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Investment value analysis of smart pension projects based on the background of aging in China

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Abstract. With the acceleration of the aging process of China's population, smart pension, as a new model of "Internet plus pension", is becoming an important breakthrough to solve the pension problem. Based on the background of China's aging society, this study combines a three-dimensional perspective of policy orientation, market dimension, and technological development. Through policy text analysis and typical case studies of the elderly care industry, it explores the investment value and risk boundary of smart elderly care projects. The results show that the scale of the smart elderly care industry is expected to reach 7.21 trillion yuan by 2025. The flourishing development of AI technology brings great convenience to smart elderly care and effectively reduces labor costs. There are investment opportunities in segmented fields, and intelligent monitoring, but people need to be alert to the challenges brought by technological iteration risks and market information differences. Research suggests that investors should focus on relevant core technological barriers and develop smart elderly care projects that are highly compatible with policies and have clear business models; actively seek cooperation with the government; and establish an investment mechanism that integrates government-guided funds with market-oriented capital. In addition, investors need to balance long-term investment and short-term returns, and design project operation models that balance social capital and public welfare attributes. Through multi-party collaboration, investment risks can be effectively reduced, and the sustainability and social benefits of smart elderly care projects can be improved.

Keywords: China's aging population, smart elderly care, investment value, policy driven, technology empowerment

1. Introduction

China is currently transitioning from the third to the fourth stage of demographic transformation, with the number of elderly populations decreasing gradually from the eastern coastal areas to the inland regions, declining from six provinces (municipalities) including Shandong, Beijing, Tianjin, Anhui, Zhejiang, and Jiangsu to surrounding areas [1,2]. As of 2024, the population aged 65 and above has reached 220 million, and it is projected that the aging rate will exceed 20% by 2032. The national condition of "aging before becoming wealthy," coupled with the "4-2-1" family structure and the surge in rural left-behind elderly, has weakened traditional family elderly care functions and caused imbalances between supply and demand in institutional care, posing structural challenges to the elderly care service system. As an innovative model of "Internet + elderly care," smart elderly care is regarded as the key to breaking this deadlock. At the policy level, the "14th Five-Year Plan" has clarified its strategic status, with continuous introduced fiscal subsidies, long-term care insurance, and other policies. Technologically, AI, the Internet of Things, and other technologies have been applied in scenarios, such as health monitoring and early risk warning, with an expected industrial scale of 7.21 trillion yuan by 2025. However, existing research mainly focuses on technological applications or policy frameworks, lacking systematic analysis of investment value. First, the collaborative logic between policy-driven and market mechanisms is not clear, especially under the imbalance of urban-rural resource allocation. How to balance public welfare attributes and commercial returns? Second, there is a lack of research on technology iteration risks and business model adaptation paths, making it difficult for investors to assess the matching degree between technology lifecycle and project profit cycle. Third, the absence of risk prevention and control mechanisms under regional differences—the contrast between mature marketization in the east and weak infrastructure in the central and western regions—urges differentiated investment strategies.

This paper takes policy guidance, market dimensions, and technological development as the analytical framework, with key contents including: (1) Analyzing how policy dividends, market demand, and technological empowerment jointly construct the investment logic. (2) Identifying opportunities and risks in sub-sectors such as integrated medical and elderly care and aging-

friendly transformations. (3) Designing effective mechanisms for collaboration between the government and social capital. Through policy text analysis and typical cases, this study provides investors with an evaluation framework of "policy compliance—technical barriers—business model," while providing references for policymakers to optimize subsidy mechanisms and improve standard systems, promoting the sustainable development of smart elderly care from pilot projects to broader implementation. This research expands the interdisciplinary research perspective of the "silver economy" and constructs a multi-dimensional model for smart elderly care investment analysis. It is expected to solve the dilemma of "market failure" and "government inefficiency" in elderly care service supply. By clarifying risk boundaries and collaboration paths, it can both activate the vitality of social capital and ensure the inclusiveness of elderly care services, providing operable solutions to address the aging challenge of "aging before becoming wealthy."

