centered service design, clustered by keywords such as user requirements, Kano model, and service blueprint. Cluster 4: Service system design, clustered by keywords such as experience, touch points, and service flow. Clustering 5: Technology-driven service design, clustered by keywords such as artificial intelligence, Internet of Things, big data, cloud computing, etc. Cluster 6: Social innovation-oriented service design (Shijian Luo,

Figure 4: The cluster diagram of keywords in service design research in China.

2018), clustered by keywords such as rural revitalization and community services.

A comparative analysis of domestic and foreign research hotspots reveals the differences between domestic and foreign service design. On the object level, due to the historical and cultural precipitation of China, under the policy background of rural revitalization, some traditional villages have become the unique objects of service design in China, and service design is combined with traditional villages to achieve precise poverty alleviation. In foreign countries, more service design is oriented to medical and health care, focusing on the experience in the medical process. Most of the research hotspots in foreign literature focus on human-centered, systematic way of thinking with the goal of innovation and improvement of service quality and service experience; domestic research hotspots focus on proposing product service systems for specific objects, for example, service design is applied in libraries, museums and other fields.

Fundamental Knowledge and Cutting-Edge Trends

By analyzing the co-citation relationship of foreign literature data, the highly cited references (top 10) in foreign service design literature are shown in Table 5. From 1982 to 1984, Shostack published two papers on the subject of "service" can be designed, and put forward the concept of combining tangible products with intangible services for the first time, and put forward the design method of "service blueprint" for the first time (G. Lynn. Shostack, 1982&1984). A. Parasuraman developed a model of "five elements of service quality evaluation", namely, tangibility, safety, reliability, responsiveness and empathy, which is called "SERVQUAL" scale, and it is still widely used today (A. Parasuraman, 1988). Vargo advocates that everything is a service and encourages enterprises to replace commodity-oriented

Table 5. Top ten highly cited references in social innovation design.

Title	Frequency of citations	Year	First author
The service concept: the missing link in service design research?	35	2002	Susan Meyer Goldstein
Evolving to a new dominant logic for marketing	35	2004	Stephen L. Vargo
Designing services that deliver	34	1984	G.Lynn. Shostack
How to design a service	28	1982	G.Lynn. Shostack
Service-dominant logic: What it is, what it is not, what it might be	25	2008	Stephen L. Vargo
A conceptual model of service quality and its implications for future research	24	1985	A Parasuraman
State-of-the-art in product-service systems	23	2007	Tim Baines
Service design for experience-centric services	21	2010	Leonieke G. Zomerdijk
Multilevel service design: from customer value constellation to service experience blueprinting	21	2011	Lia Patrício
SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality	20	1988	A Parasuraman

Note: Citation frequency represents the number of times the corresponding literature was cited by the sample of this paper, excluding the number of citations from other research areas.

logic with service-oriented logic (Stephen L. Vargo, 2004). Tim Baines defines the concept of PSS, reports its origins and characteristics, and summarizes the available tools and methods (Tim Baines, 2007). Lia Patrício proposed a new interdisciplinary method MSD for designing complex service systems (Lia Patrício, 2011). Over the past 20 years, these authors' papers have had a lasting and important impact in the field of service design. From the national distribution of service design research, although the number of papers published in China is relatively high, from the analysis of highly cited documents on service design, there are very few documents with international influence.

To explore the cutting-edge trends in the domestic service design field, the citation burst and keyword burst in Citespace were used to detect the cutting-edge trends in foreign research. From the keyword burst results (Table 6), service design research shifted from quality (GronroosC, 1993), models, design, and management to science, technology, and service systems, and focused on user needs (Cook, L. S., 2002) and experience (Zomerdik L G, 2010), and technology and design thinking (Buchanan R, 1992) became the focus of research and continues to this day.

On the domestic side, 18 articles (6 articles per year) with high service design hotness in the past 3 years were collected and analyzed based on the number of citations and downloads from the CNKI database. The number of citations in the literature in recent years can indicate the research hotness of the topic, and the number of downloads in a short period of time can indicate the degree of attention to the literature. The literature with high hotness in the design of the knowledge network service is shown in Table 7. The articles selected in 2020 and 2021 are ranked according to the number of citations, while in 2022, they are selected based on the comparative analysis of the publication time and the number of downloads. Observing the key words of the literature in Table 7, we find that the literature topic terms are mostly focused on regional revitalization, public culture, home-based care for the aged, intangible cultural heritage, Internet, intelligent services, etc., which indicates that rural revitalization and social innovation is a hot spot for service design research nowadays. With the development of the information age, service design driven by artificial intelligence, internet and other technologies is also a hot spot, especially in the post-epidemic, medical health and home-based care for the aged related directions are also the frontier of research at home and abroad.

Table 6. Strongest outbursts of keywords in service design.

Sudden Keywords	Strength	Start and end time
Design	5.05	2009–2013
Science	2.22	2008–2016
Product-service system	4.04	2018–2019
Technology	2.44	2019–2022
Design thinking	2.73	2020–2022

Table 7. Highly popular literature of service design in CNKI.

