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The Evolution and Key Themes of Smart Elderly Care Policies: A Case Study of Fujian Province

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The increasingly severe aging problem in economically developed regions has created a pressing need for effective smart elderly care policies. This study takes Fujian Province as a case to systematically explore the characteristics and development trends of regional smart elderly care policies based on data-driven analysis, aiming to provide a rational and replicable framework for policy optimization in other regions. Using 59 policy documents from Fujian Province and its prefecture-level cities as the data source, this research employs quantitative methods combined with policy text mining techniques to examine the temporal distribution, content features, and keyword themes of these policies. The analysis reveals three core focus areas: the development and application of intelligent elderly care technologies, the construction and improvement of integrated healthcare and elderly care systems, and the enhancement of public elderly care services. This data-driven approach not only identifies key policy priorities and practical directions in Fujian Province but also offers a scientific tool for policy formulation and evaluation in similar contexts. While the study provides a systematic analysis framework based on empirical data, its findings are limited to Fujian Province and require further validation for broader applicability. Future research could extend to other regions and incorporate evaluations of policy implementation outcomes to refine the data-driven policy analysis system.

Keywords: smart elderly care, policy analysis, co-occurrence analysis, clustering

Introduction

With the acceleration of global population aging, smart elderly care has become a central focus worldwide. In particular, in China, the government has introduced a series of policies to address this challenge, aiming to enhance elderly care services and improve the quality of life for the elderly through smart technologies. Since 2011, the Chinese government has emphasized the need to accelerate the development of information systems for home-based elderly care services in the "12th Five-Year Plan for the Development of China's Aging Cause" and has continued to highlight the importance of digitalization in elderly care services in subsequent policies. For example, the "Guiding Opinions on Actively Promoting the 'Internet+' Action" released by the State Council in 2015 explicitly set forth the goal of promoting the development of the smart health and elderly care industry. From 2017 to 2020, with the implementation of the "Smart Health Elderly Care Industry Development Action Plan", the smart elderly care industry was further advanced (Qianzhan Network, 2022).

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With the advent of the “14th Five-Year Plan”, smart elderly care has become an important strategic initiative at the national level. In 2021, the State Council released the “14th Five-Year Plan for the Development of National Aging Cause and Elderly Care Service System”, emphasizing the need to actively respond to the national strategy for addressing population aging, with the institutional framework largely established, and to promote the effective coordination and high-quality development of the aging industry and related sectors (State Council, 2021). Against this backdrop, the Ministry of Industry and Information Technology, the Ministry of Civil Affairs, and the National Health Commission (2021) jointly issued the “Smart Health Elderly Care Industry Development Action Plan (2021-2025)”, outlining specific goals and measures for the development of the smart health elderly care industry, including the establishment of a standard system for smart elderly care and expanding access to intelligent products and services for a greater number of elderly people.

As one of the provinces in China most affected by aging, Fujian Province has made numerous attempts and innovations in the field of smart elderly care. The Fujian Provincial Government has introduced several policy documents, including the “14th Five-Year Plan for the Development of Aging Cause and Elderly Care Service System in Fujian Province” and the “Regulations on Elderly Care Services in Fujian Province”. These documents aim to promote the digital transformation and diversification of smart elderly care services and foster the sustainable and rapid development of the elderly care industry.

In response to this trend, the academic community has conducted extensive research on smart elderly care. International studies in this field exhibit diversity and an interdisciplinary nature, encompassing areas from theoretical foundations and technological applications to innovations in service models, the impact on elderly health, and predictions of future development trends. Liu, Chau, Liu, and Wan (2023), through a quantitative analysis of high-quality literature from the CNKI and WOS databases, identified key research hotspots in the field of smart elderly care and explored emerging frontiers, thus laying the groundwork for future studies. The study highlighted six key research areas in CNKI and 11 research topics in WOS, and proposed three major stages of development and three future research directions in the field of smart elderly care. Majumder et al. (2017), focusing on practical applications, explored the use of environmental and wearable medical sensors, actuators, and modern communication technologies in smart homes. These technologies enable continuous and remote monitoring of the health and well-being of the elderly, thereby reducing costs. Smart homes provide elderly individuals the option to remain in a comfortable home environment, rather than relying on expensive and limited medical facilities. Simultaneously, healthcare professionals can track the elderly’s overall health in real time, providing feedback and support remotely. Pal, Triyason, and Funikul (2017) presented evidence on how smart homes affect the quality of life for the elderly and discussed potential future research directions. These studies indicate that smart elderly care technologies can significantly enhance the quality of life for the elderly. Furthermore, Chen, Zhang, and Wang (2023), using semi-structured on-site interviews and the Delphi method, developed an evaluation framework for community-based smart home care services. This framework includes several key dimensions such as measurability, reliability, timeliness, empathy, and ease of use. This provides a solid foundation for assessing the quality of smart elderly care services.

After a comprehensive review of international research on smart elderly care, we now shift our focus to China. This section explores the research achievements, practical experiences, challenges, and opportunities China faces in the field of smart elderly care, within the context of rapid socio-economic development and the aging population trend. Existing research can be categorized into three main areas:

Development of Theories and Models: In this area, Liang, Hong, and Ma (2022) introduced the concept of "universal elderly care", a new model that emphasizes the integration of elderly care resources through next-generation information technologies. This approach aims to meet the elderly's all-time and multi-scenario care needs. Additionally, the "Smart Elderly Care Industry White Paper (2019)" provides an in-depth analysis of the macro-environment of the industry, including both domestic and international experiences, as well as the challenges it faces. The paper offers strategies and recommendations for the development of the smart elderly care industry (Tsinghua University Internet Industry Research Institute, 2020).

Practical Innovation in Smart Elderly Care Services: On the one hand, Ma (2019) explored the construction of a smart elderly care service system, using data analysis to offer personalized service plans for the elderly, highlighting the role of technology in improving the efficiency and quality of elderly care services. On the other hand, the study by Yu and Sun (2017) focused on the development paths and applications of smart elderly care platforms, emphasizing the potential of internet technologies in supporting elderly health management and daily life services. These two studies provide empirical evidence for the innovative paths and practical applications of smart elderly care services, contributing to the optimization of service models.

Application of IoT Technology in Home Elderly Care: The contribution of Internet of Things (IoT) technology in home elderly care services has also been a significant area of exploration. Yu, Lu, Zhu, and Feng (2012) emphasized the importance of IoT in monitoring elderly physiological parameters, providing home care, and facilitating remote medical supervision. This technology offers immediate assistance in emergency situations and has demonstrated advanced applications in areas such as monitoring elderly vital signs and managing chronic diseases. Liu (2014), addressing the supply-demand relationship in elderly care services, demonstrated how IoT technology can meet the diverse needs of the elderly by seamlessly integrating services to improve the care experience. Key applications include smart pillboxes, integrated community hospital service cards, and remote monitoring systems. These innovations not only enhance the efficiency and quality of elderly care services but also offer the elderly safer and more convenient lifestyles.