2. Analysis of the dilemmas and limitations of traditional elderly care models

2.1. Weakening of family elderly care functions

China has entered a deeply aging society, with the population aged 60 and above accounting for 22%, and the total fertility rate dropping to 1.09. The "4-2-1" family structure is widespread, increasing the elderly care pressure on middle-aged and young people. The proportion of empty-nest elderly in rural areas is 23.81%, with some provinces in the central and western regions exceeding 30%, facing difficulties in care and rescue. Although most urban children live in the same city as their parents, the average distance is far, and the frequency of visits is low. Over half of the empty-nest elderly experience loneliness, and rural left-behind elderly have a higher prevalence of chronic diseases. During the economic transformation period, rising living costs and imbalances in urban-rural elderly care security have exacerbated the dilemma, with rural elderly basic pensions only one-tenth of those in urban areas. The change in social concepts has prompted the transformation of elderly care models toward communities and marketization, but the high employment rate of women has intensified the contradiction between work and care, significantly declining family care functions. With the average life expectancy extended to 78.2 years, the scale of disabled elderly is expected to increase by 11 million within five years. Families bear the main care responsibility, leading some families into a "care-poverty" cycle. The serious shortage of rural care capabilities, high risks of home care, and frequent medical disputes highlight the contradiction between the development of a longevity society and the lagging care system.

2.2. Supply imbalance and cost pressures in institutional elderly care

China's elderly care market is underdeveloped, with misunderstandings about the elderly care industry, insufficient integration of upstream and downstream industrial chains, and obvious industrial gaps. The elderly care industry is subdivided into more than ten sub-industries, including elderly information services, but with unbalanced development, most projects concentrated on the downstream life care service end. With economic and social development, the consumption demand of the elderly population has shifted toward diversification and high quality, but the underdevelopment of the mid-upstream industrial chain makes it difficult to provide comprehensive elderly care services [3].

The main reasons for the supply imbalance in elderly care institutions in 2025 include the coexistence of total quantity gaps and structural mismatches, severe regional and urban-rural differentiation, and disconnection between service capabilities and demand. China has 310 million people aged 60 and above, with over 42 million disabled elderly, and the proportion of nursing beds in national elderly care institutions is less than 50%, with only 3 million the disabled elderly admitted, highlighting the contradiction between supply and demand. Structurally, it presents a pattern of "oversaturation in high-end, scarcity in mid-range, and excess in low-end." For example, the monthly cost per bed in some institutions in Shenzhen is 11,000 yuan, far exceeding the payment capacity of ordinary elderly, leading to bed idleness, while there is a large gap in nursing beds in the central and western regions. Regional distribution is uneven, with the east concentrating 60% of the country's elderly care homes. Although the growth rate in the central and western regions exceeds 15%, the base is low, and facilities are backward [4]. The supply-demand contradiction is more prominent in rural areas, where disabled elderly in places like Daxing'anling, Heilongjiang, face the dilemma of "no one to care for" due to children working away from home and scarce medical resources.

3. Development logic and policy drivers of the smart elderly care industry

3.1. Construction of the smart elderly care industry ecosystem

Smart elderly care constructs a full-chain system of "hardware perception—software processing—service application": The hardware layer achieves real-time demand collection through diverse terminals. Health monitoring devices integrate biological sensing and wireless communication technologies to synchronize physiological data. Safety protection hardware relies on sensor networks to warn of risks and link responses. Life assistance devices provide intelligent control, mechanical automation support, and aging-friendly interaction for disabled groups. The software system serves as the core hub: health management platforms use

big data and AI to build risk assessment models and integrate telemedicine functions. Intelligent interaction systems reduce operational thresholds through aging-friendly design. Data security is ensured by encryption technology and blockchain, promoting cross-domain interoperability. The service layer integrates technical resources to form full-cycle solutions: medical and health services extend to home scenarios through mobile devices and 5G; life care builds a "monitoring-response-service" closed loop through community digital platforms; and emotional and rehabilitation services provide companionship, entertainment, cognitive intervention, and emotional management through intelligent devices, VR technology, and psychological evaluation systems, achieving deep integration of technology and elderly care needs.

