Review

Research Hotspots, Evolution, and Prospects of Intelligent Communities in China Over the Past Twelve Years:A visual analysis based on CNKI-sourced journals

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Abstract: In recent years, the construction of intelligent communities in China has flourished and become an important force in promoting urban digital transformation. Smart communities have leveraged the Internet, Internet of Things, big data, and other technologies to achieve intelligent community management and efficient services. However, the construction of intelligent communities also faces challenges such as data security and technological updates, which require continuous exploration and improvement to better serve residents and promote sustainable development of the community. A comprehensive review of the research on intelligent communities in China over the past twelve years is conducive to deepening theoretical and policy research, and better guiding educational practice. By using the Cite Space bibliometric tool, a visual graph of the evolution of research fields related to intelligent communities can be constructed, which intuitively presents the core authors and main research institutions of intelligent community research in China; Through keyword clustering, co-occurrence, and knowledge graph analysis, researchers can also have a clearer understanding of the main content, hot topics, and cutting-edge trends of intelligent community research in China over the past twelve years.

Keywords: Intelligent Community; Research Hotspots; Knowledge Graph; Visual Analysis

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1. Introduction

With the emergence of new technologies such as the Internet, cloud computing, and blockchain, the information revolution has driven innovations in urban construction, making the development of smart communities and smart cities an inevitable trend. As the "smallest unit" of a city and the "smallest organization" for the government to serve the public, smart communities have gradually become a new pilot application field for promoting smart cities and an innovative hotspot in grassroots social governance.

Against the backdrop of rapid economic and social development over the past twelve years, what remarkable achievements has the domestic Intelligent Community research field achieved? What evolution has it undergone? What themes has it primarily focused on? And what is the frontier trend of Intelligent Community research? In response, this paper proposes to systematically address these questions using the CiteSpace bibliometric tool, aiming to provide insights for deepening the promotion of smart communities in China.

2. Research Foundation

2.1 Data Source

The literature sample of this study was obtained from the China National Knowledge Infrastructure (CNKI) academic journal database. The data acquisition process was as follows:

Open the new version of CNKI, click on Advanced Search, select Academic Journals, input the theme "Intelligent Community", set the time range from 2012 to 2024, select "Peking University Core Journals" as the source category, obtain the search results, and manually filter out announcements, reports, and data with low thematic relevance. After this process, 209 valid literatures were obtained. These literatures were exported in "Refworks" format and visualized using the CiteSpace 6.3R1 (64-bit) knowledge mapping tool. All data and information hereinafter are derived from these 209 valid literatures.

2.2 Research Tools

CiteSpace employs core methods such as co-citation analysis and path-finder to explore the citation coupling relationships among data. It presents analysis results visually, making research findings more vivid and intuitive. The size of nodes and the thickness of connections intuitively reflect the importance of various elements (such as authors, institutions, or keywords) and the degree of their interconnections. Furthermore, the knowledge maps drawn by CiteSpace can reflect the current research status of a theme, facilitate the summary of research hotspots, evolutionary paths, and frontier trends, and help predict new directions for future research. This study uses CiteSpace 6.3R1 (64-bit) to conduct a visual analysis of Intelligent Community research over the past twelve years, presenting the basic research content, hotspots, and future development directions of Intelligent Community research in China since 2012.

3. Analysis of Research Overview on Smart Communities in China over the Past Twelve Years

3.1 Publication Trend and Analysis

The number of publications serves as one of the important indicators for measuring research progress and hotspots in a specific field. Based on valid data obtained from Peking University Core academic journals between 2012 and 2024, an annual publication trend chart was drawn according to the annual number of publications (Figure 1). Overall, the number of publications on the theme of "Intelligent Community" shows a fluctuating upward trend. In particular, starting from 2020, the number of publications related to smart communities reached more than 20, and even reached 35 in 2023.

Since 2010, the concept of smart communities was formally proposed and pilot projects were promoted, bringing smart communities into the public spotlight. In 2012, pilot projects for Intelligent City construction began in Beijing, Shanghai, and other cities, with smart communities as an important component. In 2013, the Ministry of Science and Technology issued the Implementation Plan for the Innovation-Driven Strategy Enhancement Action in National High-Tech Industrial Development Zones, proposing to promote the wide application of information technologies such as the Internet of Things and cloud computing in service fields like smart communities and smart homes. This was the first time smart communities were mentioned in a national document.

In May 2014, the Ministry of Housing and Urban-Rural Development issued the Guidelines for Intelligent Community Construction (Trial), which clarified the development goals of Intelligent Community construction and established an evaluation index system covering six areas: guarantee systems, infrastructure and building environment, community governance and public services, residential area management, convenient services, and theme communities. This provided a reference for Intelligent Community construction across the country. The Guidelines proposed the initial construction of about 100 Intelligent Community demonstration points by 2015, the standardization of Intelligent Community construction in more than 50% of communities by 2020, and the establishment of a sustainable community governance system and intelligent social service model. Therefore, since 2014, the pace of exploration in smart communities has accelerated, with an increase in related topics.

In 2015, with the accelerated implementation of strategies such as "Broadband China", "Internet+", and big data, the construction of smart communities across the country accelerated, showing a blooming trend. According to the Shanghai Intelligent Community Development White Paper (2015), Shanghai identified 50 pilot smart communities in 16 districts and built demonstration communities such as Lujiazui Street in Pudong. By the end of 2015, Tianjin had promoted Intelligent Community construction in 30 large residential areas, Suzhou had built 61 wired intelligent communities (villages), and Sichuan Province had completed the first batch of 10 Intelligent Community pilot projects in 2015.

On June 12, 2017, the Central Committee of the Communist Party of China and the State Council issued and implemented the Opinions on Strengthening and Improving Urban and Rural Community Governance (hereinafter referred to as the Opinions). The Opinions proposed that under the background of new community governance, localities should formulate Intelligent Community construction and development strategies based on their actual conditions such as resource endowment, basic conditions, and cultural characteristics, implement the "Internet+ Community" action plan, and promote the construction of Intelligent Community information systems. This measure attracted attention to the construction and development of smart communities across the country.

In 2020, China's urbanization rate increased from 60.60% to 63.89%, showing a significant improvement. In the same year, the Office of the Ministry of Housing and Urban-Rural Development organized the drafting of the national standard Intelligent City Buildings and Residential Areas (First Draft), which was open to public consultation. The government regarded Intelligent Community construction as the basic unit of urban governance, real estate enterprises took smart communities as a means to improve community quality and increase revenue sources, Internet enterprises used them as a support for expanding services, and various Intelligent Community applications became increasingly rich. In addition, from the end of 2019 to 2020, due to the outbreak of the COVID-19 pandemic, contactless methods developed rapidly to avoid direct human contact, giving full play to the advantages of Internet technology. Smart communities encompassing the above functions also triggered further thinking among people.