Building on extensive research both domestically and internationally, it is clear that this field is both complex and multi-faceted. Research in the area of smart elderly care has demonstrated the immense potential of technological innovations in enhancing the quality of life for older adults. International studies focus on the application of smart homes and wearable devices, which have improved health monitoring and provided greater life support for the elderly. In contrast, domestic research places more emphasis on the development of theoretical models and the establishment of service systems, as well as the practical application of IoT technology in elderly care services. However, in terms of research methodology, most studies primarily rely on qualitative analysis and theoretical framework development based on the authors' expertise, while quantitative research that utilizes data and statistical analysis remains relatively scarce.

This study aims to address this gap in the literature by conducting a systematic analysis of policy texts, exploring the evolution, key issues, and characteristics of smart elderly care policies. Using Fujian Province as a case study, this research analyzes the development dynamics of these policies. A mixed-methods approach combining quantitative and qualitative methods facilitates a comprehensive understanding of the framework and context of smart elderly care policies and provides more targeted policy recommendations for decision-makers. The methodology employed in this study is closely aligned with rational choice theory, which suggests that policymakers maximize benefits through cost-benefit analysis within the constraints of limited

resources and diverse options. The analysis of the external characteristics of policy texts and the quantitative research conducted in this study reveal the key variables in smart elderly care policies, offering data-driven support to decision-makers and enabling them to make informed and rational judgments among different policy options. Data-driven policy analysis not only complements existing qualitative research but also provides evidence-based support for the scientific and rational aspects of the policies. This approach helps policymakers more precisely assess the costs and benefits of various policy options, thereby making optimal decisions under the framework of rational choice theory. Consequently, the quantitative analysis in this study provides empirical support for the rational choice model and establishes a data foundation for optimizing and promoting smart elderly care policies.

Research Design

During the design phase of this study, a thorough analysis was conducted and the research framework proposed by Zhu Qinghua was adopted (Zhu, Shi, Lu, & Liu, 2022). This framework offers a fresh perspective and methodology for addressing key issues in the field of smart elderly care policy research, providing a solid foundation for the design of this study. Building on this foundation, this study has made necessary adjustments and extensions to Zhu Qinghua's framework to better align with the specific issues and objectives of the research. The following section will provide a detailed explanation of the methods employed in this study, as well as the innovations and adjustments made based on Zhu Qinghua's framework. The specific flowchart is shown in Figure 1.

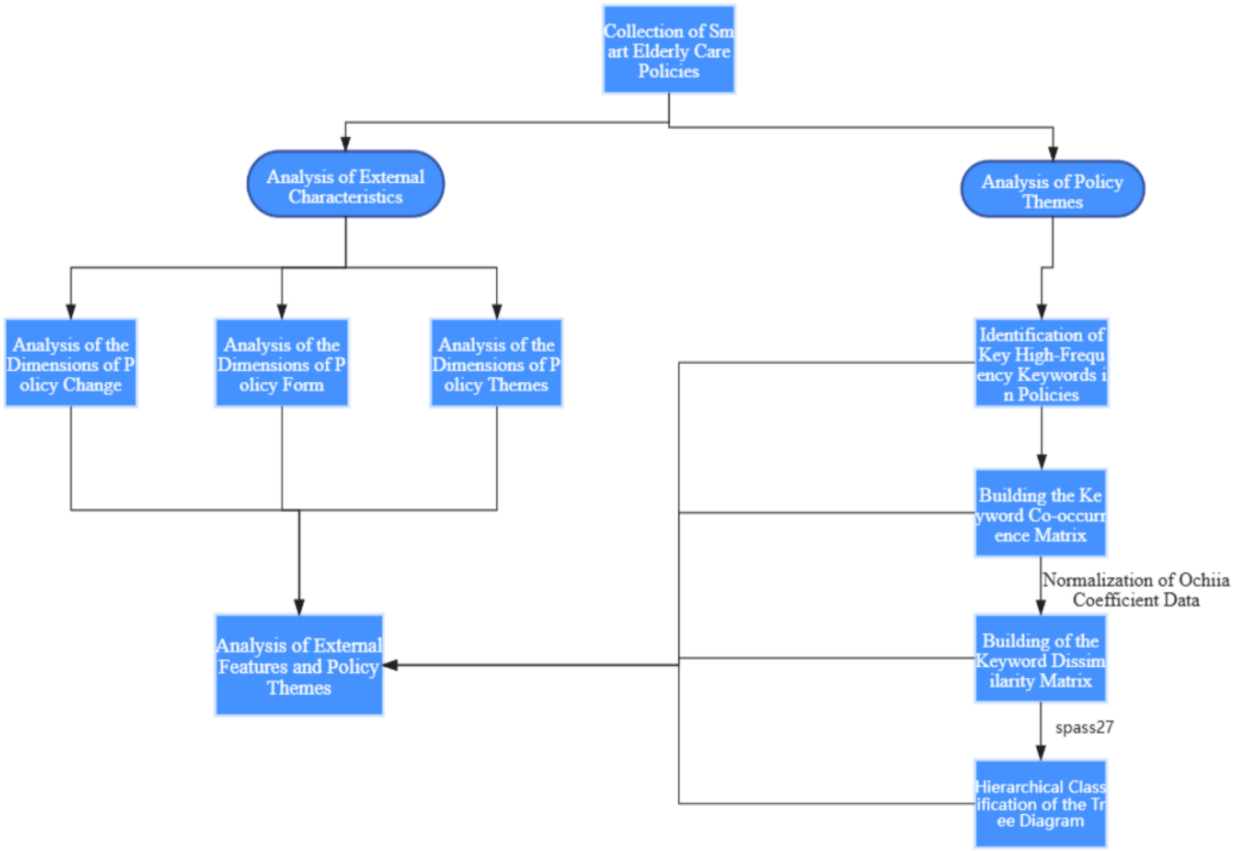

Figure 1. Research analysis workflow.

Sample Collection

This study centers on the smart elderly care policy documents released by the Fujian Provincial Government and its 9 prefecture-level cities from 2016 to the present. The data collection was carried out through specific keyword searches on the official websites of the Fujian Provincial Government and its affiliated prefecture-level cities, supplemented by searches in the Peking University fabao and Fayi databases to gather key policy documents related to smart elderly care. This comprehensive search strategy ensured the completeness and accuracy of the collected legal and policy documents from both official websites and legal databases, providing a diverse and comprehensive foundation for the subsequent analysis.

