Research on the Development Strategy of Community Embedded Elderly Care Services Under the Empowerment of Information Technology

Based on the Perspective of Integrated Services

Li Li(✉) and Shuoyi Zhu

College of Literature Law and Economics, Wuhan University of Science and Technology, Wuhan, China
1647058874@qq.com

Abstract. With the aging trend becoming more and more severe, the community-embedded elderly care service model provides a new idea for solving the problem of caring for the elderly. However, problems such as imperfect institutional planning and poor resource integration ability plague the development of community-embedded elderly care services. In the context of intelligent society, based on the integrated service framework and the use of information technology, the community-embedded elderly care service model can be optimized in an all-round way. For example, by strengthening policy design, building a multi-party secure computing system using technologies such as blockchain and federated learning, and building smart terminals with the help of information technology, the provision of elderly care services is integrated. It is hoped that these measures will ease the pressure on the elderly in China.

Keywords: Information Technology · Integration service · Community embedded elderly care services · Elderly care

1 Introduction

Since the 21st century, China's aging trend has become increasingly severe. According to relevant data from the China Bureau of Statistics, in 2016, the number of people aged 65 and above in China was 150.37 million, and the old-age dependency ratio reached 15%. In 2020, China's population aged 65 and above has reached 190.64 million, and the old-age dependency ratio has increased to 19.7%. The proportion of China's old-age dependency ratio has increased by 4.7 percentage points in the past five years, as shown in Table 1. With the aging trend becoming more and more severe, the community-embedded elderly care service model provides a new idea for solving the problem of caring for the elderly. However, the community-embedded pension model has shortcomings in the practical development, such as the lack of an intelligent multi-party collaboration system, insufficient ability to integrate resources from all parties in the pension field,

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Table 1. China's population age structure and dependency ratio from 2016 to 2020.

	2016	2018	2020
Total population at the end of the year (unit: ten thousand people)	139232	140541	141212
Population aged 65 and over (unit: 10,000 people)	15037	16724	19064
Old age dependency ratio (%)	15.0	16.8	19.7

and insufficient communication of diverse information, making it difficult to meet the needs of society for pensions.

With the development of emerging technologies such as blockchain, artificial intelligence, and big data, society has gradually moved from digitization and networking to intelligence, and human society has entered the era of intelligence. Under the guidance of a series of emerging technologies, all fields of Chinese society will usher in a new round of development opportunities (Tong 2021). Under this circumstance, we need to apply Internet+, blockchain, federated learning and other information technologies to the field of elderly care based on the concept of integrated services. We should establish and use an intelligent community-embedded elderly care service model, which includes a multi-party secure computing system of "blockchain + federated learning + elderly care", a community Internet of Things platform, and intelligent terminals. The intelligent community-embedded elderly care service model can provide a collaborative platform with data sharing and security encryption functions for the elderly, communities, medical institutions, elderly care institutions, and many other entities participating in elderly care services. In this way, problems such as information islands, data platform security loopholes, and poor communication among multiple subjects in China's elderly care field can be properly solved, and the intelligent and precise elderly care services can be realized, thereby effectively promoting the development of elderly care services.

2 Concept Definition and Literature Review

With the development of society, the concept of integrated service came into being. The concept of integrated service is developed from the theory of "integrated care". The theory was originally a medical term, referring to a service model based on individual needs and assessment by case managers. This service model requires the integration of resources such as disease prevention, medical treatment, and rehabilitation, and then the establishment of an interdisciplinary service team (Yu 2019). The aging of the population has led to a rapid increase in the demand for elderly care and a variety of types. However, there are problems such as fragmentation and low efficiency in the supply of elderly care services, making it difficult to meet the elderly care needs.

In recent years, the aging of the population has led to an increase in the demand for elderly care and more types of elderly care services. However, there are problems such as fragmentation and low efficiency in the supply of elderly care services, making it difficult to meet the elderly care needs. Therefore, the community-embedded elderly care service model has gradually attracted the attention of the public. The community-embedded

elderly care service takes the community as the carrier. This model fully coordinates the surrounding elderly care service resources, and embeds appropriate facilities, services and emotional support in the community, so as to provide elderly care services for the nearby elderly (Kang 2017).