3.2. National strategy and local practices

The "14th Five-Year Plan" for Aging Undertakings constructs a national strategic framework with a systematic mindset, defining three-stage goals and forming a four-in-one layout. It focuses on improving the elderly care security system, building an integrated medical and elderly care network, strengthening the allocation of elderly health resources, empowering smart elderly care with technology, and cultivating the silver economy. A collaborative governance mechanism is established to improve the security system and promote the upgrading of elderly care models. In terms of integrated medical and elderly care, it guides institutional cooperation, supports the transformation of public institutions, incorporates services into the long-term care insurance payment system, and clarifies that by 2025, all elderly care institutions will achieve integrated medical and elderly care, and the coverage rate of geriatrics departments in secondary and above hospitals will exceed 60%, enhancing the accuracy of health monitoring through technology. Aging-friendly transformations, through government subsidies and other means, renovate special difficult families and expand intelligent services, requiring a 100% compliance rate in community elderly care facility construction by 2025. Demonstration projects are used to cultivate industrial chains and promote standard setting. Combined with the transformation of old residential areas, market vitality is stimulated through tax incentives, forming a multi-party collaborative mechanism [5].

3.3. Synergistic effects of policy dividends and industrial development

China solves the problem of elderly care service supply through a "government guidance + market participation" model, achieving policy coordination between fiscal subsidies and market-oriented operations, as well as social capital participation. In combining fiscal subsidies with marketization, the government provides differentiated subsidies for aging-friendly transformations, integrated medical and elderly care, and other fields, and guides enterprises to carry out market-oriented services such as intelligent monitoring and rehabilitation aids through tax incentives and special bonds, forming a cycle of "public welfare capital preservation + market profitability." In 2024, Suzhou and other places drove over 20,000 households to participate in aging-friendly transformations through subsidies. At the level of social capital incentives, the "14th Five-Year Plan" optimizes the policy environment from multiple dimensions such as access, fiscal finance, land, and taxation: implementing a record-filing system to lower access thresholds, allowing multiple subjects to enter in the form of sole proprietorships, etc.; using tools such as special bonds and industrial guidance funds with supporting risk compensation; implementing classified land security to support the transformation of idle facilities into elderly care facilities; and granting value-added tax, corporate income tax incentives, and R&D additional deductions. At the same time, PPP and government procurement service models are promoted, clarifying the division of labor between government and enterprises through "user payment + fiscal subsidy," and establishing regulatory mechanisms such as credit files and risk margin. The overall policy system forms a layered supply pattern of "government ensuring basics + market providing diversity," balancing public welfare and market vitality.

4. Investment value and risk boundaries of smart elderly care projects

4.1. Multidimensional evaluation of investment value

Smart elderly care projects have both policy compliance and commercial development potential. At the policy level, they are deeply consistent with the national strategy to address population aging. Policies such as the "14th Five-Year Plan" build a development framework through fiscal subsidies and tax incentives. Although there are risks such as the sustainability of local finances and the unification of technical standards, investors can choose regions with stable eastern finances or government-led projects to reduce uncertainty. Meanwhile, policy drivers can expand social benefits, promoting the inclusive development of smart elderly care through purchasing services and targeted subsidies, forming a virtuous cycle mechanism. In terms of social benefits, intelligent devices and the "home elderly care bed" model significantly reduce family care burdens, release labor forces, create employment opportunities, and promote the transformation of elderly care models through remote video and intelligent robots. Technically, health data intelligent processing and aging-friendly interaction technologies face barriers such as precise collection, data accumulation, low-bandwidth transmission, and high R&D costs. In business models, it is necessary to build a system of "policy support, market stratification, and ecological collaboration": the policy side lays out networks through

government purchasing services, the market side provides stratified services and promotes hardware mass production, and the ecological side develops data value that is compliant and integrates resources. By reasonably allocating project types and adopting a "basic free + value-added charging" model to cultivate payment habits, deep integration of social benefits and commercial value is ultimately achieved.

4.2. Identification of core risk factors

In the development process of the smart elderly care industry, contradictions between technology iteration and market supply-demand have become prominent obstacles. Technology iteration has triggered structural contradictions: rapid upgrading of intelligent devices with insufficient adaptation, complex interface design, and function development ignoring the cognitive characteristics of the elderly have led to rising usage training costs and high equipment idleness rates. Incompatible data formats between different products have formed "information silos," not only threatening data privacy but also hindering information sharing and collaboration. The application of cutting-edge technologies, such as brain-computer interfaces has also triggered "technology over-intervention" ethical controversies, urgently requiring a balance between efficiency improvement and the protection of elderly dignity. At the same time, standardization construction has seriously lagged: the lack of unified technical interfaces, service processes, and safety evaluation standards has hindered device interconnection and made it difficult to quantify service quality assessment. The standard-setting speed is far behind the technology iteration pace, leaving emerging technology risk management without a basis, causing small and medium-sized enterprises to fall into homogeneous competition, and there are hidden dangers of disorderly development in the high-end market. The weak voice in the international standard system also restricts enterprises' international development and the introduction of advanced experience.