In the process of constructing this literature database, four types of literature were explicitly excluded from being considered part of the smart elderly care policy: (1) speeches, letters, and instructions from leaders; (2) catalogs or lists attached to other documents; (3) technical specifications and standards in specific technical fields; (4) various work summaries, situational analysis reports, and annual work guidance documents. Moreover, during the policy content review, documents with only brief mentions of smart elderly care were excluded; the literature must contain substantial content on the goals, methods, measures, and other key aspects of smart elderly care. As of January 5, 2024, 59 smart elderly care policies issued by the Fujian Provincial Government and its prefecture-level cities have been selected as research samples, as shown in Table 1.

Table 1

Smart Elderly Care Policy Documents (Partial)

No.	Policy	Date of issue
1	Fujian Province 13th Five-Year Plan: Digital Fujian Special Plan	2016
2	Longyan City “Internet + Elderly Care” Information Service Platform Implementation Plan (2016-2020)	2016
3	Sanming City Smart City Development “Internet + Medical and Elderly Care” and “One-Click” Call Service Platform Implementation Plan	2016
4	Ningde People’s Government Opinions on Accelerating the Development of Professionalized Community Home-Based Elderly Care Services in Urban and Rural Areas	2016
5	Xiamen City Aging Affairs Development 13th Five-Year Plan (2016-2020)	2016
6	Xiamen City Elderly Care Service Development Plan	2016

Research Methods

This study adopts a quantitative analysis of policy texts, focusing on the evolution of elderly care policies in Fujian Province. By analyzing the number and characteristics of policy documents in detail, this study outlines the evolution of elderly care policies and examines the key issues addressed in the policy documents. The analytical framework includes two dimensions: the external characteristics and content themes of the policies. The dimension of external characteristics looks at policy changes, stakeholders, and their forms of expression, which provides a comprehensive understanding of the evolution and current state of elderly care policies. The dimension of content themes, through keyword and thematic clustering analysis, explores the underlying meaning of policy texts and reveals the strategies and priorities for implementing elderly care.

In terms of analytical methods, This study primarily uses co-word analysis and cluster analysis techniques. These methods are widely applied in scientometrics and text mining to reveal relationships and structures between documents, concepts, or terms. Co-word analysis relies on the co-occurrence principle, exploring the relationships between knowledge units and structural changes within scientific fields by analyzing the frequency of word co-occurrence. By studying the co-occurrence network of keywords, researchers can identify

key themes and trends in a field, as well as the interconnections between different research topics. Callon, Courtial, and Laville (1991) introduced co-word analysis to depict the dynamic evolution of scientific knowledge. Cluster analysis is a statistical method used to group similar objects and is commonly applied in unsupervised learning and pattern recognition. In text analysis, cluster analysis helps identify hidden patterns or themes in a collection of documents by grouping them based on content similarity. This method enables researchers to uncover the information structure and thematic categories in large-scale text data. Jain, Murty, and Flynn (1999) provided a comprehensive review of clustering analysis methods and discussed their practical applications across various fields.

In terms of research tools, this study employs the TF-IDF algorithm combined with SPSS 26.0 software to analyze the key themes and interrelationships within policy texts. TF-IDF, a widely used text mining technique, assesses the importance of words in a document by considering term frequency (TF) and inverse document frequency (IDF). While term frequency reflects a word's significance within a document, inverse document frequency reduces the weight of common terms and amplifies the importance of rare ones, highlighting keywords that are distinctive to the document. The SPSS 26.0 clustering analysis tool is then applied to group these keywords based on their similarities, generating a dendrogram that uncovers the structural connections between policy themes, providing a clear view of the core issues and their interactions within the realm of smart elderly care policies. By integrating TF-IDF and SPSS 26.0 clustering analysis, this study offers a precise extraction of critical insights from policy texts, sheds light on the developmental trends and internal logic of smart elderly care policies, and provides both empirical evidence and new perspectives for informed policy-making and evaluation.

Results and Analysis

External Features of the Policies

Analysis of the dimensions of policy change. Amidst the accelerating aging process, Fujian Province has actively explored new models of smart elderly care, leveraging policy guidance, technological innovation, and multi-party participation to continuously enhance the quality of elderly care services, striving to create a more comfortable and convenient living environment for seniors. As shown in Figure 2, since 2016, Fujian has issued 59 smart elderly care policies, with an average of 6.25 policies released annually. In 2017, the policy release peaked at 13. Overall, the policies can be categorized into three stages: initiation and growth, stable implementation, and adjustment and optimization.

From 2016 to 2017, this period represented the initiation and growth phase of policy development, characterized by a sharp increase in policy issuance. In 2016, the Fujian Provincial Government took the lead in releasing the "Special Plan for the Digital Development of Fujian during the 13th Five-Year Plan Period", which proposed optimizing the information systems for community-based home care and institutional elderly care, utilizing mobile technologies such as portable health checkups, emergency call systems, and wearable health monitoring devices to provide comprehensive elderly care services, including nursing, health management, and rehabilitation support. The year 2016 marked a turning point for Fujian Province, as the aging trend became more pronounced. During this year, the elderly population in Fujian grew at an accelerated pace, particularly the elderly population aged 80 and above, leading to a rapid increase in demand for elderly care services and placing unprecedented pressure on the elderly care system. In response to this growing need,

both the Fujian Provincial Government and local governments actively began seeking innovative solutions to address the challenges posed by an aging population. Given the urgency of the situation, in 2017, the Fujian Provincial People's Congress enacted the "Fujian Province Elderly Rights Protection Regulations", which promoted the integration of technology into elderly care services, including emergency rescue and remote monitoring capabilities, and encouraged the establishment of service platforms by various sectors of society.

From 2018 to 2020, Fujian Province entered the stable implementation phase of its smart elderly care policies, with a more consistent frequency of policy issuance and an increased focus on the execution and enhancement of specific measures. During this period, policies such as the "Fuzhou City Comprehensive Plan for Expanding the Elderly Care Service Market and Improving Service Quality" and "Implementation Opinions of the Putian Municipal Government on Supporting Social Forces to Provide Multilevel and Diversified Medical Services" promoted the integration of modern information technologies, including big data, cloud computing, and the Internet of Things. By building a unified smart health and elderly care platform, these policies aimed to integrate home and institutional services, ensuring seamless connection between supply and demand and providing seniors with more systematic and comprehensive healthcare and living services. Particularly in 2020, the "Action Plan for Promoting Elderly Care Service Development (2020-2022) in Xiamen" called for the vigorous development of the "Internet + Elderly Care" model. This included the establishment of a city-level regulatory and service platform to enhance service efficiency, increase transparency in supervision, and promote the application of the sharing economy in the elderly care sector to improve resource utilization. The policy also placed particular emphasis on improving the personal information files and service records for the elderly, ensuring real-time sharing with regional medical information platforms and residents' electronic health records. This would enable the provision of more accurate and efficient services, thus further enhancing the convenience and quality of life for seniors.

