Development Economics of China
2025, VOL. 9, NO. 11, 29-33
DOI: 10.47297/wspdecWSP2515-797306.20250911

Digital Technologies Empowering the Development of the Silver Economy: Mechanisms and Practical Constraints from the Perspective of Smart Elderly Care

Haoyang Huang

School of Economics, Guangzhou College of Commerce, Guangzhou, Guangdong, 511363, China

ABSTRACT
This paper analyzes the mechanisms through which digital technologies contribute to the development of the silver economy, with a particular focus on smart elderly care as a typical application scenario. By constructing an analytical framework linking digital technology, service provision, and economic outcomes, the study explores how digitalization can enhance resource allocation, risk management, and service innovation in elderly care. At the same time, it critically examines the structural dilemmas encountered in practice, including the digital divide among older adults, data governance and privacy risks, the sustainability of business models, and fragmented institutional coordination.The findings suggest that digital technology does not automatically translate into effective economic empowerment. Its impact on the silver economy is highly dependent on institutional arrangements, governance capacity, and user adaptability. The paper argues for a more cautious and people-centered approach to smart elderly care development and provides policy implications for promoting the sustainable and inclusive growth of the silver economy.

KEYWORDS
Silver economy; Digital technology; Smart elderly care; Aging society; Governance challenges

1 Introduction

Population aging in China has moved beyond a demographic trend and has become a concrete and pressing social and economic reality. The rapid increase in the elderly population is no longer a distant projection but a structural condition that is already reshaping labor markets, public finance, and social service systems.

In recent years, digital technologies—including artificial intelligence, big data, and the Internet of Things—have been widely promoted as effective tools to address long-standing mismatches between the supply and demand of elderly care services. However, the practical outcomes of digital technology application in elderly care remain highly uneven. While some regions and institutions have achieved noticeable improvements in service coordination and monitoring capabilities, others face persistent difficulties in implementation. Many elderly users struggle with limited digital literacy, leading to low actual utilization of smart care systems. At the same time, service providers confront rising operational costs, unclear profit models, and increasing dependence on public subsidies. These challenges reveal a growing tension between commercial logic and public welfare objectives, which complicates the sustainability of smart elderly care initiatives.

This paper seeks to address three key questions. First, through what mechanisms can digital technology contribute to the development of the silver economy? Second, what structural dilemmas emerge in the real-world operation of smart elderly care systems? Third, to what extent has the empowering role of digital technology been overstated in existing practice and policy design?

2 Conceptual Framework: Digital Technology, Smart Elderly Care and the Silver Economy

The relationship between digital technology, smart elderly care, and the silver economy is not linear but mediated by institutional arrangements and service practices. Clarifying this relationship is essential for understanding both the potential and the limitations of digital empowerment in an aging society. Rather than treating technology as an independent driver, this paper conceptualizes digital empowerment as a process embedded in specific service systems and governance contexts.

Smart elderly care represents a digitalized service model within the silver economy. It typically integrates information technologies such as sensors, data platforms, and intelligent terminals to support daily care, health monitoring, emergency response, and service coordination. Conceptually, smart elderly care aims to improve service efficiency and responsiveness by transforming fragmented care activities into more coordinated and data-informed processes. In practice, however, the degree of "smartness" varies widely, ranging from basic digital record-keeping to more advanced real-time monitoring and platform-based service delivery.

Digital technology plays a dual role in this framework. On the one hand, it serves as an enabling tool that can enhance

information flow, reduce transaction costs, and support more precise service matching. On the other hand, it introduces new requirements for infrastructure, data governance, and user capability. The effectiveness of digital technology therefore depends on whether it can be meaningfully integrated into existing care systems and whether elderly users and service providers are able to adapt to new modes of interaction.

Based on these considerations, this study proposes an analytical framework in which digital technology influences the silver economy primarily through the operational practices of smart elderly care. The framework emphasizes three interconnected dimensions: technological capability, service organization, and institutional environment. Digital technology affects service outcomes only when these dimensions are aligned. If institutional coordination is weak or user adaptability is limited, technological inputs may fail to generate the expected economic and social benefits.

By adopting this framework, the paper shifts the focus from technological potential to actual mechanisms and constraints. It provides a basis for examining how digital technology can both enable and complicate the development of the silver economy, setting the stage for the subsequent analysis of empowerment mechanisms and practical dilemmas.

