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Digital Technology Adoption among Older Adults in China's Transition to a Smart Society: A Comprehensive Analysis of Attitudes, Determinants, and Enhancement Pathways

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Abstract

Against the backdrop of an accelerating digital economy and a deepening aging population, the digital technology adoption of China's older adults has become a critical issue impacting social equity. Drawing on existing research, this paper systematically analyzes the fundamental attitudes, multi-dimensional determinants, and potential enhancement strategies for digital technology adoption among China's elderly population. It constructs a comprehensive analytical framework encompassing individual, social, technological, and economic factors. The study finds that the willingness to adopt digital technologies among older adults is generally low, yet exhibits significant structural disparities. Older adults in rural areas, those in central and western regions, and elderly women constitute "multiply disadvantaged groups". Their adoption barriers stem from the interplay of individual resource endowments and psychological characteristics, a lack of robust social support systems, a pervasive "youth-centric" technology design paradigm, and the economic burden of digital access. Accordingly, this paper proposes a systematic set of enhancement strategies across four dimensions: educational empowerment, multi-stakeholder collaboration, institutional safeguards, and grassroots capacity building. This research aims to provide theoretical insights and policy implications for bridging the elderly digital divide, fostering an inclusive digital society, and synergizing the "Digital China" and "Active Aging" national strategies.

Keywords

Older Adults, Digital Technology Adoption, Digital Divide, Digital Inclusion, Age-Friendly Design, Social Support, Digital Literacy

1. Introduction

In the era of the Fourth Industrial Revolution and rapid digital economic development, digital technology is profoundly reshaping social structures and individual lifestyles. The emergence of the digital society has rendered activities such as information acquisition, public services, social interaction, and economic participation increasingly dependent on digital platforms and technological capabilities. However, not all social groups can participate in this process equally. Due to the combined effects of factors like age, education, income, and psychology, older adults often find themselves in a "marginalized position" within the digital society, becoming one of the most typical vulnerable groups affected by the digital divide. Insufficient adoption of digital technologies among the elderly not only impedes their daily life convenience and social participation but may also engender new forms of social inequality at a deeper level.

From a global perspective, international institutions such as the United Nations and the OECD have emphasized digital inclusion as a vital component of achieving the Sustainable Development Goals (SDGs). The UN's 2030 Agenda for Sustainable Development explicitly calls for enhancing the use of technology, particularly information and communication technology (ICT), to promote gender equality. Other frameworks highlight the importance of developing foundational and digital skills for all. Empowering vulnerable groups necessitates narrowing both gender and age gaps in digital technology use, ensuring equal opportunities in education, employment, healthcare, and political participation for diverse populations. In the digital society, gender inequality and age inequality exhibit a compounding effect: women generally demonstrate lower digital proficiency than men, while older adults show significantly lower digital participation rates than younger generations. When these two disadvantaged attributes intersect, older women become the group most susceptible to exclusion from the digital society. Consequently, building an inclusive, equitable, and accessible digital society has become a crucial consensus in global governance.

Within the Chinese context, this issue carries even more pronounced practical significance. As the world's largest developing country, China has experienced an exceptionally rapid pace of digital development, with technologies like mobile payments, smart healthcare, and e-governance achieving widespread penetration in a short period. However, concomitant with this rapid digitization is the phenomenon of older adults being "left behind." According to statistics from the China Internet Network Information Center (CNNIC), while the proportion of older internet users is increasing, significant gaps remain compared to younger cohorts in terms of usage depth, frequency, and skill level. Many older individuals often experience anxiety and helplessness when confronted with smart devices and online services, struggling not only to enjoy the conveniences of digital life but also facing practical obstacles in essential activities like transportation, seeking medical care, and making payments. This disparity in digital technology adoption capability is gradually evolving into a new form of social exclusion.

In response, the Chinese government has introduced several policies to promote digital inclusion for the elderly. Both the "Implementation Plan for Effectively Addressing the Difficulties Seniors Face in Using Smart Technologies" and the "14th Five-Year Plan for the National Development of Aging Undertakings and the Elderly Care Service System" emphasize improving digital literacy and participation capabilities among the elderly through education and training, age-friendly product adaptations, and community support. Simultaneously, the "Overall Layout Plan for Digital China Construction" proposes building a digital society that is "accessible to and shareable by all."

Nevertheless, existing research on digital technology adoption among China's elderly population remains fragmented, often limited to descriptive analyses and lacking systematic theoretical integration. Significant gaps persist, particularly concerning urban-rural disparities, gender differences, and underlying psychological mechanisms, in both domestic and international scholarship.