From 2021 to the present, Fujian Province has entered the phase of adjustment and optimization for its smart elderly care policies. During this stage, policies have shifted towards deeper evaluation and more refined optimization, with a reduced frequency of issuance. The content of these policies has become more detailed and focused. However, the overall leadership still remains with the Provincial Government. In 2022, the "Notice of the General Office of the People's Government of Fujian Province on Accelerating the Development of Medical-Elderly Care Integration" led to the issuance of the "Notice of the General Office of the People's Government of Putian City on Accelerating the Development of Medical-Elderly Care Integration" and the "Implementation Opinions of the General Office of the People's Government of Zhangzhou City on Accelerating the Development of Medical-Elderly Care Integration". These policies focused more on the development of infrastructure, expanding the pilot program for medical and elderly care integration and remote collaborative services, strengthening the connectivity of remote medical information, and promoting the expansion of telemedicine services. Additionally, the policies encourage medical institutions to enhance their information technology infrastructure and improve the setup of remote consultation rooms to ensure their efficient operation. Building on home and community health service centers, the policies advocate for the creation of "smart health cabins", equipped with health management devices to provide daily health monitoring and guidance, ensuring that the health needs of seniors are met in a timely manner.

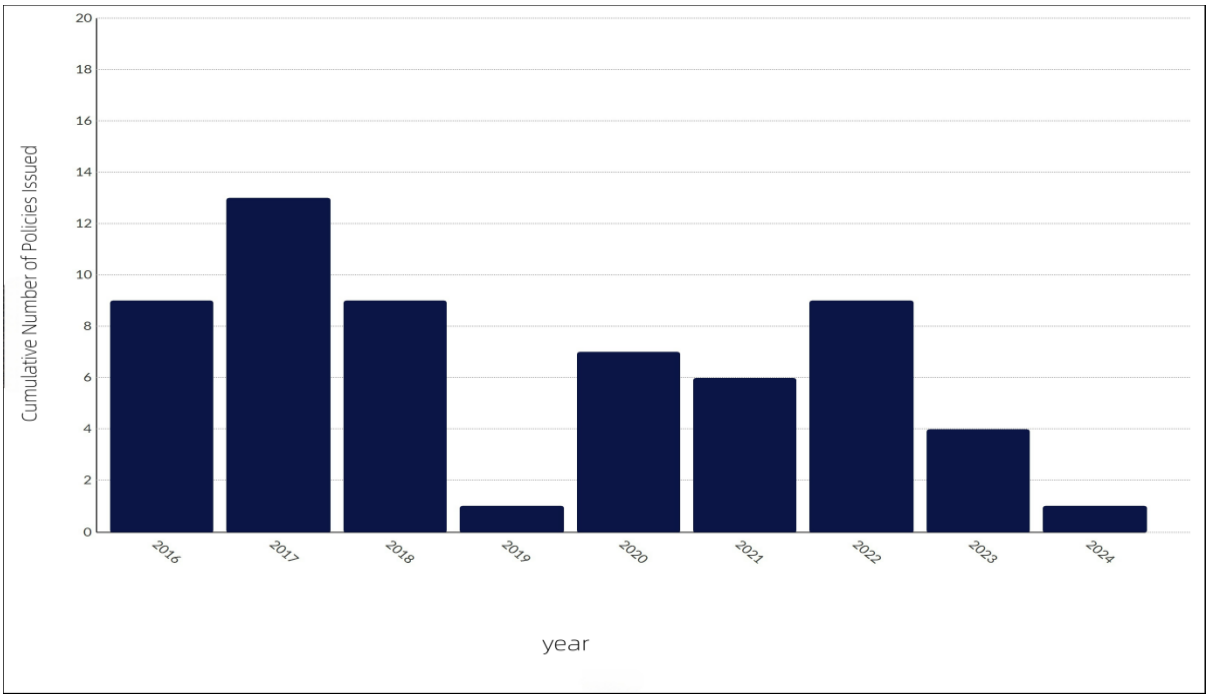

Figure 2. Policy issuance timeline.

Analysis of the policy actors dimension. The smart elderly care policy framework of Fujian Province outlines two administrative levels: provincial and municipal. At the provincial level, from 2016 to 2023, a total of 14 smart elderly care policies have been released, involving various departments such as the Provincial Government, Provincial Health and Family Planning Commission, Provincial Department of Civil Affairs, and Provincial Department of Finance. This reflects the importance of interdepartmental collaboration. At the municipal level, 9 prefecture-level cities have released 45 policies, showcasing local governments' innovation and proactive exploration. Although these policies are not directly derived from the provincial policy framework, they are designed according to local needs and characteristics, offering services and measures that address the specific demands of elderly populations. For example, the "Implementation Plan for Building a Smart City 'Internet + Elderly Care' and 'One-Click' Call Service Information Platform" in Sanming City supports local enterprises in platform development, providing emergency rescue, healthcare, and other services.

The discrepancy in the number of policies across regions reflects the varying levels of attention given to aging issues. Figure 3 illustrates the number of smart elderly care policies released by 9 prefecture-level cities. Sanming City, with the second-highest aging rate in the province, has placed significant emphasis on the modernization of elderly care services. Since 2016, Sanming has released 9 related policies, marking in-depth exploration into smart elderly care. On the other hand, Fuzhou, leveraging its resources as the provincial capital, has actively explored and practiced smart elderly care, releasing 7 related policies. These policies cover areas such as innovation support, scientific research, and finance, aiming to create a collaborative decision-making network involving the city government, the civil affairs bureau, the finance department, and research institutions, working together to promote the development of a smart elderly care service system. While cities like Quanzhou and Zhangzhou have fewer policies, they are also actively pushing forward innovations in smart elderly care services. Overall, Fujian Province is committed to seizing opportunities in the smart elderly care industry and enhancing elderly care services.