3 Mechanisms of Digital Technology Empowering the Silver Economy

Digital technology contributes to the development of the silver economy not through a single channel but through a set of interconnected mechanisms that reshape service delivery, risk management, and market organization in elderly care. These mechanisms operate primarily at the level of service practice rather than at the abstract technological level. Understanding how digital technology works in practice is therefore essential for evaluating its real empowering effects.

3.1 Improving Service Efficiency and Resource Allocation

In the context of smart elderly care, digital tools can facilitate centralized scheduling and dynamic adjustment of care services. For example, service platforms can allocate caregivers, medical resources, or emergency support based on real-time data rather than fixed administrative arrangements. This flexibility is particularly important in urban areas with highly mobile populations and diversified elderly care needs. By improving information transparency and coordination, digital technology can enhance the overall efficiency of service systems and support the expansion of elderly care services within the silver economy.

However, efficiency gains are not automatic. They depend on the quality of data, the interoperability of systems, and the willingness of service providers to share information. Where data standards are inconsistent or institutional barriers remain strong, digital platforms may replicate existing inefficiencies rather than resolve them.

3.2 Enhancing Risk Management and Health Monitoring

Another important mechanism of digital empowerment lies in risk management and health monitoring. In smart elderly care systems, health monitoring is often integrated with alert mechanisms that connect elderly users, family members, and service providers. This integration can reduce response time in emergencies and alleviate pressure on traditional healthcare institutions. From an economic perspective, early risk detection and preventive care can help lower long-term costs associated with hospitalization and intensive treatment, contributing to a more sustainable development of the silver economy.

Nevertheless, the effectiveness of digital risk management is closely linked to user acceptance and data accuracy. If elderly users are reluctant or unable to use digital devices consistently, the reliability of monitoring systems may be compromised. In such cases, technological solutions may generate a false sense of security rather than genuine risk reduction.

3.3 Expanding the Market Boundaries of the Silver Economy

Digital technology also plays a role in expanding the market boundaries of the silver economy by enabling new forms of products and services. The integration of digital tools into elderly care has stimulated the development of smart devices, digital health services, and platform-based care solutions. These innovations create new demand and encourage cross-sector collaboration among technology firms, healthcare providers, and care institutions.

By lowering entry barriers and facilitating service customization, digital platforms can support the diversification of elderly care offerings. This diversification helps transform elderly care from a narrowly defined social service into a broader economic sector with multiple value chains. As a result, the silver economy gains greater resilience and growth potential.

At the same time, market expansion driven by digitalization raises questions about inclusiveness. Commercially attractive segments may receive disproportionate attention, while elderly groups with lower purchasing power or higher

care needs risk being marginalized. This tension highlights the need to balance market mechanisms with public responsibility.

3.4 Institutional Complementarity and Governance Support

The empowering effects of digital technology are ultimately conditioned by institutional arrangements. Digital tools require complementary governance structures, including regulatory frameworks, data protection mechanisms, and coordination among public and private actors. Without such institutional support, technological initiatives may face implementation bottlenecks or generate unintended consequences.

In the context of smart elderly care, effective digital empowerment depends on the alignment of government policy, service provision, and technological development. Governments play a critical role in setting standards, ensuring data security, and guiding market behavior. Where institutional coordination is weak, digital technology may increase complexity rather than improve outcomes.

4 Practical Constraints and Structural Dilemmas of Smart Elderly Care

Despite the widely recognized potential of digital technology, the real-world operation of smart elderly care systems reveals a range of structural constraints that limit their empowering effects. These constraints are not merely technical problems but are rooted in social inequality, institutional arrangements, and governance capacity. Ignoring these issues may lead to an overestimation of the role of digital technology in the development of the silver economy.

4.1 The Digital Divide among the Elderly Population

One of the most prominent challenges faced by smart elderly care is the persistent digital divide among older adults. Differences in education level, cognitive ability, health condition, and prior exposure to technology significantly affect elderly users' capacity to engage with digital systems. While some relatively younger and healthier elderly individuals can adapt to smart devices and digital platforms, many others struggle with basic functions such as device operation, interface navigation, or information interpretation.