In 2022, nine departments including the Ministry of Civil Affairs, the Central Political and Legal Affairs Commission, the Central Cyberspace Affairs Commission, the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the Ministry of Public Security jointly issued the Opinions on Deeply Promoting the Construction of Smart Communities, clarifying the overall requirements, key tasks, and guarantee measures for Intelligent Community construction. The construction of smart communities entered a stage of multi-department collaborative promotion, which strongly promoted the construction and ushered in a spring for the development of smart communities.

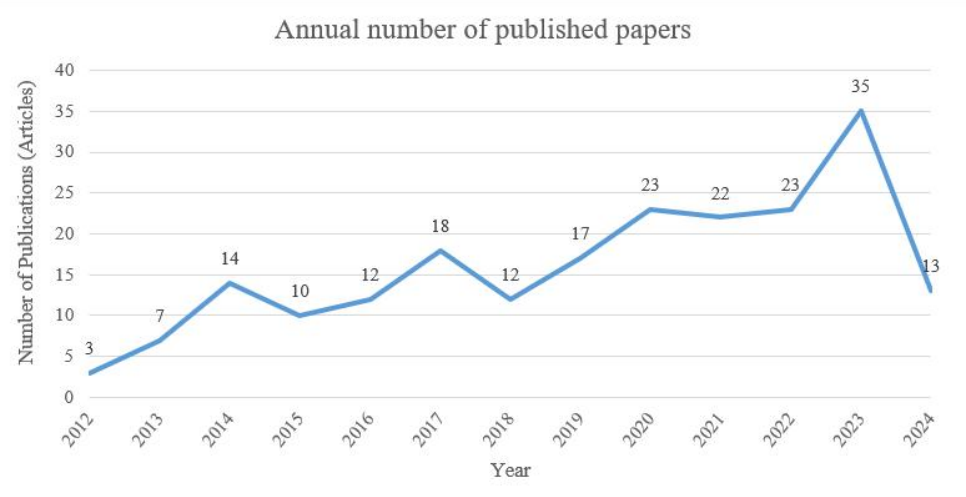

Fig. 1. Trend in the Annual Number of Published Papers on Intelligent Community Research (2012–2024)

Fig. 2. Urbanization Rate in China from 2009 to 2023

Data source: Compiled by the author based on the publicly available data from the National Bureau of Statistics.

3.2 Analysis of Core Authors

The author map generated by CiteSpace 6.3R1 (64-bit) reflects the core authors researching the theme of "Intelligent Community" and their collaborative relationships. From 2012 to the present, the scholars with the highest number of first-authored publications on "Intelligent Community" (as shown in Figure 3 and Table 1) are Liu Quan and He Jixin. Authors with two or more publications include: Liu Quan (3), He Jixin (3), Zhu Yi (2), Chang Enyu (2), Wu Xuhong (2), Qian Kun (2), Sun Jiaqi (2), Cheng Jiaxuan (2), Zhang Yanguo (2), and Ru Peng (2). Each node represents an author, while connections represent collaboration between authors—the thicker the connection, the more frequent the collaboration. Overall, authors publishing on the theme of "Intelligent Community" are relatively scattered, with limited collaborative publications. Specifically, He Jixin has collaborated with He Haiqing, Li Tianyi, and Hou Yu; Liu Quan has three collaborations with Huang Dingfang; Zhu Yi has two collaborations with Han Yong; five scholars including Lei Yan, Gao Fei, Fang Huaying, Wang Jingchun, and Gao Bin have all collaborated with each other; and Chang Enyu mainly engages in discussions with Sun Chen and Zhen Feng.

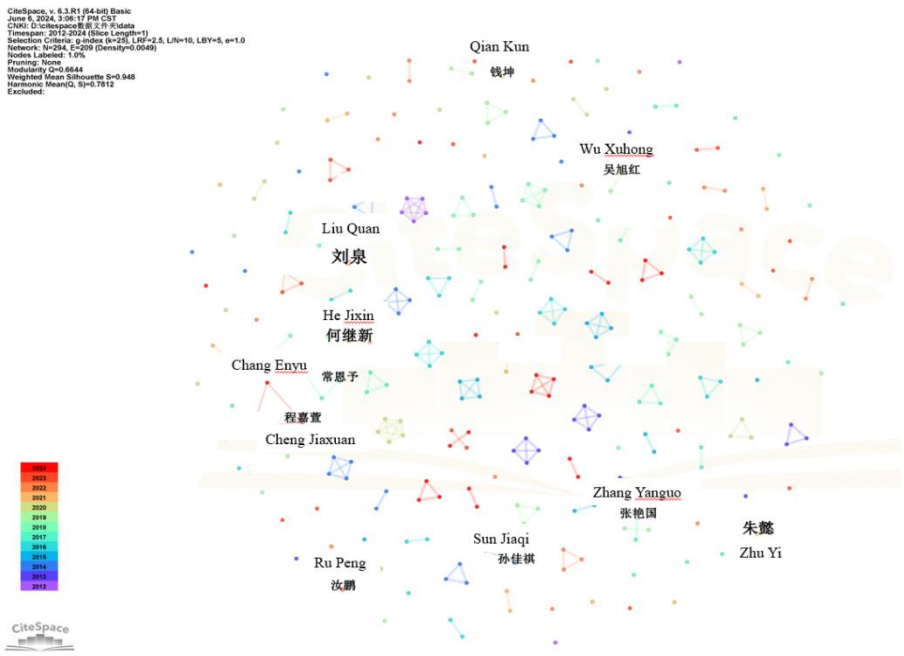

Fig. 3. Visualization Map of Authors' Collaboration Network in Chinese Intelligent Community Research over the Past 12 Years

Table 1 is another table formulated based on the data analyzed by CiteSpace 6.3R1 (64-bit), listing authors with two or more publications and their corresponding institutions, etc. As shown in Table 1, the main research directions of five scholars, including Liu Quan, Zhu Yi, Chang Enyu, Wu Xuhong, and Cheng Jiaxuan, focus on smart communities and community governance. Ru Peng's research themes mainly involve intelligent society, innovation models, cyberspace, community attachment, and science and technology policies. Scholar He Jixin's research field primarily focuses on public services and grassroots collaborative governance. Scholars Qian Kun and Zhang Yanguo mainly explore issues related to urban-rural governance and community building, while Sun Jiaqi's research themes tend to focus on the Internet, online media, and public services.