Addressing the challenges of population aging requires the active participation of the government, society, and individuals. The leadership role of the Fujian Provincial Government is crucial. It is not only responsible for formulating policies and providing funding but also for creating a supportive environment that fosters technological innovation and cross-sector collaboration. This will encourage the participation of local governments and the private sector in exploring new models that address aging. By guiding policies, integrating resources, and optimizing service provision, along with strengthening regulatory and evaluation mechanisms, the government aims to enhance the coverage and quality of elderly care services, making elderly people's lives more intelligent and convenient.

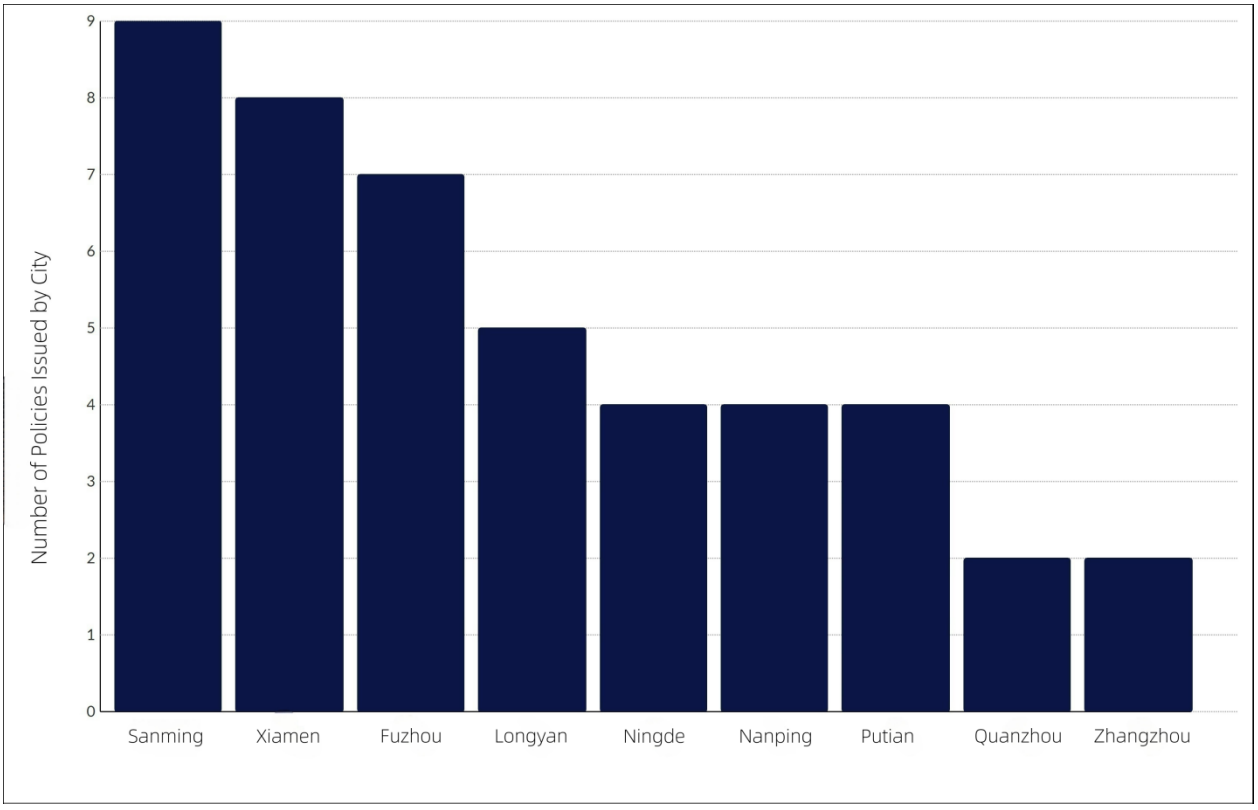

Figure 3. Policy release statistics by city.

Policy form dimension analysis. Fujian Province's smart elderly care policies take various forms, including opinions, notices, plans, proposals, and regulations, which together form a comprehensive policy framework. As demonstrated in Figure 4, the largest proportion of policies are in the form of plans (33.89%), which outline development goals, key tasks, and supporting measures for the upcoming years, offering a detailed blueprint. For instance, the "14th Five-Year Plan for the Development of Elderly Affairs and the Elderly Care System in Xiamen" sets the goal of building "Internet+" smart elderly care facilities. Proposal-type policies (32.2%) provide specific actions and timelines for addressing particular issues, emphasizing implementation and enhancing the development and efficiency of smart elderly care services. Notice-type policies (16.9%) provide concrete action guidelines, such as the "Notice from the Fujian Provincial People's Government on Accelerating the Development of the Rehabilitation Industry with Eight Measures". Opinion-type policies (13.5%) offer strategic guidance, focusing on innovation and cooperation, and provide a

framework for developing the service system. Regulation-type policies (3.38%) are the fewest, clearly defining legal responsibilities and management standards, offering the legal foundation for smart elderly care.

Overall, Fujian Province's smart elderly care policies emphasize guiding and strategic documents, such as opinions, proposals, and notices, to address the rapidly evolving market demands and technological advancements. Regulations impose stronger legal constraints, but as a nascent field, smart elderly care requires greater flexibility and space for innovation. Consequently, early-stage policies tend to be more adaptable and experimental, with considerable potential for further development and refinement in establishing standards and regulations in the future.