Therefore, at this critical juncture of digital societal transformation, systematically reviewing the current state and determinants of digital technology adoption among China's older adults holds not only academic value but also profound practical significance for achieving social equity and enhancing the inclusiveness of national governance. This paper aims to synthesize relevant domestic and international research, analyze the influence mechanisms of economic, social, psychological, and other multi-dimensional factors on the digital technology adoption of China's elderly, and propose targeted enhancement strategies. By constructing a multi-level analytical framework, this study seeks to provide theoretical reference and policy insights for facilitating the comprehensive integration of older adults into China's digitization process.

2. Methodology

This paper takes the adoption of digital technology by the elderly population in China as the core issue and adopts a narrative review method. This approach systematically screens and qualitatively analyzes existing literature, integrates key perspectives, and constructs a theoretical framework. It is suitable for comprehensive discussions on multi-dimensional issues, flexibly covering analytical dimensions such as individual, social, technological, and economic aspects, aligning with the research objective of "integrating attitudes, determinants, and enhancement strategies" in this paper.

Based on the research-based "China context" attribute, this paper's literature search is limited to China National Knowledge Infrastructure (CNKI). This database collects core literature across multiple fields, comprehensively reflecting domestic academic research achievements and providing solid support for the review.

This study employs a "core + extension" keyword combination strategy, with core terms including "senior population", "elderly", "digital technology adoption", and "digital inclusion", while extension terms encompass related concepts

such as "digital divide" and "digital literacy." The search queries are formulated using "AND" and "OR" combinations (e.g., "senior population AND digital technology adoption AND determinants") to ensure comprehensive literature coverage.

To ensure that the cited literature aligns with the current social status and needs of China's elderly population in adopting digital technologies, the literature search time range is from January 2020 to May 2025. During this period, the application of digital technologies accelerated, the issue of elderly digital exclusion became prominent, and relevant research findings were concentrated. Including the latest literature ensures the timeliness of the review.

To ensure the quality and relevance of the literature, this paper follows the following inclusion criteria: First, the cited literature should focus on the adoption of elderly digital technology and related issues, supporting the analytical framework of this paper; its research subjects are clearly defined, with Chinese elderly aged 60 and above as the core research subjects. Meanwhile, the cited literature should meet quality standards, so we prioritize including core journals, CSSCI source literature, and fund-supported achievements.

3. Basic Attitudes of China's Older Adults towards Digital Technology Adoption

Digital technology use attitude (hereafter "digital attitude") refers to an individual or group's cognition, understanding, and the mindset and behavioral tendencies they hold during the use of digital technologies (Zhu et al., 2025). A higher level of digital attitude helps promote more active use of digital technologies by older adults in their daily lives. Within relevant domestic academic research, it is generally accepted that a strong correlation exists between the elderly's digital attitude and their willingness to adopt digital technology, often treated as equivalent core variables in research contexts.

Existing research indicates that the current willingness of China's older adults to adopt digital technologies remains generally low, though a gradual increasing trend is observed. Specifically, the willingness among rural elderly is significantly lower than among their urban counterparts; the willingness among elderly in central and western regions is lower than in eastern regions; and the willingness among male elderly is higher than among female elderly.

Fundamentally, the weak adoption willingness stems from a low level of psychological acceptance of digital technologies among the elderly. While older adults often cite reasons such as advanced age and difficulty understanding technology, the underlying cause frequently lies in a lack of subjective interest-driven motivation. They also commonly harbor skepticism towards digital technology, often rooted in fear of failure, distrust of new things, or resistance to change (Sun et al., 2025). Coupled with China's pronounced urban-rural dual structure, the lower level of economic development in rural areas limits exposure to and appreciation of the Internet's importance (Zeng & Lin, 2025). Consequently, compared

to urban areas, rural regions commonly face structural issues such as lagging digital development, insufficient digital resource provision, and the outmigration of the working-age population. This "lack of technological accessibility" prevents rural elderly from sharing the dividends of digital development and stifles endogenous motivation to integrate into the digital society, ultimately superimposing a rural-urban digital divide upon the generational digital divide and creating a dual digital divide governance dilemma. Furthermore, demand for digital devices is lower among the rural elderly. Thus, insufficient digital technology access and lower usage levels in rural areas result in a significantly lower adoption willingness among rural elderly compared to urban elderly. (See Figure 1)

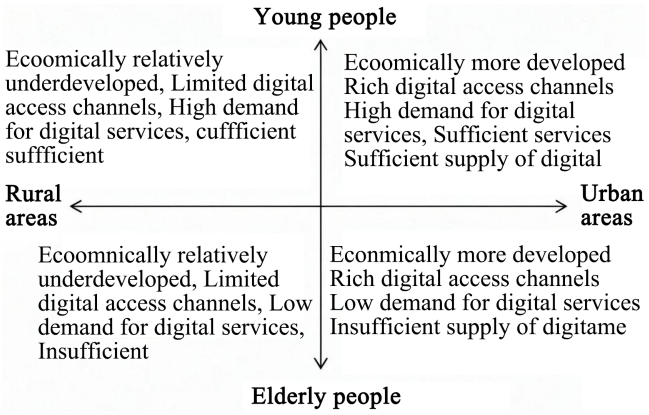

Figure 1. Dual digital divide governance dilemma.