Table 1 High-Yield Authors with Two or More Publications on Intelligent Community Theme and Their Affiliated Institutions

Publication Quantity	Author(s)	Research Direction/Theme	Author Affiliation
3	Liu Quan	TOD, Intelligent City, Urban Form, Future Community, Intelligent Community, Future City, Urban Design	Shenzhen L&A Urban Planning & Design Consulting Co., Ltd.
3	He Jixin	Urban Community, Public Services, Grassroots Governance Community, Community Public Services, Intelligent Supply, Collaborative Governance	Tianjin Chengjian University

Continued Table

Publication Quantity	Author(s)	Research Direction/Theme	Author Affiliation
2	Ru Peng	Intelligent Society, Innovation Model, Cyberspace, Community Attachment, Science and Technology Policy	Tsinghua University
2	Zhu Yi	Social Governance, Intelligent Community, Collaborative Governance, Grassroots Social Governance	Guangxi University of Finance and Economics
2	Chang Enyu	Intelligent Community, Community Participation, Urban System Pattern, Community Planning, Community Network, Elderly Migrants	Nanjing University
2	Wu Xuhong	Intelligent Community, Government Governance, Digital Divide, Smart Elderly Care, Governance Capacity, Digital Vulnerable Groups, Grassroots Community	Nanjing University of Science and Technology
2	Qian Kun	Urban Fine Governance, Rural Governance, Urban Governance, Community Construction, Urban Management, Community Reconstruction	Nanjing Forestry University
2	Sun Jiaqi	Intelligent Internet of Everything, Media Integration, National Public Services	Jinan University
2	Cheng Jiaxuan	Intelligent Community, Cultural and Recreational Facilities, Aging-Friendly Design	Jiyang College of Zhejiang A&F University
2	Zhang Yanguo	Community Governance, Urban Community, Community Construction, Interactive Relationship	Jiangxi Normal University

3.3 Analysis of Research Institutions

The knowledge map of research institutions shows nodes N=241 and edges E=114 (Figure 4), indicating that there is some interaction between Intelligent Community research institutions, though cooperation needs further strengthening. The School of Politics and International Relations at Central China Normal University has communicated with only 2 institutions; the School of Politics and International Relations at Tongji University has collaborated with only 1

institution; and the School of Economics and Management at Tianjin Chengjian University has not published any "Intelligent Community"-related articles in collaboration with other institutions.

The School of Architecture and Urban Planning at Nanjing University has had close cooperation with the Jiangsu Engineering Laboratory for Intelligent City Design Simulation and Visualization Technology, Jiangsu Research Base for Smart Cities, Human Geography Research Center at Nanjing University, and Shenzhen Tiehan Ecological Environment Co., Ltd. Meanwhile, the School of Politics and International Relations at Central China Normal University has collaborated multiple times with the Policy Theory Research Base of the Ministry of Civil Affairs at Central China Normal University and the School of Public Administration at Hubei University. The Zhou Enlai School of Government at Nankai University has co-published papers with the European Graduate School of the Chinese Academy of Social Sciences, School of International Relations at the University of International Business and Economics, School of Public Administration at Inner Mongolia University, and School of Economics and Management at Inner Mongolia University. The School of Geography and Information Engineering at China University of Geosciences (Wuhan) has collaborated with the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing at Wuhan University, National Engineering Research Center for Geographic Information System, and the Collaborative Innovation Center for Geospatial Information Technology—all four have collaborated with each other. Tongji University is connected with Shanghai Maritime University, Shanghai University of Electric Power, Library of the Party School of the Guangxi Zhuang Autonomous Region Committee (Guangxi Administration Institute), and School of International Education at Guangxi University of Finance and Economics.

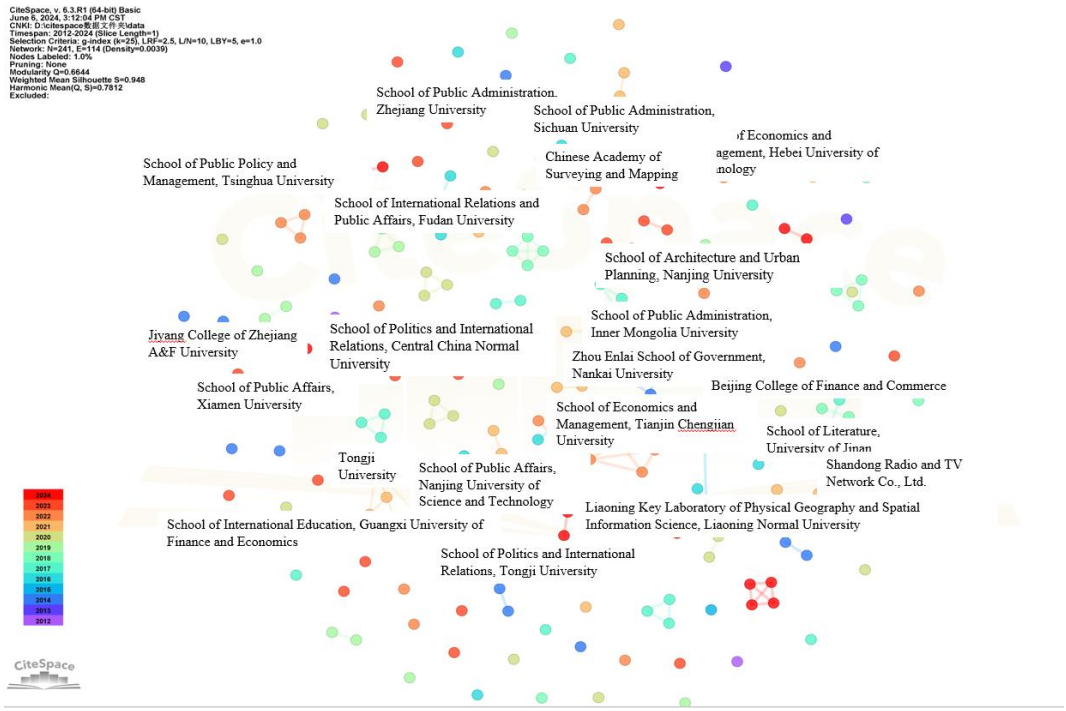

Fig. 4 Visualization Map of Publishing Institutions Network in Chinese Intelligent Community Research over the Past 12 Years

As shown in Figure 5, research institutions are listed by the number of publications in descending order. The figure indicates:

In terms of publication quantity: The top five institutions are the School of Architecture and Urban Planning at Nanjing University, School of Politics and International Relations at Central

China Normal University, School of Economics and Management at Tianjin Chengjian University, School of Politics and International Relations at Tongji University, and Zhou Enlai School of Government at Nankai University. This suggests that schools and institutions focusing on economics & management, urban planning, and political science constitute the main forces in Intelligent Community research.

In terms of administrative divisions: Publishing provinces are mainly concentrated in regions with relatively high economic development levels, such as Jiangsu Province, Tianjin Municipality, Shanghai Municipality, Zhejiang Province, and Hebei Province.