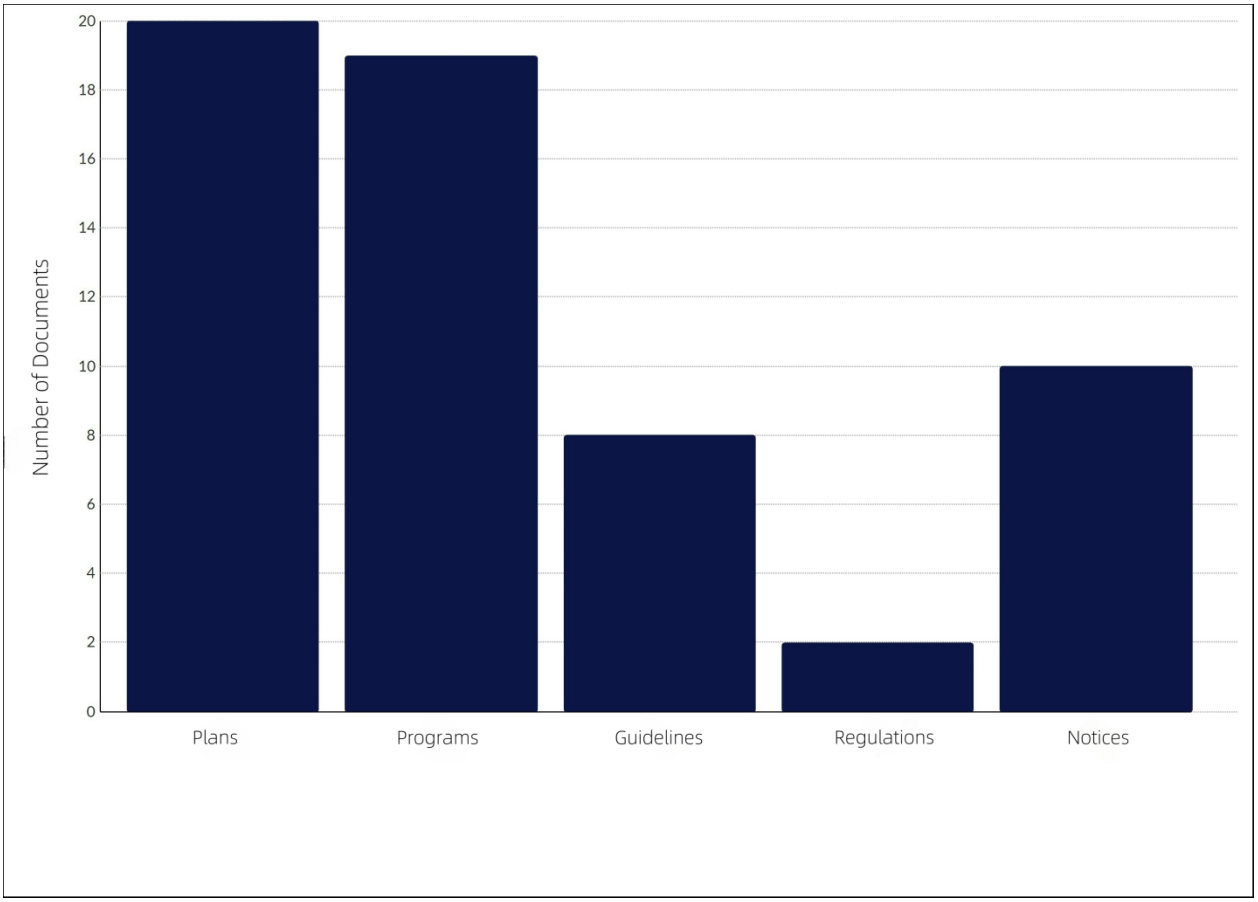

Figure 4. Distribution of policy issuance forms for smart elderly care.

Characteristics of Policy Themes

Identification of key terms. The frequent occurrence of keywords is crucial for elucidating the central themes of policy documents. These keywords help to precisely identify the focal points and priority areas of the policies, thus providing a solid foundation for understanding their main objectives and directions. In this study, policy documents are treated as independent sources, and the TF-IDF algorithm is employed to evaluate the relative importance of terms within each document, facilitating the identification of key terms. During the preprocessing phase, a domain-specific dictionary and stopword list were constructed for the field of smart elderly care. The domain-specific dictionary includes terms such as "telemedicine services" and "smart wearable devices", which are excluded from tokenization to preserve their original meaning. Additionally,

based on an expanded stopword list in the context of the Chinese language, common verbs like “implement”, “promote”, and “carry out”, as well as frequent policy adjectives such as “important”, “comprehensive”, and “modern”, were included. Following a thorough parameter optimization process, the study identified the top 20 keywords with the highest weights in each policy document, providing a basis for further in-depth analysis, as shown in Table 2.

Table 2

Keywords of Smart Elderly Care Policies (Partial)

No.	Policy	Keyword
1	The “13th Five-Year Plan” for the Development of Elderly Affairs and the Construction of the Elderly Care System in Fuzhou City	elderly, services, elderly care, aging, society, elderly care services, community, system, home-based care, community elderly care, basic, elderly institutions, system, rural areas, insured, daily care, pension insurance, service facilities, security, livability
2	The Action Plan for Promoting the Development of Elderly Care Services in Xiamen (2020-2022)	elderly care services, subsidies, elderly people, elderly care institutions, service facilities, professionals, government, elderly assistance, operations, medical institutions, rural areas, community-based elderly care, care, home-based elderly care, supervision, system, enterprises, society, rehabilitation, volunteers
.....	.....	.....

The frequency of the 40 most common keywords across 85 policy documents is presented in Table 3. The findings show that subsidies are a central focus in Fujian Province’s smart elderly care policies. The province is committed to improving the quality and accessibility of elderly care services by providing government subsidies, upgrading service facilities, and supporting the development of elderly care services in both enterprises and rural areas, with the aim of enhancing the quality of life for seniors. Keywords such as “subsidies”, “rehabilitation”, and “nursing” highlight the emphasis on building a robust elderly care service system, striving to create a comprehensive network of care services for the elderly. Fujian Province is also promoting the modernization and intelligence of elderly care services through the “Internet+” strategy, introducing smart health management systems and virtual elderly care homes in response to population aging. Additionally, references to elderly care institutions, societal organizations, and medical facilities within the policy documents reflect a collaborative service model that aims to address the medical, nursing, and rehabilitation needs of the elderly through innovation and home-based care solutions. The government not only provides direct subsidies but also encourages community-based elderly care, supports the integration of medical and elderly care services, and fosters the development of smart elderly care technologies.

Table 3

Most Frequent Keywords in Smart Elderly Care Policies

Subsidies	Rehabilitation	Nursing	Service facilities
Enterprises	Rural	Infrastructure	Informatization
Framework	Platform	Elderly care institutions	Society
Medical institutions	Innovation	Home-based elderly care	Government
Community elderly care	Demand	Smart	Healthcare
Intelligent	Elderly care	Data	Responsibility
Application	Health	System	Bed capacity
Protection	Internet	Training	Senior care services
Resources	Digital	Collaboration	Internet of Things (IoT)
Professional	Traditional Chinese medicine	Integrated healthcare and elderly care	Investment

Co-occurrence analysis based on keyword construction. In the in-depth analysis of Fujian Province's smart elderly care policy literature and its focal areas, this study employed co-occurrence analysis to explore the relationships between keywords and the underlying thematic structure within the texts. Co-occurrence analysis is a bibliometric method that quantifies the frequency with which keyword pairs co-occur, constructing a keyword co-occurrence network to reveal the relationship density and structure between them. Based on 59 policy documents on smart elderly care, this study selected the 40 most frequently occurring keywords and generated a 40×40 keyword co-occurrence matrix, which serves as the basis for the analysis, as shown in Table 4. To overcome the challenges of comparing co-occurrence frequencies due to scale differences, this study applied the Ochiia coefficient (a measure used for data normalization) to standardize the data, enabling a clearer comparison of keyword similarities and differences under a unified standard, as shown in Table 5.