In practice, digital systems designed to improve service accessibility may unintentionally exclude those who need care the most. For elderly individuals with limited digital literacy, smart care services often require assistance from family members or caregivers, thereby shifting rather than reducing care burdens. As a result, digitalization may reinforce existing inequalities in elderly care instead of narrowing them. This uneven adaptability challenges the assumption that technological upgrading necessarily leads to inclusive service improvement.

4.2 Data Governance and Privacy Risks

Smart elderly care relies heavily on the collection and processing of personal and health-related data. While data integration enables more precise service delivery and risk monitoring, it also raises serious concerns regarding data security and privacy protection. Elderly users are often less aware of how their data are collected, stored, and used, which complicates the implementation of informed consent in practice.

Moreover, the involvement of commercial technology firms introduces additional governance challenges. Data generated through smart care systems may carry significant commercial value, creating incentives for excessive data collection or secondary use beyond care purposes. In the absence of clear regulatory boundaries and effective oversight mechanisms, data governance risks may undermine trust in smart elderly care services and limit their long-term viability.

4.3 Sustainability of Business Models

Another major constraint lies in the sustainability of business models for smart elderly care. Digital infrastructure development, system maintenance, and data management require substantial upfront investment. However, the willingness and ability of elderly users to pay for digital services remain limited, particularly among lower-income groups. As a result, many smart care projects depend heavily on government subsidies or short-term policy support.

This reliance creates uncertainty regarding long-term operation. When public funding decreases or policy priorities shift, service continuity may be threatened. At the same time, efforts to commercialize smart elderly care services often face resistance due to concerns over affordability and equity. The tension between market-oriented operation and public welfare objectives remains unresolved, constraining the scalability of smart elderly care within the silver economy.

4.4 Fragmented Governance and Institutional Coordination Problems

The governance structure of elderly care is typically characterized by fragmentation across multiple administrative departments and service providers. The introduction of digital technology further complicates coordination, as different systems and platforms often operate under separate standards and management frameworks. Lack of interoperability among digital systems hinders data sharing and reduces overall efficiency.

In addition, unclear division of responsibilities among government agencies, technology providers, and care institutions may lead to governance gaps. Without effective coordination mechanisms, digital initiatives risk becoming isolated pilot projects rather than integrated components of the elderly care system. This fragmentation weakens the potential of digital technology to generate systemic improvements and limits its contribution to the broader development of the silver economy.

5 Discussion: Rethinking Digital Empowerment in the Silver Economy

The analysis of both empowerment mechanisms and practical constraints suggests that the role of digital technology in the development of the silver economy is more conditional and context-dependent than commonly assumed. While digital tools can improve service efficiency, risk management, and market expansion in smart elderly care, these effects are neither automatic nor uniform. The gap between technological potential and actual outcomes highlights the limitations of technology-centered narratives in addressing the complex challenges of population aging.

A key issue lies in the tendency to equate technological adoption with substantive improvement. In policy discourse and project design, digitalization is often treated as a proxy for modernization, leading to an implicit assumption that the introduction of smart systems will naturally enhance service quality and economic performance. However, the findings of this study indicate that digital empowerment operates through specific organizational and institutional channels. Without adequate governance capacity, user adaptability, and service integration, digital technologies may produce symbolic modernization rather than meaningful change.

The discussion also underscores the importance of a people-centered perspective in smart elderly care. Elderly users are not homogeneous recipients of technology but individuals with diverse abilities, preferences, and constraints. When digital systems are designed primarily from a technical or managerial perspective, they risk imposing additional burdens on elderly users instead of reducing them. In such cases, technological solutions may shift responsibilities to families or frontline caregivers, undermining the original goal of improving care accessibility and efficiency.

From an economic standpoint, the expansion of the silver economy through digitalization raises questions about inclusiveness and sustainability. Market-driven digital services tend to prioritize segments with higher purchasing power, potentially marginalizing elderly groups with greater care needs but limited ability to pay. This dynamic challenges the assumption that market mechanisms alone can ensure equitable development of smart elderly care. The silver economy, therefore, cannot be understood solely as a commercial opportunity but must be situated within a broader framework of social responsibility and public governance.

6 Policy Implications

The findings of this study suggest that promoting the development of the silver economy through digital technology requires more than expanding technological investment. Effective policy design should focus on aligning technological tools with institutional capacity, service practices, and the actual needs of elderly users. Based on the analysis, several policy implications can be drawn.