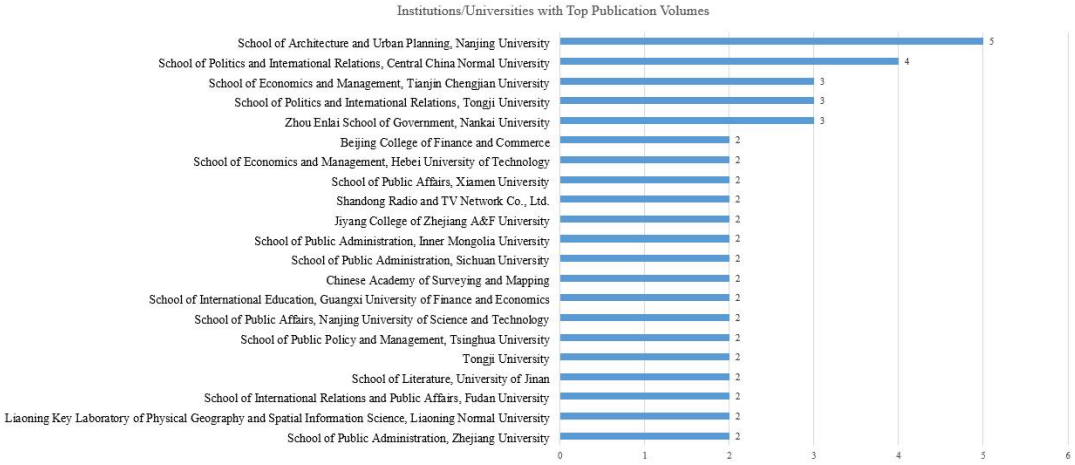

Fig. 5 Number of Publications by Relevant Institutions on the Theme of 'Intelligent Community' in China over the Past 12 Years

3.4 Keyword Clustering Analysis

Keyword clustering analysis can summarize research questions in a field over a specific period, and thus infer research hotspots and directions from the aggregated keywords. The CiteSpace 6.3R1 (64-bit) software was used to cluster keywords related to "Intelligent Community" (see Figure 6). Each region is composed of related keyword clusters, named with "#serial number + cluster name," where the serial number represents the concentration—the smaller the number, the higher the concentration.

As shown in Figure 6, the Modularity Q value is 0.6644, and the Weighted Mean Silhouette S value is 0.948, indicating significant community structure and efficient clustering in the data. The Q value typically ranges in [0, 1): a $Q > 0.3$ signifies a significant network community structure, and an $S > 0.5$ indicates reasonable clustering. Thus, the keyword clustering structure of Intelligent Community research is both significant and reasonable. A total of 8 major keyword clusters were generated (Figure 6 and Table 2), namely: #0 Intelligent Community, #1 Community Governance, #2 Intelligent City, #3 Integration, #4 Urban Community, #5 Governance, #6 Video Security, and #7 Intelligentization.

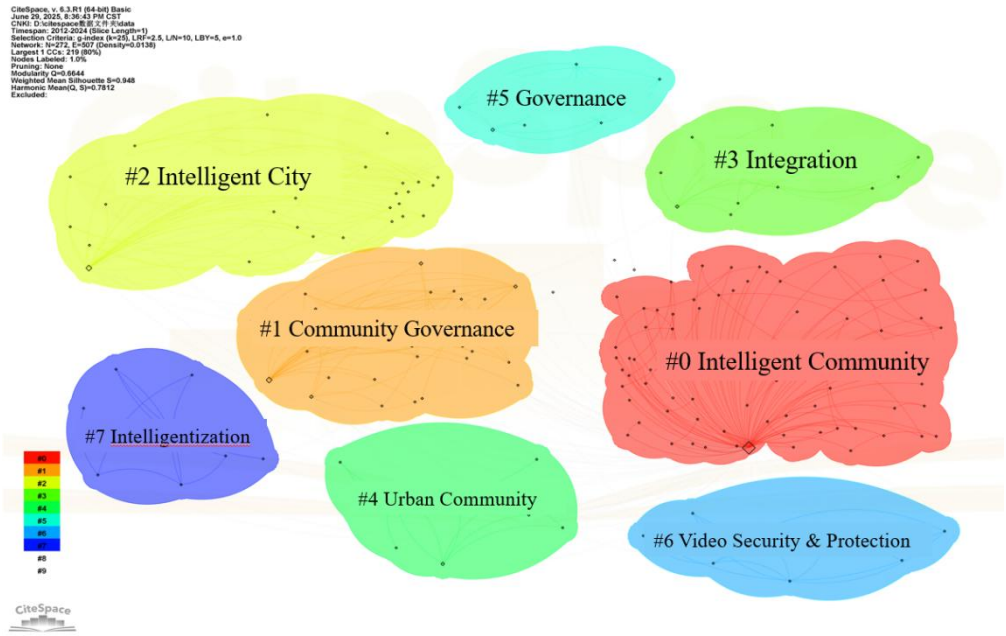

Fig. 6 Keyword Clustering Map of Intelligent Community

Table 2 High-frequency Keyword Clusters in Intelligent Community Research

Cluster ID	Size	Silhouette	Label	Top Terms
0	72	0.982	Intelligent Community	Intelligent Community, Intelligent City, community governance, big data, technical governance, emerging technologies
1	37	0.835	Community Governance	Community governance, big data, technical governance, digital governance, grassroots governance
2	30	0.93	Intelligent City	Intelligent City, future community, creative class, Intelligent Community, urban management
3	11	0.945	Integration	Integration, wisdom, supply model, new-type community
4	10	0.954	Urban Community	Urban community, community network, emergency management, time-space behavior
5	8	0.988	Governance	Governance, big cities, urban villages, quality standards, connotative attributes

Continued Table

Cluster ID	Size	Silhouette	Label	Top Terms
6	8	0.968	Video Security	Video security, grid management, spatiotemporal information, universal management, Intelligent City
7	7	0.974	Intelligence	Intelligence, design strategy, intelligence, residential space, home-based elderly care
Total=8	183	MD=0.947	Q=0.6644	S=0.948

According to the keyword clustering map, research on Intelligent Community construction mainly falls into three categories:

Focus on the relationship and overview of smart communities, urban communities, and smart cities, represented by #0 Intelligent Community, #2 Intelligent City, and #4 Urban Community.Smart communities serve as an important means to promote Intelligent City construction, while smart cities are the result of fully developed smart communities. Urban communities are the carrier for Intelligent Community construction, and smart communities represent the ultimate goal of urban community development. Since IBM proposed the concepts of "Smart Planet" and "Intelligent City" in 2009, the Intelligent City concept has been adopted by many countries and regions as a new path for urban governance. As the key entry point of smart cities, smart communities are the closest Intelligent City applications to citizens. As social communities formed by residents in a specific living space of a city, urban communities play a vital role in promoting urban governance. Intelligent Community construction relies on urban communities as platforms, with pilot projects implemented within them. Promoting Intelligent Community construction is not only a measure to implement national plans but also a strategic choice and practical requirement for the development of urban communities in China. Wang Fashuo divided governance practices into four types based on China's Intelligent Community governance reality: technical empowerment, technical authorization, empowerment authorization, and technical disembedding[1]. Zhang Chen (2021) found that the successful innovative practice of the Intelligent Community platform in Y Community relied on the positive interaction among needs, actors, and performance within the community governance environment[2].