$$\text{Ochiia coefficient} = \frac{The\ co{-}occurrence\ frequency\ of\ keywords\ A\ and\ B}{\sqrt{The\ total\ frequency\ of\ keyword\ A} * \sqrt{The\ total\ frequency\ of\ keyword\ B}} \quad (1)$$

The difference matrix value between keyword A and keyword B = 1 - Ochiia coefficient (2)

Table 4

Keyword Co-occurrence Matrix (Partial)

Keyword	Elderly care institution	Service facilities	Home-based elderly care	Community-based elderly care	Internet of Things (IoT)	Integration of medical care and elderly care	Elderly care services
Elderly care institution	26	15	7	12	0	2	26
Service facilities	15	20	8	10	0	2	20
Home-based elderly care	7	8	15	5	0	2	14
Community-based elderly care	12	10	5	14	0	2	14
Internet of Things (IoT)	0	0	0	0	5	0	0
Integration of medical care and elderly care	2	2	2	2	0	4	4
Elderly care services	26	20	14	14	0	4	38

Table 5

Keyword Dissimilarity Matrix (Partial)

Keyword	Elderly care institution	Service facilities	Home-based elderly care	Community-based elderly care	Internet of Things (IoT)	Integration of medical care and elderly care	Elderly care services
Elderly care institution	0.000	0.342	0.645	0.371	1	0.803	0.172
Service facilities	0.342	0.000	0.538	0.402	1	0.776	0.274
Home-based elderly care	0.645	0.538	0.000	0.654	1	0.741	0.413
Community-based elderly care	0.371	0.402	0.654	0	1	0.732	0.393
Internet of Things (IoT)	1	1	1	1	0	1	1
Integration of medical care and elderly care	0.803	0.776	0.741	0.732	1	0	0.675
Elderly care services	0.172	0.274	0.413	0.393	1	0.675	0

A 40×40 matrix of keyword dissimilarities was constructed as shown in Table 5. This matrix was designed to quantify the differences between keywords, where values closer to 0 indicate a stronger co-occurrence

relationship between the two keywords within the text. To further investigate the similarity among these keywords, this study utilized advanced clustering analysis in SPSS statistical software. As a result, the keywords were effectively grouped based on their similarities, forming distinct clusters, each representing a set of closely related terms. As shown in Figure 5, the core keywords of Fujian Province's smart elderly care policy can be categorized into three distinct groups.

The first category focuses on the role of smart technologies in elderly care services, highlighting the importance of integrating digital, systematic, and informatized methods into these services. Keywords such as "smart", "application", "intelligent", and "platform" reflect policymakers' strong intention to leverage modern technology to improve the quality and efficiency of elderly care services. Typical policy documents, such as the "Implementation Plan for Building a Smart City 'Internet + Medical and Elderly Care' and 'One-Click' Call Service Information Platform in Sanming City" and the "Implementation Plan for Building the 'Internet + Elderly Care' Information Service Platform in Longyan City (2016-2020)", both emphasize that by integrating Internet of Things (IoT), big data, and internet resources, elderly care institutions can offer more personalized and efficient services. The analysis of these policies shows that the application of smart technologies in elderly care is becoming an irreversible trend, which calls for the government, society, and businesses to collaborate in constructing a smart elderly care service system, ensuring that elderly individuals can enjoy safer, more convenient, and smarter care services.

The second category of keywords focuses on the creation of a comprehensive integrated medical and elderly care service system, emphasizing the deep integration of healthcare and elderly care, blending traditional Chinese medicine with modern elderly care needs. Fujian Province aims to develop a multi-level, interdisciplinary service model to address the growing and diverse health and care needs of the elderly. "Medical-elderly care integration" stresses the seamless connection between healthcare and elderly care, promoting professional training and effective resource allocation. This collaboration involves healthcare institutions, elderly care organizations, the government, social services, educational training, and families, forming a multi-party care network. The keywords "professional" and "training" highlight the importance of improving service quality through systematic training, which not only enhances nursing efficiency but also lays a foundation for the sustainable development of the elderly care sector. By integrating these concepts, Fujian Province has established a human-centered medical-elderly care service system that combines policy support, cross-sector cooperation, and market demand, fostering seamless integration and resource sharing between healthcare and elderly care.

The third category of keywords focuses on the government's pivotal role in the financial investment in public elderly care services, aiming to strengthen the infrastructure and improve the quality of community elderly care, rehabilitation, and nursing services through financial support. Keywords such as "government", "investment", and "subsidy" underscore the critical role of Fujian Province's finance in constructing and maintaining an inclusive and sustainable elderly care system. From an academic perspective, government financial investment is not only a key factor in the quality and coverage of the elderly care service system but also a major driver of service innovation and efficiency improvement. Government investment operates at multiple levels: direct financial infusion strengthens the infrastructure of elderly care institutions and community services, providing a safe and comfortable environment for the elderly; subsidies help narrow the urban-rural gap in elderly care services, particularly improving facilities in rural and remote areas; fiscal support encourages service providers to adopt innovative models and technologies, improving overall

effectiveness and accessibility. Furthermore, the government's role in elderly care policy formulation and system construction extends beyond financial support. It involves guiding social capital into the elderly care sector through policy frameworks and standards, promoting cooperation between the government and private sectors, and developing a diversified service system. In conclusion, the investment and policy support from Fujian Province's government form the cornerstone of ensuring the elderly receive high-quality care services. Through financial support, policy guidance, and interdepartmental cooperation, a comprehensive, efficient, and sustainable elderly care system can be built to address the challenges of population aging.