At the regional level, numerous studies find that the digital penetration rate among the elderly in central and western regions is lower than in the eastern region, a major factor contributing to their lower adoption willingness. Driven by both policy dividends from market-oriented reforms and resource advantages, development in the eastern region significantly outpaces that of the central and western regions, providing older adults there with better living conditions (Ding & Wang, 2025).

Within the elderly population, gender-based inequality in digital technology use exists. Information technology was historically perceived as a male domain, and older women tend to exhibit stronger technophobia than older men (Dixon et al., 2014). Survey research by Liu and Zhang (2025). shows that the digital technology embeddedness rate is significantly higher for males (50.39%) than females (44.45%) among the elderly. Most current academic studies conclude that the digital technology adoption willingness of older men is higher than that of older women.

4. Determinants of Digital Technology Adoption among China's Older Adults in the Smart Society Transition

Theoretically, the formation of the digital divide among older adults results from the interplay of multi-level factors, encompassing not only individual-level capa-

bility disparities but also the combined shaping by social structures, technological environments, cultural perceptions, and governance systems. Existing research has extensively discussed barriers to digital access and use among the elderly, yet characteristics such as dispersed theoretical frameworks and conceptual overlaps remain. Therefore, this section, based on a systematic synthesis of existing literature, summarizes predominant academic viewpoints and offers moderate judgments informed by the real-world context, aiming to present a holistic picture of the mechanisms behind the elderly digital divide.

1) Individual factors: The micro-level roots of digital disadvantage

Academic consensus holds that individual-level resource endowments, physiological conditions, psychological structures, and cognitive experiences constitute the most fundamental prerequisites for digital participation among the elderly. These factors often operate cumulatively, rendering the digital disadvantage of the elderly a continuum from "access" to "use." Specific aspects include:

Firstly, differential accumulation of socio-economic resources. Socio-economic status (SES) determinants such as education level, income status, and occupational history shape the starting point for elderly participation in the digital society. Research indicates that those with lower education levels and limited economic resources demonstrate significantly weaker device ownership rates, internet usage frequency, and learning capacity compared to urban, higher-educated elderly groups (Liu & Ma, 2021). This disparity essentially represents the continuation of "lifecycle resource accumulation differences" into later life stages.

Secondly, structural impacts of physiological functional changes. Age-related physiological changes, such as declining eyesight, hearing loss, reduced manual dexterity, and memory deterioration (Ji & Lu, 2024), exponentially amplify the difficulties older adults face when operating smart devices (Yang & Jin, 2021). However, some research also points out that poorer health status can translate into a pressing need for specific digital services like smart healthcare and online consultations, thereby becoming a driver for adopting particular digital technologies. Thus, health status exhibits a "dual effect": while poorer health imposes greater operational constraints, it may also increase reliance on digital health services (Hu et al., 2024). This places many older adults in a typical "high need - low capability" paradox.

Thirdly, psychological apprehensions and lack of motivation. "Psychological gap" factors such as privacy concerns, fear of fraud, learning anxiety, and worry about making errors directly impact the willingness of older adults to use digital technologies. Fear of identity theft and financial security risks are significant reasons many elderly reject new media. Digital self-efficacy has become a crucial variable determining adoption: those with fewer successful experiences and stronger feelings of frustration are more prone to developing a "I can't do it" self-perception (Yang & Ju, 2024). Furthermore, some studies note that older adults often lack learning motivation because they perceive digital technology as irrelevant to their lives or interfaces as unfriendly, further weakening their usage

intention.

Fourthly, insufficient digital cognition and prior experience. Many older adults lack early experience with computers and the internet, leading to weak perceived usefulness and overly strong perceived risks regarding digital technology. This cognitive bias is not merely a knowledge deficit but rather the result of a reinforcing cycle between "absent early experience" and "limited current capability".