However, the good development of the community-embedded elderly care service model needs the support of information technology and computer technology. As emerging Internet technologies, blockchain and federated learning can provide assistance for the development of elderly care services. The essence of the blockchain is a decentralized database, which is derived from the underlying framework in the Bitcoin system. The application of blockchain technology benefits from the development of various information technologies, such as encrypted chain block structures, smart contracts, and distributed node consensus protocols. Therefore, the blockchain has the characteristics of multi-center, traceability, and high transparency. Federated learning refers to a distributed machine learning framework with secure encryption technology that enables multi-party collaboration without sharing their own data. Therefore, federated learning technology can provide a secure sharing model for all participants to ensure a high degree of sharing of data and information.

3 Materials and Methods

Based on the integrated service framework and combined with the objective reality of Chinese society, this paper first analyzes the development status of the community-embedded elderly care service model, and explores the obstacles encountered in its development process, and then proposes a variety of integrated measures to promote the development of community-embedded elderly care services. This research adopts literature research method, data analysis method and other methods to investigate and research the materials related to community-embedded elderly care services and the research literature on information technology such as blockchain and federated learning. Then analyze the problems in its development and propose optimization measures. We hope to help the development of China's elderly care services.

4 The Development Status of Community-Embedded Elderly Care Services in China

In recent years, community embedded elderly care services have gradually attracted public attention, and the Chinese government has successively issued corresponding support policies to provide assistance for the development of community embedded elderly care services. For example, in 2016, the "Notice on Supporting the Integration and Transformation of Idle Social Resources for the Development of Elderly Care Services", which was jointly initiated by multiple ministries and commissions, required that the construction of community elderly care service facilities should be promoted through the full integration of idle social resources and stock land in the society to meet the needs of elderly care. Since then, local governments have also issued policy documents to encourage and support the development of community-embedded elderly

Table 2. Statistical table of the development status of community elderly care services in China.

	2017	2018	2019	2020
Number of various types of elderly care institutions and facilities (unit: ten thousand)	15.5	16.8	20.4	32.9
Number of nursing beds (unit: ten thousand)	744.8	727.1	775	821

care services. For example, in 2019, Shanghai issued the "Guidelines for the Work of Community Embedded Elderly Care Services in Shanghai", which put forward standard regulations on the requirements, contents and specific implementation plans of community embedded elderly care services.

Recent years, China has vigorously promoted the development of community pension model, and has achieved corresponding results. According to the relevant bulletin, by 2020, China had 329,000 institutions and facilities for the elderly and 8.210 million beds for the elderly, as shown in Table 2.

However, as far as the concrete practice of community embedded elderly care service is concerned, relevant projects are mainly carried out in some economically developed cities, such as Shanghai, Beijing, Chengdu and Changsha. Taking Shanghai as an example, the community embedded old-age service model has been promoted and popularized in Shanghai at present, mainly in elderly care homes and comprehensive service centers for the elderly. According to related information, by 2020, Shanghai had 729 pension institutions, 259 community pension service organizations, 204 elderly care homes, and 320 community comprehensive service centers for the elderly, as shown in Table 3. In addition, the Shanghai Municipal Government has successively issued documents such as the "Notice on Accelerating the Construction of the Mayor's Nursing Homes" and the "Guidelines for Shanghai Community Embedded Elderly Care Services". To ensure the continuity of this model in policy formulation and implementation, it lays a foundation for embedding various pension resources into the community (Zhang 2016).

However, in practice, information technology, computer technology and intelligent technology are not widely used in the field of elderly care. On the one hand, the existing elderly care service products such as smart bracelets and electronic babysitters provide similar functions, and intelligent products such as smart beds and smart dining tables are rarely used, which cannot meet the individual needs of the elderly. On the other hand, an intelligent multi-party collaboration platform has not been effectively built in the entire pension field, resulting in a low level of information sharing and low collaboration efficiency among all parties in the pension field. This has led to many problems such as pension information, pension needs, and the inaccuracy of matching between pension facilities, hindering the development of pension services.

Table 3. The development status of community-embedded elderly care services in Shanghai.

	2017	2018	2019	2020
Number of pension institutions	703	712	724	729
Number of community aged care service organizations	334	266	266	259
Number of elderly care homes	127	155	187	204
The number of community comprehensive service centers for the old	100	180	268	320

5 Problems Existing in the Development of Community-Embedded Elderly Care Services in China

5.1 Lack of an Intelligent Multi-party Collaboration Platform, Resulting in Poor Integration of Resources from All Parties

At present, in the field of elderly care in China, an intelligent multi-party collaboration platform has not been built. The existing information technology, intelligent technology, and computer technology are not widely used in the field of elderly care, resulting in limited elderly care services. Because elderly care services involve multiple subjects such as families, communities, elderly care institutions, and the government, these multiple subjects have not built a unified multi-party collaboration platform, resulting in poor information exchange and low level of collaboration between subjects.