Focus on soft approaches to Intelligent Community development, mainly represented by #1 Community Governance, #3 Integration, and #5 Governance. The core of a community is the "people" living in it, and its vitality and warmth stem from comprehensive development and residents' emotional attachment. Through soft approaches like community governance and integration, the sense of commonality and belonging among residents can be enhanced, residents' self-governance capabilities can be improved, and the democratization and diversification of community self-governance can be promoted. Residents can jointly negotiate matters such as infrastructure and community activities, solve community problems democratically, create a positive community atmosphere, and provide public wisdom and strength for the development of smart communities. Jiang Xiaoping argued that a Intelligent Community is a complete ecosystem encompassing technical, functional, result-oriented, and value-oriented dimensions[3]. It is a new community governance model that provides convenient, efficient, transparent, and fair public services to residents, guided by residents' needs, aimed at a better life, with multiplex

organizations as the main body, intelligent services as the means, and resource integration as the foundation.

Focus on technical means for Intelligent Community construction, mainly represented by #6 Video Security and #7 Intelligentization. Communities have abundant public spaces and facilities serving the public, making security prevention in public spaces crucial. Video security is an important component of smart communities, which will integrate with urban safety inspection and monitoring systems to serve safe community construction through big data monitoring and emergency command platforms. From a governance perspective, Intelligent Community construction emphasizes using digital connections as a bridge to achieve effective co-governance among multiple stakeholders in the community space.As the current core technical trend, "intelligentization" is the greatest feature and technical means of Intelligent Community construction. China's Intelligent Community construction achieves interconnection among people, objects, and networks through IoT and interconnection, integrates various community resources, and forms a new community form that is modern, networked, and information-driven. "Intelligentization" in Intelligent Community construction is embodied in key technologies such as "Internet of Things (IoT) technology, artificial intelligence, cloud computing and big data, green building technology, and spatial information technology". Wang Di stated that new-generation information technologies such as big data and cloud computing, in new forms and models, can achieve digital, networked, intelligent, interactive, and collaborative services and governance for elements like urban community party building, population management, public activities, commercial operations, and home life, thereby promoting Intelligent Community construction[4]. Chen Yuehua believed that the integration of "the Internet" and community governance actively responds to and supports the strategies of "Cyber Power, Digital China, and Smart Society"[5].

4. Analysis of Research Hotspots and Frontier Trends

4.1 Analysis of Research Hotspots

In the keyword co-occurrence map, N=272 and E=507, where larger nodes indicate higher occurrence frequencies. Based on the frequency of keyword occurrences, the hotspots in Intelligent Community research are: Intelligent Community (101), Community Governance (22), Intelligent City (19), Big Data (11), Smart Governance (6), Urban Community (6), Technological Governance (5), Grassroots Governance (4), Community (4), Community Service (4), Digital Governance (4), Internet+ (3), Smart Elderly Care (3), Smart Society (3), Governance (3), Digital Society (3), Public Participation (3), Intelligentization (3), Informatization (3), Cloud Computing (3), New Infrastructure (3), etc.According to betweenness centrality values, research hotspots in Intelligent Community studies focus on keywords such as Intelligent Community (1.17), Intelligent City (0.26), Community Governance (0.09), Internet+ (0.09), and Big Data (0.05).

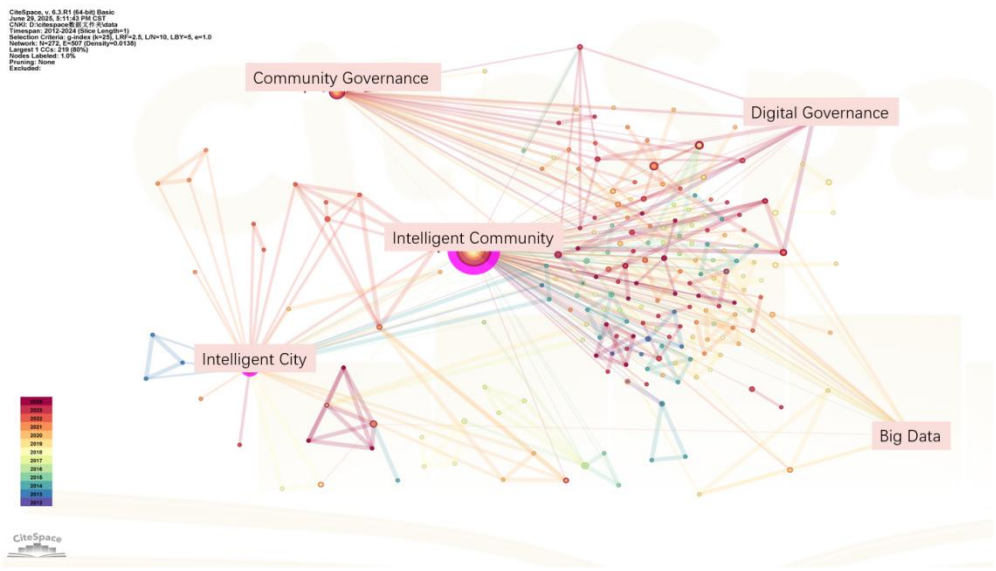

Fig. 7 Keyword Co-occurrence Visualization Map of Intelligent Community

4.2 Analysis of Frontier Trends

Burst terms refer to keywords with a significant increase in frequency within a specific research field over a certain period. Keyword bursts are measured by two indicators: burst strength and burst duration. Extracting and analyzing burst terms through CiteSpace 6.3R1 (64-bit) can, to a certain extent, predict the frontier directions of Intelligent Community research in China over the past twelve years. Figure 8 presents the network visualization map of burst terms, reflecting 18 keywords with high burst intensity: Community Construction, Information Technology, Development Strategy, Cloud Computing, Grid Management, Urban Community, Wisdom, Smart Elderly Care, Community Elderly Care, Optimization Scheduling, Big Data, Community Governance, Informatization, Smart Governance, New Infrastructure, Digital Economy, Digital Governance, Emergency Governance.