The core contradiction of the "high demand-low capacity" paradox makes it a critical issue that policy interventions must address, significantly increasing the complexity of such efforts. On one hand, if policies focus solely on capacity building (such as providing general digital skills training) while ignoring seniors 'urgent needs for specific services, they may create a disconnect between intervention and demand, making it difficult to motivate learning. On the other hand, if only non-digital alternatives are offered (like maintaining offline service counters), this might temporarily meet needs but could reinforce digital disadvantage among seniors, leaving them excluded from the digital society long-term. Therefore, policy interventions should adopt a dual-track approach combining capacity building with demand assurance: in the short term, alleviate the dilemma of "unmet demand" through age-friendly alternatives (such as community assistance and home operation support) to eliminate seniors' anxiety about digital exclusion; in the long term, implement demand-oriented precision training (like specialized practical courses on smart healthcare) to transform service needs into intrinsic motivation for capacity building. Simultaneously, promote age-friendly adaptations of digital products to lower accessibility barriers, achieving a virtuous cycle where "demand drives capacity, and capacity supports integration."

In conclusion, while individual factors are undoubtedly significant, their impact is not inherent but amplified by social, technological, and institutional environments. The "digital disadvantage" among older adults should be understood as a structural outcome rather than mere capability deficiency. The "high demand-low capacity" paradox serves as the critical nexus connecting individual vulnerability with systemic exclusion, providing precise policy intervention targets. (See Figure 2)

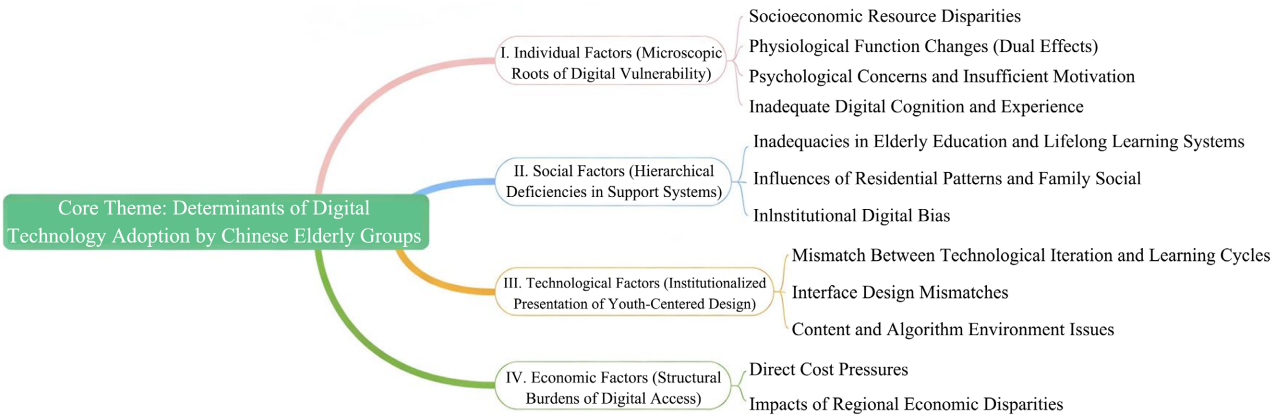

Figure 2. Correlation between factors.

2) Social factors: The hierarchical absence of support systems

Beyond micro-level individual factors, the social environment provides older adults with digital learning materials, emotional support, and institutional guarantees. Disparities in these resources directly shape digital capability gaps and can easily lead to digital exclusion. Key aspects include:

Firstly, inadequacies in elder education and lifelong learning systems. Numerous studies point out the scarcity of digital literacy courses within current elder education systems, insufficient community training resources, and teaching methods misaligned with the learning pace and cognitive characteristics of the elderly (Wang, 2024). The failure of elder education to respond promptly to the high demands of the digital society leaves older adults lacking reliable learning channels when faced with "compulsory digital access" scenarios like health codes or online medical registration.

Secondly, the differential impact of living arrangements and family support. Family members play a crucial role in providing devices, offering operational guidance, and giving emotional encouragement. Elderly living with family typically receive more digital support, whereas those living alone, having lost their only child, or with children living away from home lack "family technology tutoring" and face higher learning barriers. This closely links digital capability to family structure. However, some researchers have found that isolated, widowed, or mobility-impaired elderly, due to loneliness, emptiness, and anxiety in real life, may find relief on the internet, leading to more positive adoption of digital technologies (Lu & Wei, 2021). Richer social networks facilitate easier digital integration, and vice versa. Some studies even suggest a "cyclical amplification effect" between the digital divide and social isolation, where digital disadvantage reduces social participation, and social disadvantage further weakens digital capacity.

Thirdly, institutional digital bias in the digital ecosystem and governance. The accelerated digital transformation of society in recent years has seen public services, healthcare, transportation, finance, and other sectors rapidly shift online, while physical service counters shrink, placing older adults with weak digital skills at a systemic disadvantage. Concurrently, infrastructure development is unevenly distributed across regions. From this perspective, the elderly digital divide has transitioned from a "capability issue" to a "governance issue." If the public service system adopts a "digital-by-default" logic, it institutionalizes digital exclusion.