Greater emphasis should be placed on age-friendly digital design and gradual technological integration. Policymakers should encourage the development of digital systems that accommodate the cognitive and physical characteristics of elderly users, rather than assuming rapid adaptation. Simplified interfaces, alternative non-digital access channels, and human-assisted service options should be regarded as integral components of smart elderly care, not as transitional substitutes. This approach can help reduce exclusion risks and improve actual service utilization.

Data governance and privacy protection should be strengthened as foundational elements of smart elderly care. Clear rules regarding data ownership, data usage boundaries, and accountability mechanisms are essential for building trust among elderly users and their families. Regulatory frameworks should balance innovation incentives with strict safeguards against misuse of sensitive health and personal data. Public authorities have a critical role to play in setting standards and enforcing compliance, especially in collaborations involving commercial technology firms.

Given the limited payment capacity of many elderly users, relying solely on market mechanisms is unlikely to ensure long-term service provision. A mixed model that combines public funding, reasonable user contributions, and regulated market participation may offer a more viable path. Instead of short-term pilot subsidies, policy instruments should

prioritize stable financing arrangements that support continuous service operation and quality improvement.

Overall, policy efforts should move beyond a narrow focus on technological deployment toward a more comprehensive approach that integrates technology, governance, and human factors. Such an approach is more likely to support the sustainable and inclusive development of smart elderly care and to enhance the contribution of digital technology to the long-term growth of the silver economy.

7 Conclusion

This paper examines the role of digital technology in promoting the development of the silver economy from the perspective of smart elderly care. By analyzing both the mechanisms of digital empowerment and the structural constraints observed in practice, the study highlights the conditional nature of technology-driven development in an aging society. Digital technology can enhance service efficiency, improve risk management, and support market expansion, but these effects depend critically on institutional arrangements, governance capacity, and user adaptability.

The analysis shows that smart elderly care should not be understood as a purely technical solution to population aging. Instead, it represents a complex interaction between digital tools, service organization, and social institutions. When governance fragmentation, unequal digital capabilities, or unsustainable business models persist, the empowering potential of digital technology may be significantly weakened or even offset by new forms of exclusion and risk.

By shifting the analytical focus from technological potential to actual service practices and institutional conditions, this study contributes to a more realistic understanding of digital empowerment in the silver economy. It also underscores the importance of adopting a people-centered and governance-oriented approach to smart elderly care development.

Several limitations should be acknowledged. This paper relies primarily on conceptual analysis and institutional observation, without empirical testing based on micro-level data. Future research could incorporate case studies or quantitative evidence to further assess the effectiveness of specific digital interventions. Despite these limitations, the findings offer useful insights for policymakers and practitioners seeking to promote the sustainable and inclusive development of the silver economy in an aging society.

About the Author

Haoyang Huang received a master's degree and is currently a Teaching Assistant at the School of Economics, Guangzhou College of Commerce, His research focuses on industrial economics.

References

[1] FLYVBJERG B. What you should know about megaprojects and why: An overview[J]. Project Management Journal,2014,45(2):6-19.

[2] ZHOU J, SALZMAN J, ROGERS P. Governing smart aging: Digital technology, elderly care, and public responsibility[J]. Social Science & Medicine,2020,258:113072.

[3] WANG J, ZHANG H, LIU Y. Digital health and elderly care in aging societies: Opportunities and governance challenges[J]. Health Policy and Technology,2021,10(4):100561.

[4] LIU Y, DAI H, XU J. Smart elderly care services in China: Development models, policy frameworks, and implementation barriers[J]. Journal of Aging & Social Policy,2022,34(3):329-347.

[5] CHEN K, CHAN A H S. Use or non-use of gerontechnology: A qualitative study of older adults' perceptions[J]. International Journal of Environmental Research and Public Health,2022,19(3):1345.

[6] SUN Q, MEDAGLIA R. Mapping the challenges of digital transformation in public elderly care services[J]. Government Information Quarterly, 2023,40(2):101754.

[7] LI X, HUANG J, ZHOU Y. Digital technologies and the development of the silver economy: Evidence from smart elderly care initiatives[J]. Technological Forecasting and Social Change,2024,198:123041.