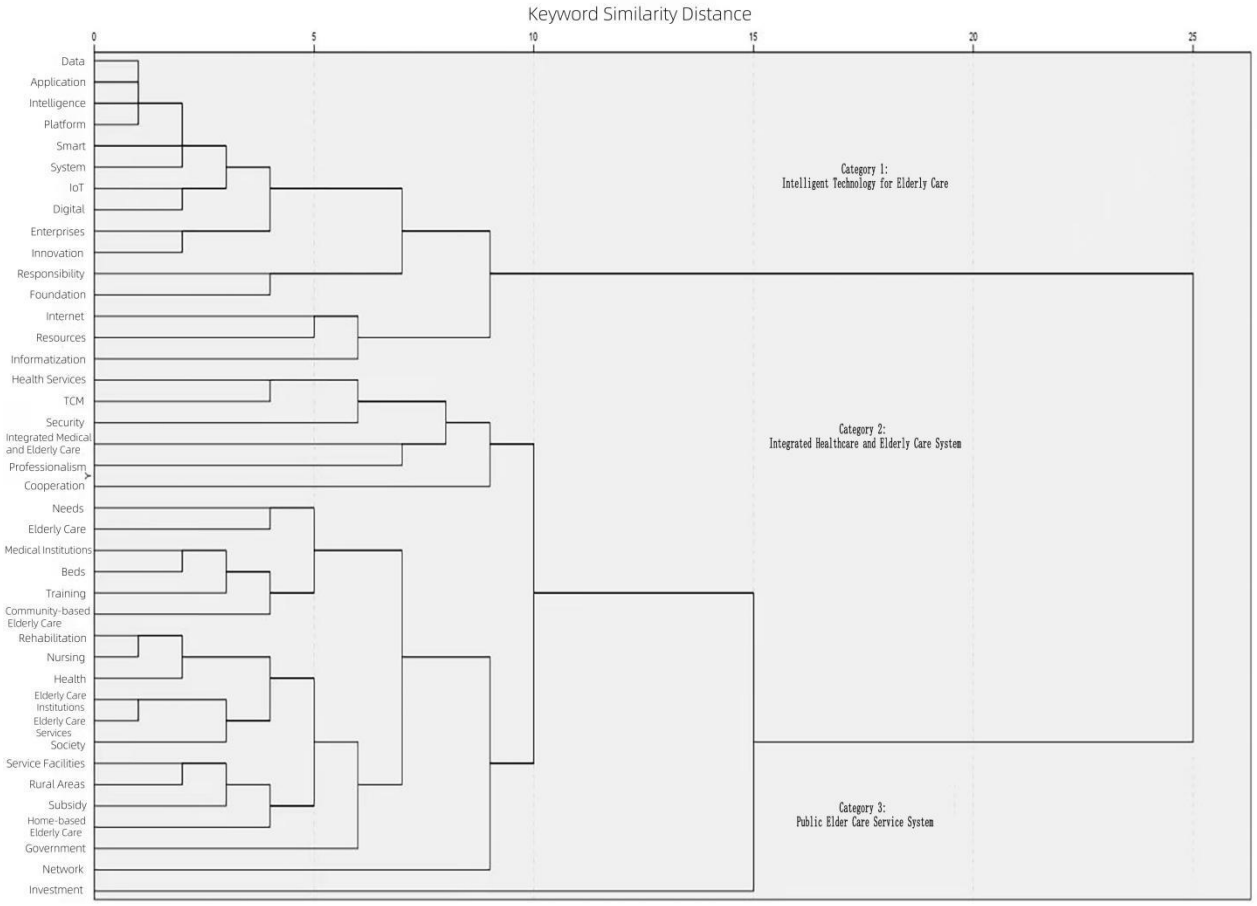

Figure 5. Cluster diagram of smart elderly care policies.

Conclusions and Recommendations

Summary

In Fujian Province, a key strategy to address the aging population challenge will be the rapid advancement of smart elderly care policies. These policies have evolved from the initial application of basic information technology to a more integrated system and technological innovation in smart elderly care, demonstrating a clear developmental trajectory. The Fujian Provincial Government has consistently issued policy documents aimed at enhancing the quality of elderly care services through technology, ensuring that the elderly enjoy a safe and convenient living environment. This approach has far-reaching implications for the rapidly aging society of Fujian.

The evolution of smart elderly care policies in Fujian Province is primarily reflected in three key aspects: the application of smart technologies, the advancement of an integrated medical and elderly care system, and the enhancement of the public elderly care service framework. The government has actively promoted the use of technologies such as the Internet of Things (IoT) and big data in elderly care to improve both the efficiency and quality of services. The integrated medical and elderly care system emphasizes the seamless combination of healthcare and elderly services, improving the management of elderly people's health and overall quality of life. In terms of public elderly care, the government continues to invest in infrastructure development to promote the widespread availability and high-quality delivery of services. Despite some positive outcomes from policy implementation, Fujian still faces challenges in refining the policy system and addressing the insufficient details in its execution. Current policies are largely macro-level guidelines, and more specific execution plans are required. Furthermore, the development of regulations and standards is urgently needed to ensure the quality and safety of services and to close potential legal loopholes.

Regarding the application of smart technologies, while smart elderly care technologies hold significant potential, elderly individuals still face the challenge of the digital divide when using these technologies. Therefore, policies should be more tailored to the needs of the elderly, encouraging businesses to develop user-friendly, simple interface smart products that better align with the elderly's lifestyle and enhance their digital literacy. The integrated medical and elderly care system is gradually being refined, but the continuity and accessibility of services still need improvement. The successful integration of medical and elderly care services requires close cooperation among the medical, elderly care, and community service sectors, facilitated by seamless integration via information-sharing platforms. With regard to the public elderly care system, Fujian has made some progress, but further optimization of the service structure and quality improvements are necessary to meet the increasing demand. The government should prioritize a balanced distribution of elderly care facilities, particularly in rural and remote areas. Investment should be increased in day care centers and community elderly care service stations to ensure that elderly people can access convenient services in their local communities.

Suggestions for Nationwide Implementation

Data-driven approach to policy. This study employs co-word and cluster analyses of policy texts to systematically uncover the core themes and developmental trajectories of smart elderly care policies, offering robust, data-driven insights for policymakers. Framed within the context of rational choice theory, this approach ensures that decision-makers can base their policy formulations on empirical evidence, facilitating the identification of optimal solutions. The proposed data-driven model effectively addresses the subjectivity and reliance on anecdotal evidence often prevalent in traditional policy-making, thereby enhancing the scientific rigor and precision of policy decisions. Consequently, the model advocated here not only offers a solid theoretical foundation but also demonstrates practical value for nationwide implementation. Policymakers across diverse regions can leverage localized policy data analysis to tailor smart elderly care policies that meet specific regional needs, thereby maximizing policy impact and effectiveness.

The integration of data analysis methods with rational choice theory. Rational choice theory suggests that policymakers make rational decisions to maximize benefits within the constraints of limited resources. This study uses analysis of external factors and empirical data to examine the dimensions of policies and their potential influencing factors, providing a solid, evidence-based foundation for decision-making. Specifically,

the policy themes and structures identified through data analysis offer valuable empirical insights for policy selection, allowing decision-makers to more accurately evaluate the costs and benefits associated with different policy alternatives.

The data-driven policy recommendation model presented in this paper is both theoretically applicable across a wide range of contexts and adaptable through continuous empirical feedback. As local governments implement smart elderly care policies, they can utilize the analytical framework outlined in this study to dynamically adjust their policy strategies based on data, thereby improving the effectiveness and long-term sustainability of the policies.

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