Therefore, we argue that social factors reflect a systemic absence of support structures. As population aging and digitalization accelerate in tandem, families, communities, and society at large have failed to provide support structures for the elderly that match the pace of societal change.

3) Technological factors: The institutionalized manifestation of youth-centric design

Digital technology, intended to reduce information costs, can in reality become a force of exclusion for the elderly due to mismatched design logic. Specific issues involve:

Firstly, the mismatch between rapid technological iteration and learning cycles. The fast update pace of smart devices and software is misaligned with the learning rhythm of older adults, leading to a continuously shortening lifecycle of digital skills. Seniors must constantly re-adapt to interface changes, permission settings, pop-up ads, etc., making their learning costs significantly higher than other groups.

Secondly, the misalignment between interface design and cognitive abilities. Prevailing research consistently points out that mainstream digital products suffer from issues like small fonts, complex structures, long operational sequences, and symbol systems biased towards youth, which are inconsistent with the physiological and cognitive characteristics of the elderly (Liu & Ma, 2021). While age-friendly design has become a policy directive, it remains largely "patchwork retrofitting", far from achieving systematic age-friendly design.

Thirdly, content and algorithmic environments insufficiently support elderly needs. For instance, there is a lack of high-quality, trustworthy digital content readily accessible to the elderly; meanwhile, algorithmic recommendations might push them into "information cocoons", exposing them long-term to homogenized, low-quality, or even harmful information environments—such as a large number of unverified rumors about health and wellness or financial fraud traps targeting the elderly. It may also systematically shape the social cognition of older adults, exacerbating their alienation from the mainstream social information environment; induce irrational consumption, creating "digital exploitation"; and even exploit emotional vulnerabilities, affecting their mental health and social relationships. This not only fails to support their digital integration but instead increases risk exposure and social alienation for the elderly group (Xie & Liu, 2024). Therefore, the impact of algorithms on the elderly is a comprehensive risk issue involving social integration, economic fairness, and spiritual well-being. However, the core issue lies not in the digital technology itself, but in the long-standing youth-centered design philosophy. Age-friendly adaptation should involve "rethinking product logic", not merely singular modifications like "large-text versions".

4) Economic factors: The structural burden of digital access

Beyond the aforementioned factors, the costs of digital devices, internet fees, and technical maintenance directly impact the digital access capacity of the elderly (Chen, 2020). Low-income older adults face difficulties not only in purchasing devices but also in bearing the long-term costs associated with frequent updates, data usage, and ensuring connection stability. Furthermore, economic disparities between urban and rural areas exacerbate the digital divide. Rural areas often have weak network infrastructure and insufficient public digital service points, coupled with lower income and education levels among the rural elderly, creating multiple, overlapping structural barriers (Kuang & Yu, 2024). Particularly in some western rural regions, unstable internet and insufficient service provision significantly hinder digital adoption among the elderly population.

5. Strategies for Enhancing Digital Technology Adoption Willingness among China's Older Adults in the Context of a Smart Society

Given that the prominent digital divide among older adults results from the interplay of multi-dimensional factors, addressing it requires not only considering individual-level digital capability shortfalls and cognitive biases but also involving the comprehensive influence of elder education supply, family support effectiveness, social collaboration mechanisms, and technological environment adaptability. While existing research has explored the constraints and enhancement pathways for digital technology adoption among the elderly, limitations such as dispersed research perspectives and a lack of systematic strategy frameworks persist. Therefore, this section, based on a systematic review of existing literature, integrates core academic viewpoints on educational empowerment, multi-stakeholder collaboration, and grassroots organizational support, combined with the realities of digital societal development, to provide moderate insights and clearly present the overall logical framework for enhancing adoption willingness among the elderly.

1) Strengthening access to digital education for the elderly

Specifically, in the current context where digital technology is deeply integrated into social life, enhancing the willingness of older adults to adopt digital technology and bridging the elderly digital divide are crucial measures for actively responding to population aging. Elder education serves as the core vehicle for empowering digital inclusion. Research converging on an educational perspective has formed several consensus points. There is a general consensus that elder education must be guided by a humanistic care orientation, fully accommodating the physiological decline, slower learning pace, and higher dependence on external support characteristic of the elderly population. It should abandon a purely technocratic mindset, integrating emotional care and age-friendly services throughout the educational process. By optimizing age-appropriate teaching facilities and enriching the supply of targeted educational resources, it can alleviate feelings of unfamiliarity and anxiety towards digital technology among the elderly, thereby strengthening the psychological foundation for their adoption. Focusing on humanism and emotional care, it should actively explore moving towards "service emotionalization" in establishing service relationships between educational providers and recipients, service practice processes, service content design, and the internal human resource management of participating entities. Regarding resource guarantees, emphasis is placed on strengthening the integration and linkage of internal and external resources for elder education. This involves activating internal community vitality, cultivating volunteer services and mutual learning teams, and improving internal service mechanisms. It also entails relying on diverse collaboration models like "school-community linkage" and "enterprise-community linkage" to broaden channels for introducing external resources and enhance the efficacy of socialized provision of educational resources, providing