Moreover, due to the lack of an intelligent multi-party collaboration platform, the elderly care resources in the community are not fully shared with external elderly care resources, resulting in some problems. For example, the elderly care institutions embedded in the community have less contact and cooperation with surrounding hospitals, and cannot fully meet the requirements of the elderly in professional medical care. In addition, there is a problem of overlapping between the elderly care facilities in the institutions and the elderly care facilities in the community, and the degree of sharing is not enough, resulting in a waste of resources.

5.2 The System Planning is not Perfect, Which Restricts the Development and Implementation of the Work

Firstly, at the national level, China has not issued an overall guiding policy document for community-based elderly care services, which restricts the promotion of community-based elderly care services.

Secondly, at the local government level, local governments did not fully consider the needs of community-embedded elderly care services when planning for local development, and lacked corresponding acceptance regulations and guidance documents, which directly limited the implementation of community-embedded elderly care services. In addition, China currently lacks the norms and standards for the construction and operation of community-embedded elderly care services that are widely recognized by the society, resulting in a lack of consistency in the development of community-based elderly care services.

5.3 The Income of Pension Institutions is Low, and the Number of Professionals is Insufficient

As far as China is concerned, the development of elderly care services is highly dependent on the government, and the government's investment in the field of elderly care continues to increase, but this is still a drop in the bucket compared to the resources required for elderly care. The Chinese government has continuously introduced relevant preferential subsidy policies, and adopted measures such as including some service items in the scope of medical insurance and providing operating subsidies for elderly care institutions to help the development of elderly care institutions. However, due to the high initial investment cost of pension institutions and the long period of profit-making, coupled with the single financing channels of pension institutions and the limited profits of pension institutions due to the public welfare of the pension business, the superposition of many factors has made it difficult to maintain the balance of income and expenditure of pension institutions, and it is difficult to operate.

In addition, the operation of each aged care facility needs to rely on professional staff, such as professional doctors and nursing staff. However, due to the imperfect talent training mechanism in China, the high workload of elderly care service institutions, and the low salary level, the number of staff in existing elderly care service institutions is insufficient. This greatly restricts the supply level of elderly care services and hinders the development of the elderly care service industry.

6 Optimization Strategies for the Development of Community-Embedded Elderly Care Services in China

This paper believes that we should use blockchain, federated learning, and artificial intelligence technologies to build an intelligent community-embedded elderly care service model (as shown in Fig. 1). This model includes a multi-party secure computing system of "blockchain + federated learning + pension", a community Internet of Things platform, and smart terminals. This model uses a variety of modern intelligent information technologies such as artificial intelligence, blockchain, federated learning, and the Internet of Things. It is jointly used by multiple elderly care participants such as elderly care institutions, the elderly, communities, and medical institutions, and integrates a variety of elderly care service resources, such as medical care, care, and entertainment. It can provide convenient services for the elderly at the lowest cost. At the same time, we must improve the top-level policy design in the field of elderly care, such as clarifying the boundaries of powers and responsibilities of various departments.

6.1 Integrate Elderly Service Organizations by Building a Multi-party Secure Computing System

First, by building a multi-party secure computing system of "blockchain + federated learning + pension" to achieve information sharing among multiple subjects such as

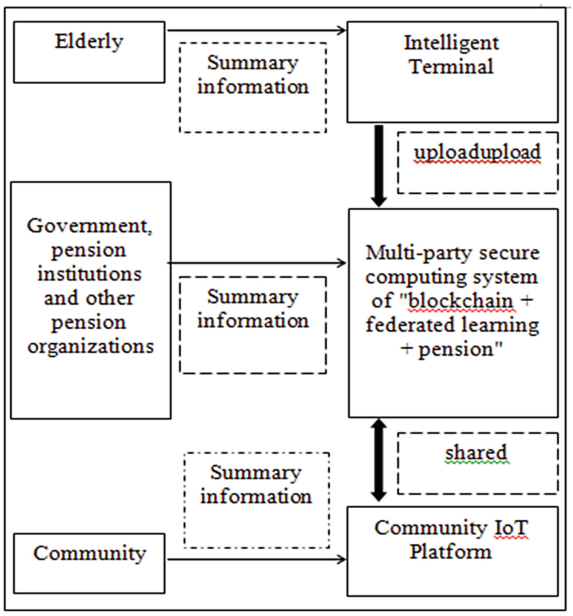

Fig. 1. Community embedded elderly care service model empowered by information technology.