Top 18 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2012 - 2024
Community Construction	2012	1.29	2012	2013	
Information Technology	2012	1.16	2012	2014	
Development Strategy	2012	0.95	2012	2016	
Cloud Computing	2014	1.77	2014	2015	
Gridification	2014	1.18	2014	2015	
Urban Community	2015	0.92	2015	2017	
Wisdom	2016	0.98	2016	2018	
Smart Elderly Care	2018	1.65	2018	2019	
Community - based Elderly Care	2018	1.09	2018	2019	
Optimal Scheduling	2018	1.09	2018	2019	
Big Data	2015	2.39	2019	2021	
Community Governance	2017	1.22	2019	2021	
Informatization	2019	1.21	2019	2021	
Smart Governance	2017	1.01	2020	2022	
New Infrastructure	2021	1.03	2021	2024	
Digital Economy	2021	0.99	2021	2022	
Digital Governance	2022	1.44	2022	2024	
Emergency Governance	2022	0.9	2022	2024	

Figure. 8 Knowledge Graph of Keyword Bursts in Smart Community Research in China Over the Past Twelve Years

By using CiteSpace 6.3R1 (64-bit) to draw historical curves of burst terms, the changes in the research frontier trends of smart communities since 2012 can be obtained.

First, from 2012 to 2014, the main research themes were "Community Construction", "Information Technology", and "Development Strategy", focusing on how information technology and development strategies could play roles in community construction. The burst term "Community Construction" emerged in 2012, with two related literatures published in 2012 and 2013, but did not appear thereafter. Research mainly centered on how to achieve "intelligentization" in community construction. Wu Jinliang conducted in-depth and multi-faceted discussions on the top-level design of the "Zhejiang Intelligent Community Network" and proposed that the information platform of "smart communities" must aim to promote the reconstruction of community collectives, drive the transformation of community governance methods and structures from traditional to modern, and achieve seamless integration with e-government[6]. Li Zhiping suggested that the application of Internet of Things (IoT) technology could subvert traditional community models and accelerate the process of intelligentization[7].

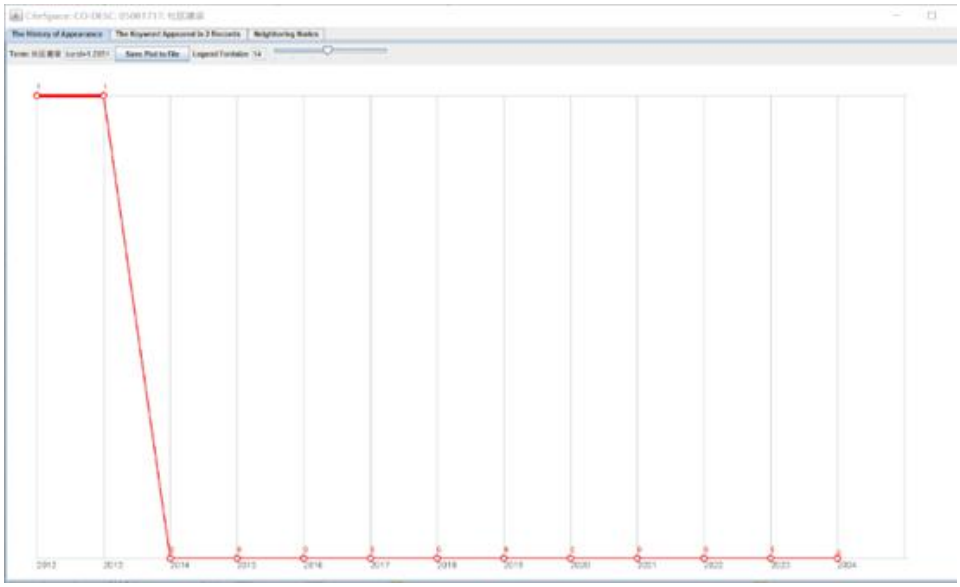

Fig. 9 Historical Curve Chart of "Community – building"

Second, from 2014 to 2018, the main research focuses were "Cloud Computing", "Grid Management", "Urban Community", and "Wisdom". In August 2014, eight ministries and commissions including the National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Science and Technology, Ministry of Public Security, Ministry of Finance, Ministry of Natural Resources, Ministry of Housing and Urban-Rural Development, and Ministry of Transport issued the Guidance on Promoting the Healthy Development of Smart Cities, stating that "by 2020, a number of smart cities with distinct features should be built." In the same year, many domestic cities took smart cities as a strategic choice for transformational development: more than two-thirds of the 661 cities nationwide announced plans to build smart cities, including 100% of provincial and sub-provincial cities, over 74% of prefecture-level cities, and 32% of county-level cities. During this period, public attention focused on how to achieve "intelligentization" of "urban communities" through technology and "grid management" systems. The burst term "Cloud Computing" emerged in 2014, with 1 publication in 2014 and 2 in 2015."Urban Community" emerged in 2015, with a total of 3 publications from 2014 to 2018 and 1 publication each in 2022, 2023, and 2024, still exerting significant influence on current research. Wang Lingqun proposed a Intelligent Community architecture based on J2EE and cloud computing to address construction issues, offering corresponding solutions for three key problems in overall design, software, business, and data[8].

Chai Yanwei proposed an intelligentization path for urban community management and services in China, emphasizing that community planning should break through physical space, redivide community spaces, and achieve re-communityization in terms of behavioral and social spaces[9]. Zhang Yan planned and designed the eight application functions of a smart cloud community service management system based on ubiquitous networks, cloud computing, cloud services, and big data technologies. She proposed accelerating the construction, development, and deployment of public information platforms for smart communities, improving community management credit systems, and providing integrated, fast, and efficient property management services to residents through these platforms[10].

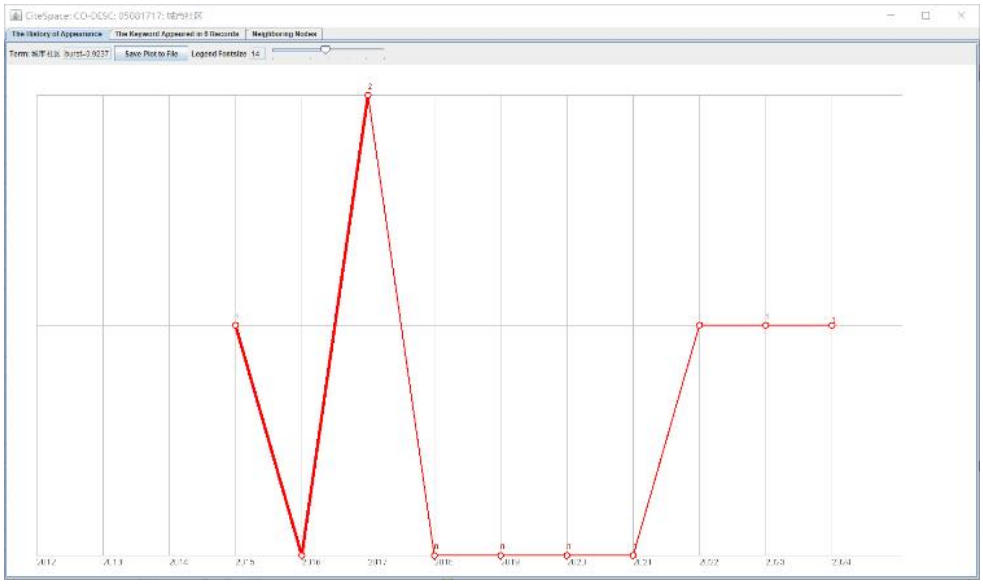

Fig. 10 Historical Curve Chart of “Urban Community”