solid support for boosting adoption willingness. In terms of practical pathways, the consensus advocates for a precise and scenario-based approach to elder education. Starting from the high-frequency needs of daily life such as transportation, healthcare, and consumption, it should construct a comprehensive curriculum system encompassing "general education + skills training + practical application." Optimizing elder education curriculum content, digital literacy is a key competency for the effective use of digital technology by the elderly and should be incorporated as an important component into the curriculum system. Course design should be closely integrated with the "small scenarios" of elderly daily life, precisely aligning with their actual needs and learning characteristics (Zhu et al., 2025). Creating immersive experience classrooms and integrated online-offline teaching scenarios, along with practical and interactive instructional design, can enhance older adults' perception of the usefulness of digital technologies, stimulate their endogenous motivation for active learning and adoption, and ultimately facilitate their smooth integration into the digital society.

2) Activating individual endogenous motivation and family support efficacy: Constructing an individual-family synergy system

At this stage, enhancing the digital technology adoption willingness of the elderly requires fully activating individual endogenous motivation and family support efficacy, constructing a synergistic path of "individual active participation - family targeted assistance." Theoretically, this aligns closely with the "perceived usefulness" and "perceived ease of use" emphasized by the Technology Acceptance Model (TAM), as well as the intrinsic motivation and autonomy highlighted by Self-Determination Theory (SDT). The Technology Acceptance Model (TAM) reveals the path to lowering the cognitive threshold for initial adoption (i.e., making technology appear useful and easy to use). Self-Determination Theory (SDT) further identifies the key to transforming initial adoption into sustained use: by supporting autonomous choice, creating successful experiences, and building mutual assistance relationships to satisfy their intrinsic psychological needs, thereby cultivating high-quality, self-sustaining endogenous motivation. Therefore, from the individual perspective, within the governance field of the elderly digital divide, it is essential not only to focus on constructing the agency of the elderly population and addressing issues of digital rights safeguarding and capacity building through "empowerment" (Yang & Jin, 2021), but also to strive to enhance their perception of the usefulness of digital technology and strengthen their sense of autonomy and competence during use, thereby stimulating stable intrinsic adoption motivation. Efforts should focus on transforming the cognitive perceptions of the elderly and cultivating intrinsic digital needs. Through media publicity and community hands-on practice, dispel the mystique and fear the elderly associate with digital technology, allowing them to experience the sense of gain and happiness derived from digital technology applications (Ji & Lu, 2024). Simultaneously, establishing mutual assistance mechanisms among the elderly for digital technology, relying on a "passing on experience" culture to foster a sup-

portive atmosphere, can strengthen their sense of agency, promoting a transition from "can't use, don't want to use, dare not use" to "can use, want to use, adept at using." At the family level, the core role of intergenerational digital tutoring must be leveraged, guiding the younger generation to proactively attend to the digital needs of the elderly, providing comprehensive and patient assistance from technical access and operation to knowledge and understanding. This approach both upholds the tradition of filial piety and offers direct support for enhancing the digital skills of the elderly. Targeting rural elderly populations, emphasis should be placed on strengthening their digital empowerment within community participation. Government guidance can help build participation and feedback mechanisms suited to rural realities, developing simplified digital tools to overcome spatiotemporal limitations and providing convenient digital participation channels for rural seniors. Concurrently, within rural self-governance systems, projects such as public hearings, development seminars, and intergenerational communication programs can be established, forming a closed loop of "participatory planning - deliberative decision-making - co-governance management", ultimately leading to influential self-organization that consolidates community consensus and advances common community agendas (Bian et al., 2025), comprehensively promoting the smooth integration of the elderly into the digital society.

3) Forming a government-led and socially multi-synergistic support system

In the smart society, enhancing the digital technology adoption capacity of the elderly requires strengthening government leadership and guidance alongside social multi-stakeholder collaboration, building a comprehensive, multi-level support system to form a systemic governance synergy for precise empowerment. At the government level, top-level design must be enhanced, uniting the strengths of diverse actors to jointly foster a harmonious digital ecological environment, ensuring the gradual improvement of digital literacy levels among the elderly (Ji & Lu, 2024). The core role of policy safeguards should be leveraged: improving laws and regulations related to digital age-friendliness, adding clauses for cybersecurity protection of the elderly, and using legislation to promote age-friendly adaptations of digital products; constructing a policy system that encourages multi-stakeholder participation, promoting the value of digital tutoring, and establishing volunteer assistance platforms. Simultaneously, increasing investment in digital education, supporting research and discipline construction in elder digital education, and improving mechanisms for digital elderly care, medical insurance, and resource subsidies to reduce the costs and risks associated with digital technology use for the elderly are crucial. At the societal level, upholding and improving the social governance model of co-construction, co-governance, and sharing serves as a guiding principle. Considering the long-term goals of promoting the construction of a modern socialist country and realizing the great rejuvenation of the Chinese nation, the mission of a "digital-sharing elderly-friendly society" to "promote development" becomes increasingly urgent. There is a pressing need to strengthen the cornerstone of elderly livelihood security, stabilize social expecta-