medical organizations and pension organizations. We should use blockchain and federated learning technology to build a multi-party secure computing system of "blockchain + federated learning + pension" to create a collaborative platform for pension service entities. At the same time, we must combine artificial intelligence technology to realize real-time transmission and sharing of information. This system can not only play the strict confidentiality function in the blockchain technology, but also play the data sharing ability in the federated learning technology. The multi-party secure computing system of "blockchain + federated learning + pension" can provide a set of collaborative systems with both data sharing and security encryption functions for all parties involved in pension services. It can properly solve the problems of information islands, platform security loopholes and poor communication between multiple subjects in the current pension field. So as to realize the intelligence and precision of elderly care services.

Second, by building an intelligent community Internet of Things platform, the platform-based docking of elderly care services can be realized. With the help of artificial intelligence algorithms, cloud computing and other information technologies, and at the same time using the basic community information database to build a community Internet of Things platform, the elderly care service facilities in each community can be registered online. Then, through the manual collaboration mode, the multi-party secure computing system of "blockchain + federated learning + pension" is connected with the community Internet of Things platform. In this way, pension resources can be better matched, the combination of pension information, pension needs and specific pension services in each community can be ensured, and the exchange of pension information and the precise connection of services between pension organizations can be realized.

6.2 Integrate Specific Elderly Care Service Projects Through Platform-Based and Networked Operations

The first is to build intelligent terminals to provide accurate services. With the help of "Internet+", blockchain, big data and other information technologies, we need to explore the design of intelligent terminals to monitor and accurately collect the health status of the elderly in real time. At the same time, the health files of the elderly are formed and stored simultaneously in the multi-party secure computing system of "blockchain + federated learning + pension", so that the health data of the elderly can be shared between pension service organizations from time to time. This can not only achieve information linkage, but also achieve "one person, one file", which can improve the accuracy of elderly care services.

Second, we must focus on information technology innovation and continuously improve the service platform system. Information technology is updated and iterated rapidly, so we must continue to strengthen platform construction. We should gradually improve the elderly care service process, and form a complete service supply process including user application, needs assessment, program formulation, service evaluation, supervision and management. Then, it is necessary to continuously strengthen the construction of existing platforms and databases, and strengthen the application of emerging technologies such as federated learning. In this way, the security and applicability of the platform can be improved, and the quality and overall level of elderly care services can be improved.

6.3 Integrate the Elderly Care Service System by Strengthening Top-Level Design

First, the government strengthens system and policy design, and defines the boundaries of powers and responsibilities of various departments (Kim 2010). The government should strengthen the system and policy construction of community-embedded elderly care services, coordinate the resources of all parties, and make overall plans for the construction of service areas. At the same time, the government should clarify the boundaries of rights and responsibilities of civil affairs, social security and other departments in elderly care services, and create a good situation with clear division of labor and coordination among departments.

Second, the government has increased financial support and expanded the financing channels for elderly care institutions. The government should increase financial support for the elderly care sector and unify financial support policies to ensure the continuous operation of elderly care institutions and attract more social resources into the elderly care industry. In the end, multiple financing channels such as government purchases, social security funds, and voluntary contributions by residents will be formed.

Third, the government should improve the talent training mechanism and strengthen the construction of elderly care service teams. On the one hand, the government can increase policy support, develop colleges and technical colleges and other schools with conditions to set up majors related to healthy aging, and cultivate professional talents. On the other hand, the government can improve the professional skills of elderly service personnel through pre-job training and vocational education to meet the needs of elderly care work.

7 Conclusions

In the era of intelligence, the rise of various emerging technologies has brought impetus to the development of various fields of society, as well as opportunities for the development and innovation of the elderly care industry. At present, the problem of old-age care is becoming more and more serious, and many problems have been exposed in the field of old-age care, such as the lack of intelligent multi-party cooperation platform and difficulty in balancing the income and expenditure of old-age care institutions.

Faced with such a situation, China should attach importance to the application of various modern intelligent information technologies such as artificial intelligence technology, blockchain technology, federated learning technology and Internet of Things technology. Based on these modern information technologies, China should build a multi-party secure computing system, conduct platform-based and networked operations for elderly care services, and strive to form a community-embedded elderly care service model empowered by information technology. At the same time, the Chinese government should continuously improve the top-level policy design in the field of elderly care.

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