2022	2021	2020
Research on the marketing strategy of agricultural products based on service design thinking1089	Research on museum experience design based on service design thinking and methodology(13)2352	Basic principles of service design: from user-centered to stakeholder-centered(49)2195
Research on the design of refined intelligent services for the home care population 1642	Value-based Co-creation of Group Intelligent Service Design Model and Empirical Analysis(11)4825	Research on the design of intelligent home care service system(25)2435
A study on the participatory experience of users of West African cultural heritage products from a service design perspective(4)2189	Design strategies for intelligent museum services under new technological conditions(10)1262	Product design innovation strategy integrating service design concept(17)1061
Contact Points in Service Design: Definition, Research Status and Trends 1363	Identification and study of journey visualization tools in service design(8)1383	Design strategies for public cultural services based on mobile Internet - an example of museum app design in the era of artificial intelligence(16)954
Strategies for designing intelligent services of farmhouse in the context of rural revitalization(4)950	Research on rural tourism innovation from the perspective of service design(7)2332	Branding Liaoning Non-Foreign Heritage Based on Service Design Thinking(15)1427
Research on the design of retail services for Winter Olympic cultural and creative products under BPC scenario architecture(1)1211	Research on the Design of User Participatory Public Cultural Services in the Context of Rural Revitalization(5)1660	Research on the design of community home care health management service based on Internet+(14)1578

Note: The number of citations in parentheses is the number of times the article has been cited, and the number of downloads outside of parentheses is the number of times the article has been downloaded.

CONCLUSION

Through the analysis of the relevant literature on service design at home and abroad, we can see that the research at home and abroad is generally on the rise, and the attention to service design is getting higher and higher. At present, the UK and the US are the leading countries in service design research, which is closely related to their economic development stages in developed countries. Correspondingly, the institutions, authors and documents in Britain and the United States have the strongest influence. As a hot research direction of design discipline, service design will also become a research carrier for people's innovative behavior, and analyzing its laws and characteristics will become a hot topic in the future. In the design process of human-centered, insight into the user's behavior, psychological changes and needs and worries in a service system, accurate access and expression of

contact points, so as to better grasp the loopholes and improve the existing service ecosystem.

The study shows that there is still a gap between the domestic service design field and the advanced level. Domestic research institutions should strengthen cross-level and interdisciplinary cooperation to better apply service design to scientific research, business, and industry. At the same time, there are some limitations in this paper. The results of the database and the retrieval method chosen for the study may have some deviation from the actual, and the service design has the property of cross-discipline, the article does not analyze the above knowledge points in depth, and will be further enhanced in the subsequent research.

REFERENCES

Baines, T. S., Lightfoot, H. W., Evans, S., Neely, A., Greenough, R., Peppard, J., & Wilson, H. (2007). State-of-the-art in product-service systems. Proceedings of the Institution of Mechanical Engineers, Part B: journal of engineering manufacture, 221(10), 1543–1552.

Buchanan, R. (1992). Wicked problems in design thinking. Design issues, 8(2), 5–21.

Cheng, X., (2020). A Review of Product Service System and Service Design Research. Journal of Beijing University of Posts and Telecommunications (Social Sciences Edition), 22(05): 61–73.

Cook, L. S., Bowen, D. E., Chase, R. B., Dasu, S., Stewart, D. M., & Tansik, D. A. (2002). Human issues in service design. Journal of operations management, 20(2), 159–174.

Grönroos, C. (1984). A service quality model and its marketing implications. European Journal of marketing, 18(4), 36–44.

Hollins, G., & Hollins, B. (1991). Total Design: Managing the design process in the service sector. Pitman.

Hu, F,. Li, W,. (2019). Defining "Service Design". Packaging Engineering, 40(10): 37–51.

Li, J. and Chen, C. M. (2016). CiteSpace: Technology Text Mining and Visualization. Beijing: Science Press.

Luo, S,. Zou, W,. (2018). Status and progress of service design research. Packaging Engineering, 39(24): 43–53.

Lynn Shostack, G. (1982). How to design a service. European journal of Marketing, 16(1), 49–63.

Parasuraman, A., Zeithaml, V. A., & Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. 64(1), 12–40.

Patrício, L., & Fisk, R. P. (2013). Creating new services. Serving customers: Global services marketing perspectives, 185–207.

Patrício, L., Fisk, R. P., Falcão e Cunha, J., & Constantine, L. (2011). Multilevel service design: from customer value constellation to service experience blueprinting. Journal of service Research, 14(2), 180–200.

Shostack, L. (1984). Designing services that deliver. Harvard business review, 62(1), 133–139.

Vargo, S. L., & Lusch, R. F. (2014). Evolving to a new dominant logic for marketing. In The service-dominant logic of marketing (pp. 21–46).

Zomerdijk, L. G., & Voss, C. A. (2010). Service design for experience-centric services. Journal of service research, 13(1), 67–82.