tions, stimulate domestic demand potential, accelerate overall social development, and contribute to the new development paradigm with domestic circulation as the mainstay and domestic and international circulations reinforcing each other (Dai & Fu, 2025). The pivotal role of communities must be strengthened, linking entities such as neighborhood committees, senior universities, enterprises, and universities to form volunteer teams, conduct precise tutoring and scenario-based training, cultivate elderly learning communities, and create smart experience scenarios integrating life and learning. Deepening grassroots digital governance, coordinating digital resources across urban and rural areas, and building grid-based, customized governance platforms to precisely match needs are essential. Simultaneously, learning from international advanced experiences, promoting technological innovation and international exchange, and fostering an inclusive and secure digital ecology from all aspects will help the elderly integrate smoothly into the digital society.

4) Strengthening grassroots organizations and talent system construction

Within the context of the smart society, the construction of grassroots organizations and talent systems is a core support for promoting digital technology adoption among rural elderly populations. Village committees, as grassroots self-governance organizations, need to fully leverage their synergistic role: by forming elderly information activity groups, they can stimulate learning interest through the demonstration effect of digitally skilled senior leaders, promoting the sharing of digital learning experiences; transforming village affairs WeChat groups and village-level public accounts into standard governance carriers, providing rural elders with digital channels for accessing community affairs; addressing the implementation challenges of long-term centralized training, relying on community workers and volunteers to conduct regular, door-to-door one-on-one services, precisely cultivating the smart device operation abilities of the elderly. Concurrently, it is necessary to build a cultivation and reserve system for rural elderly-friendly community governance talent, breaking from traditional management mindsets. A government-led model of "college teaching + practice" can enhance professional expertise, while combining local talent recruitment and market-based service procurement meets personalized needs. Establishing talent databases, specialized mentorship programs, and cross-regional exchange platforms can build a dynamic, open talent reserve network, tapping into the value of "implicit talent" such as local cultural inheritors and community opinion leaders, transforming lived wisdom and community memory into governance resources. The talent system must precisely align with community needs, using incentive mechanisms to guide professional talent to take root in service and encouraging outflow talent to return and contribute, ultimately forming an ecological closed loop of "cultivation - practice – feedback", providing inexhaustible momentum for the sustainable governance of rural elderly-friendly communities (Bian et al., 2025). In summary, enhancing the level of digital technology adoption among the elderly and bridging the digital divide require coordinated efforts based on mul-

tiple dimensions—individual, family, organizational, and societal—forming a systematic strategy framework characterized by "educational empowerment laying the foundation, multi-stakeholder linkage strengthening support, and institutional adaptation ensuring long-term effectiveness." Future governance should transition from "passively resolving digital obstacles" to "proactively building an age-friendly digital ecosystem." Through age-friendly technological adaptation, improved institutional safeguards, and precise resource provision, the construction of the digital society should shift from a "technology-led" to a "humanistically inclusive" orientation, effectively ensuring the equal participation of the elderly in digital life and their sharing of digital dividends, thereby providing practical support for actively responding to population aging and building an inclusive digital society.

6. Conclusion and Outlook

Currently, in response to the transition towards a smart society, the issue of digital technology adoption among China's older adults is not merely a matter of technical access but a comprehensive topic involving social equity, governance efficacy, and humanistic care. By systematically reviewing the basic attitudes, multidimensional determinants, and existing enhancement strategies related to digital technology adoption among the elderly, this paper reveals the complexity and multi-layered nature of the issue, constructing a comprehensive analytical framework covering individual, social, technological, and economic factors.

First, the study finds that the willingness of older adults to adopt digital technology is generally low and exhibits clear structural disparities: significant gaps exist in digital access, usage capability, and psychological acceptance between urban and rural areas, across regions, between genders, and among elderly from different socio-economic backgrounds. Rural elderly, those in central and western regions, and older women become "multiply disadvantaged groups" within the digital divide. The barriers to their adoption stem not only from individual-level resource scarcity, physiological decline, and psychological resistance but are also constrained by multiple external factors including deficient social support systems, "youth-centric" technology design, and economic burdens. This superimposing effect of "multiple disadvantages" warns us that any single-dimensional intervention will struggle to fundamentally resolve the governance dilemma of the digital divide.