Third, from 2018 to 2019, "Smart Elderly Care", "Community Elderly Care", and "Optimization Scheduling" gained significant attention. Scholars primarily explored the relationship between smart elderly care and community elderly care, as well as how to manage resource allocation in smart communities through optimization scheduling." Smart Elderly Care" was discussed in 2 publications in 2018 and 1 in 2019."Community Elderly Care" had a total of 2 publications from 2018 to 2019, focusing on how to construct community elderly care within the context of smart communities. Liu Xia surveyed the status quo of smart and healthy elderly care in 30 communities of Zhengzhou through questionnaires and found that community elderly care services were basically intelligent, but with low usage rates among the elderly, who hoped communities would provide more health services[11]. Wang Hongyu argued that the construction of smart communities inevitably drives the rise of Intelligent Community elderly care services, which act as a bridge for communication and information transmission, providing strong support for the development of elderly care services[12].

Fourth, from 2019 to 2021, the research frontiers were "Big Data", "Community Governance", and "Informatization", focusing on the transformation of community governance in the new era, informatization construction of smart communities, and the operation, challenges, and solutions of community governance. Through secondary review, there are 22 literatures related to "Community Governance", including 11 on related themes from 2019 to 2021 and 9 from 2022 to the present, reflecting that community governance has remained an academic research hotspot. The burst term "Big Data" had 1 related article in 2015, 2 in 2017, and a total of 8 publications from 2019 to 2021.On April 19, 2019, the China Intelligent Community Service Industry Summit Forum was held at the China Optics Valley Technology Exhibition Center (Wuhan). The forum addressed topics such as the integration of technical means, convenient data

utilization, community platform operation, and demonstration of optimal smart communities, reigniting attention to the integration of communities and new technologies. Zhang Yanguo emphasized the need to comprehensively explore the main links and specific applications of big data platform operation, adhere to the principle requirements of big data governance in Intelligent Community construction, and fully unleash the governance efficiency of smart communities[13]. Mao Peijin pointed out that China's Intelligent Community construction currently faces multiple development challenges in systems, technology, efficiency, and security[14]. The development of smart communities should focus on four aspects: improving top-level design, strengthening technology introduction and integration, enhancing the coordination of Intelligent Community construction, and perfecting information security management mechanisms.

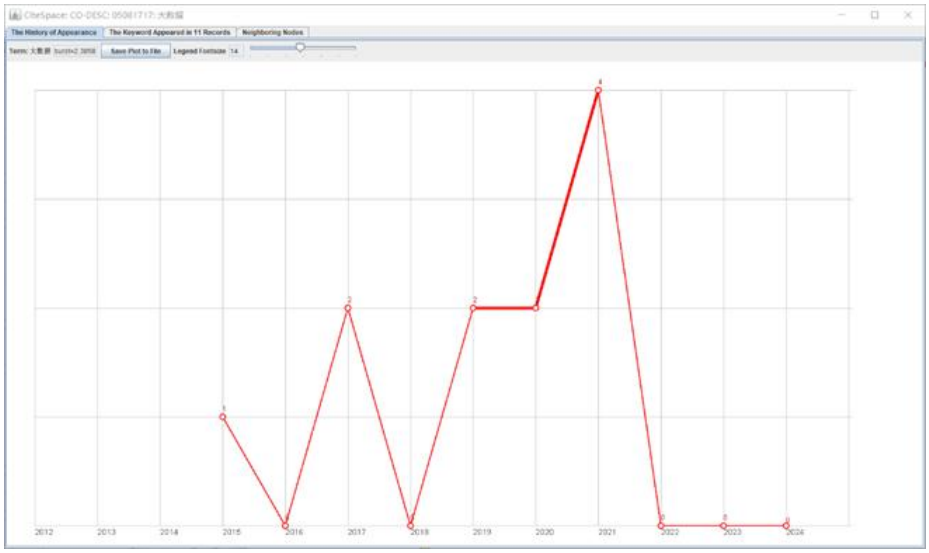

Fig. 11 Historical Curve Chart of "Big Data"

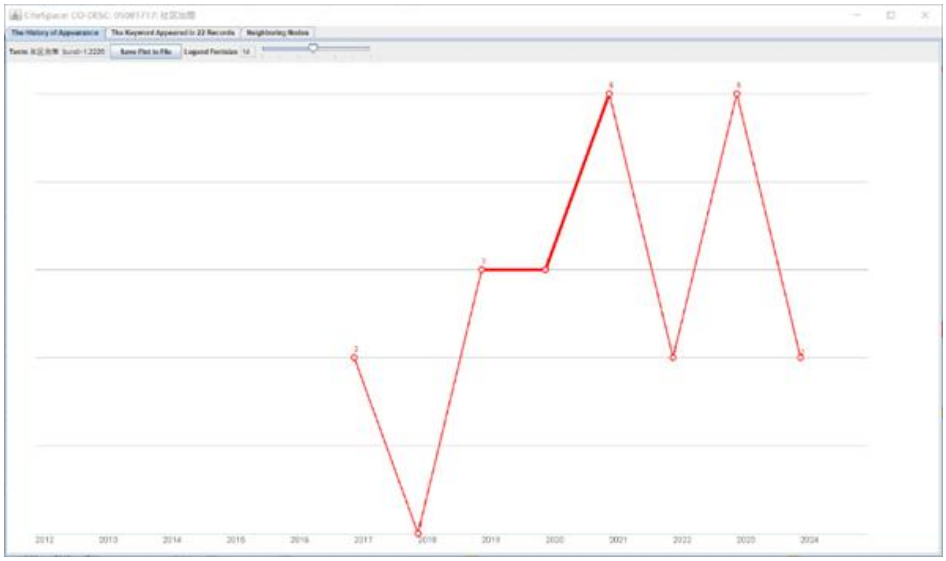

Fig. 12 Historical Curve Chart of "Community Governance"

Fifth, from 2020 to 2022, "Smart Governance" emerged as a hot topic. Although there was 1 related literature in 2017, a total of 4 publications were issued from 2020 to 2022, and 1 in 2024, mainly focusing on the integration and implementation paths of smart governance in urban communities. Zhu Yi proposed that smart governance in urban communities requires embedding the concepts of technology and rules, integrating platforms, and enhancing capabilities to construct the demand, operation, and support systems for smart governance in urban

communities[15]. Fan Fengchun's research revealed that the driving models for the effectiveness of smart governance in urban communities include terminal service-driven, platform integration-driven, online collaboration-driven, and comprehensive application-driven models.[16] Urban communities should dynamically adjust the driving models for smart governance effectiveness based on resource endowments and development needs.