Second, the study finds that the formation of adoption barriers among the elderly is the result of intertwined factors across multiple levels: at the micro-level, it is fundamentally constrained by basic conditions such as individual education level, economic income, physiological decline, digital cognition, and psychological self-efficacy; at the meso-level, it is closely related to the effectiveness of social support systems, including insufficient supply in elder education and lifelong learning systems, the absence of family digital tutoring, scarcity of community resources, and the implicit "digital bias" in public service design; at the techno-

logical environment level, the misalignment between product iteration pace and elderly learning cycles, the mismatch between interface design and the physiological/cognitive characteristics of the elderly, and the non-age-friendly nature of algorithm and content ecosystems collectively constitute a technological force of exclusion; while macro-economic factors, manifested through device and network costs, and the uneven distribution of infrastructure and digital resources between urban and rural areas, establish a structural threshold for digital access. These factors do not exist in isolation but rather superimpose and reinforce each other, collectively placing the elderly in a "high need - low capability" paradoxical situation, particularly rendering rural, female, and low-income elderly groups as the "multiply disadvantaged" within the digital divide.

In response to the above issues, this paper further proposes a systematic set of enhancement strategies across four dimensions: educational empowerment, multi-stakeholder collaboration, institutional safeguards, and grassroots capacity building. At the educational level, an elderly-centered digital literacy cultivation system should be constructed, emphasizing emotional care and scenario-based teaching. In terms of stakeholder collaboration, it is necessary to strengthen the multi-party linkage of family digital tutoring, community mutual assistance, and government guidance. At the institutional level, legislation, policy incentives, and resource allocation should promote the transition of digital age-friendliness from "patchwork retrofitting" to "systematic reconstruction". At the grassroots governance level, reliance on village committees, community organizations, and volunteer networks should create a digital support closed-loop tailored to the actual needs of the elderly. These strategies are interconnected and mutually supportive, collectively forming a three-dimensional governance system of "micro-foundation - meso-support - macro-guidance". Its core lies in achieving a conceptual elevation from "capacity assistance" to "rights empowerment", ensuring that older adults are not merely passive recipients of digital technology but active participants and value co-creators in the digital society.

This study not only theoretically integrates previously fragmented research perspectives, constructing an analytical framework for elderly digital technology adoption applicable to Chinese society—thus overcoming the limitation of "emphasizing description over integration" in prior research and providing a more systematic theory for understanding the formation and bridging of the elderly digital divide—but also offers actionable pathway references for policymakers, technology developers, and social organizations in practice. In the future, as China advances the "Digital China" and "Active Aging" strategies, greater emphasis should be placed on the institutionalization of digital inclusion, shifting technological development from "efficiency-first" to "balancing fairness and inclusion", and building a truly "accessible to and shareable by all" digital society.

It is, of course, important to note that this study still has certain limitations, such as insufficient in-depth exploration of the heterogeneity within the elderly population, a lack of support from large-sample empirical data, and inadequate

attention to subtle differences among cultural and regional sub-groups. Future research could further incorporate quantitative methods and in-depth case studies, expanding the understanding of elderly digital behavior from perspectives like the life course, digital trajectories, and cultural capital, For example, it could specifically compare systematic differences in digital needs, learning paths, and barriers between retired professionals (e.g., teachers, doctors) and elderly who have engaged in manual labor or agricultural work throughout their lives; or investigate the differing adoption willingness and usage capabilities for specific digital health services (e.g., online consultations, medication reminders) among elderly groups with different chronic conditions (such as visual impairment, cognitive decline). Researchers could examine the digital adoption patterns of "retired professionals" (e.g., teachers, administrative staff) and "traditional industry practitioners" (e.g., farmers, manual laborers) during their later career stages. By analyzing life trajectories and human capital development, these groups may demonstrate systematic differences in perceived usefulness of digital technologies, learning patterns, and primary barriers (functional complexity versus cognitive dissonance). Another approach involves comparing elderly individuals with immediate digital support (e.g., living with children) and those living alone with limited social support. Such subgroup-specific studies with predefined comparison dimensions may reveal distinct patterns in digital adoption initiative, risk perception, and reliance on public service digitization.

Simultaneously, with the proliferation of emerging technologies like generative AI and virtual reality, the landscape of digital inclusion for the elderly will face new opportunities and challenges. How to proactively transform these technologies into empowering tools for the elderly, rather than new barriers to exclusion, will be a pressing question of the times requiring collective attention from academia, industry, and government. Only through continuous theoretical innovation, policy optimization, and social collaboration can we all share in the promising future of digital civilization.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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