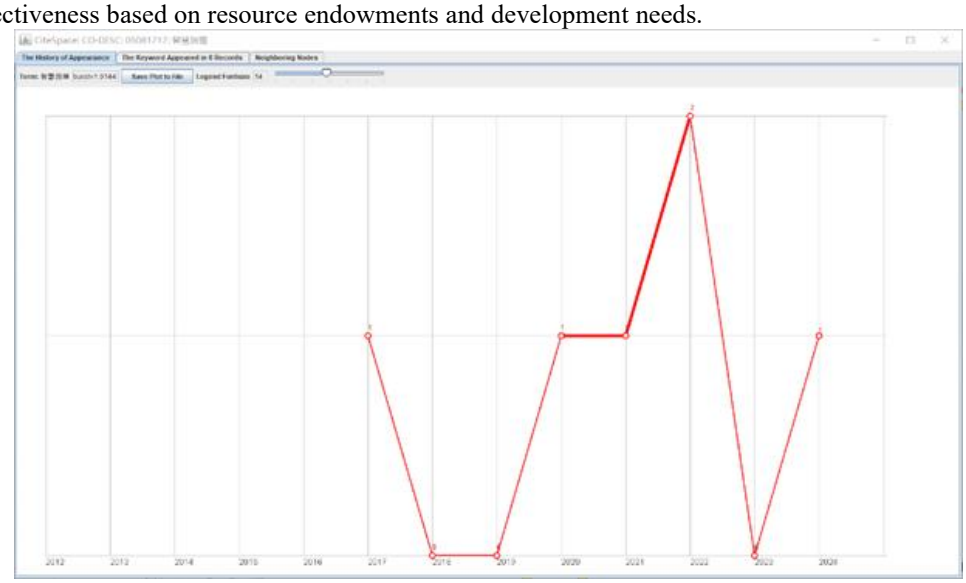

Fig. 13 Historical Curve Chart of "Smart Governance"

Sixth, from 2021 to 2024, the latest research hotspots focus on "New Infrastructure", "Digital Economy", "Digital Governance", and "Emergency Governance", mainly exploring how to implement digital governance and emergency governance for smart communities and cities, and promote resident participation against the backdrop of new infrastructure and the digital economy. "New Infrastructure" saw 2 publications from 2021 to 2023."Digital Economy" had 1 publication each in 2021 and 2022."Digital Governance" accumulated 4 publications from 2022 to 2024."Emergency Governance" was discussed in 2 related literatures from 2022 to 2023. New Infrastructure — defined by the National Development and Reform Commission (NDRC) as new-type infrastructure represented by 5G, artificial intelligence, industrial internet, and the Internet of Things (IoT) — was first proposed in 2015 and formally defined at the Central Economic Work Conference in December 2018. On December 27, 2021, the General Office of the State Council issued the 14th Five-Year Plan for the Construction of Urban and Rural Community Service Systems, calling for accelerated digital construction of community services, encouraging social capital investment in smart communities, and promoting the construction of information infrastructure for smart communities using 5G, IoT, and other modern information technologies. Zhang Hui proposed reducing transaction costs in the cooperative supply of digital infrastructure for smart communities through four approaches: clarifying data sharing standards, introducing interest negotiation mechanisms, improving information transmission methods, and optimizing compliance rules and processes[17]. Li Zhiqiang's research revealed that the dual drive of constructing an "integrated intelligent governance" model through community data and advancing "network integration" via information platforms can achieve data-driven, two-way empowerment, information sharing, and institutional standardization, enhancing the overall efficiency of emergency governance in smart communities. He also proposed a "civilizational" emergency governance model for smart communities[18]. In 2023, the Central Committee of the Communist Party of China and the State Council issued the Overall Layout Plan for Digital China Construction, indicating that China's digital construction has entered a new stage of balancing development and regulation. It emphasizes improving digital governance capabilities, strengthening the construction of digital governance ecosystems, and fostering a governance environment adapted to digital development. Against this backdrop, the development and

implementation paths of "New Infrastructure", "Digital Governance", "Intelligent Community", and "Smart Governance" will become future research frontiers.

5. Summary and Prospects

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

5.1 Research Summary

Over the past twelve years, research on smart communities in China has yielded fruitful results. This paper uses CiteSpace 6.3R1 (64-bit) software to conduct a visual analysis of Intelligent Community research in China over the past twelve years, with the following conclusions:

Publication Quantity in Core Journals: The number of related publications on "Intelligent Community" has been increasing, which is closely related to the sustained and healthy development of China's economy and society, deserving continuous attention from all sectors.

Distribution of Authors and Institutions: There is a large number of authors and institutions, with schools and institutions focusing on economics & management, urban planning, and political science serving as the main research forces. Collaboration between authors and institutions remains limited, with independent research as the main mode. Additionally, authors and institutions show certain regionality, primarily concentrated in eastern and southern developed regions, possibly related to economic development levels.

Research Themes and Hotspots: The research in the "Intelligent Community" field has always centered on "Big Data", "Digitalization", "Intelligent Community Governance", and "New Infrastructure", with research priorities closely tied to social hotspots and emerging technological achievements in each period. The focus has evolved from improving hardware conditions in the early stage to emphasizing soft governance of smart communities. With technological innovation, there is a growing emphasis on transforming communities into "smart communities" that keep pace with the times to build "smart cities". With the issuance of the Overall Layout Plan for Digital China Construction, it can be predicted that topics related to "Intelligent Community", "Intelligent City", "Intelligent Community Governance", and "New Infrastructure" will continue to be highly researched in the future.

5.2 Future Prospects

Regarding the future development of smart communities in China, the author believes the following directions are worthy of attention:

Strengthen Collaboration among Researchers and Institutions: Domestic scholars and institutions should enhance communication and cooperation, compare the development status of smart communities in different regions, and summarize common construction and development conclusions.

Deepen Research on Interactive Factors: Scholars in this field should increase discussions on the interactive effects of social environment, high-tech development, population mobility, higher-quality education, etc., especially research on resident participation and emergency management in smart communities.

Expand Participation from Diverse Disciplines: In addition to schools and institutions focusing on economics & management, urban planning, and political science, scholars and institutions from other fields—particularly those with high-tech backgrounds—should increase their focus on smart communities.

Promote International Comparative Studies: Comparative studies on international smart communities need further in-depth exploration, which can provide useful references for China's Intelligent Community research and facilitate exchanges and cooperation between domestic and foreign researchers.

Balance Intelligentization and Humanization: Pay attention to the integration of intelligentization and humanization, excavation of industrial value, and protection of data security and privacy. With the deepening of Intelligent Community construction, the creation of digital industrial value will receive increasing attention, and research on smart healthcare, smart homes, data security, and privacy protection technologies must be continuously promoted.

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