At the market level, information asymmetry and payment willingness deviations are prominent. The implicit processing of key information by service providers, combined with the technical complexity of smart elderly care products, makes it difficult for the elderly and their families to accurately assess service value, resulting in resource waste of "high configuration, low usage," undermining market trust and causing adverse selection. Payment willingness deviations are influenced by both economic capabilities and social concepts: the pricing of elderly care services has a large gap with the actual payment capabilities of the elderly, especially in rural areas. The risk-averse psychology caused by information asymmetry inhibits payment willingness, intergenerational decision-making differences exacerbate supply-demand mismatches, and the lack of quality evaluation standards pushes consumers into a dilemma of "dare not buy, unwilling to buy," seriously restricting industrial development.

5. Construction of government-market collaboration mechanisms

5.1. Role and operation mode of government guidance funds

China's Public-Private Partnership (PPP) model in the smart elderly care field and policy levers work together to promote innovative development of elderly care services. The PPP model entered an adjustment period in 2019. As of September 2021, there were 170 elderly care PPP projects in the national pipeline, with a total investment of 96.22 billion yuan. Although the number and scale of projects have both decreased, it integrates public resources and market technical capabilities through government-enterprise collaboration, forming a "government investment + enterprise operation" model in scenarios such as joint construction of data platforms and intelligent device deployment, providing a path to break through traditional supply bottlenecks. However, it faces challenges, such as a lack of institutional norms, technical adaptation issues, and data security, which need to be solved through policy guidance, standard priority, dynamic supervision, and integration of elderly user experience. The core is to balance government public services and enterprise profits to achieve a win-win goal. As regulatory levers, tax incentives and subsidy policies— the former reducing corporate income tax to make up for public welfare revenue gaps, the latter using special funds to support weak links—form a "policy combination punch" to promote the cycle of "government guidance—market response—industrial upgrading." The key to releasing their effects lies in precise positioning and dynamic adjustment, such as implementing a strategy of "early-stage subsidies—mid-stage tax incentives—long-term self-circulation" for emerging industries to achieve both efficient fiscal utilization and market vitality stimulation [6,7].

5.2. Participation strategies of market-oriented capital

In the smart elderly care field, balancing long-term investment and short-term returns, as well as accommodating social capital and public welfare attributes, requires constructing a systematic collaboration mechanism. In balancing long-term investment and short-term returns, the policy establishes a stratified framework, guiding the direction with long-term strategic planning and reducing market subjects' costs through short-term incentive policies. Financing adopts government-enterprise cooperation models, with the government providing long-term support and social capital achieving stratified profitability. Technologically, rely on shared platforms to accelerate transformation and explore new payment models. Promote regional differentiation while

establishing a national data-sharing platform. Risk prevention and control are carried out from multiple dimensions, such as data security, payment protection, and talent training, forming a virtuous cycle of "policy-driven + model innovation + technology iteration."

In terms of reconciling social capital with public welfare attributes, achieve collaboration through institutional innovation. The government clarifies basic public welfare service standards, incorporates public welfare indicators into enterprise credit evaluation and access, and allows enterprises to carry out value-added services after meeting basic service requirements. In income distribution, basic services are government-guided priced to ensure small profits, while value-added services are self-priced, and enterprises are encouraged to reinvest part of their profits into public welfare. Supervision adopts a tolerant and prudent strategy, establishing an evaluation system, regulatory sandboxes, and exit buffer mechanisms. In resource integration, government and enterprises jointly build platforms, capital invests in shares under supervision, and donated equity is reinvested into public welfare, forming a sustainable development ecosystem of "quantifiable public welfare value + predictable capital returns," driving multiple parties to jointly address aging challenges.

6. Conclusion

China's aging population is characterized by "fast speed, large scale, aging before becoming wealthy, and urban-rural imbalance," with over 220 million people aged 65 and above, and a rural aging rate of 23.81%, far exceeding that of cities. Traditional elderly care models are unsustainable, making smart elderly care a key solution. Driven by policies and technology, it has huge market potential, with the "14th Five-Year Plan" clarifying its strategic status and an expected industrial scale of 7.21 trillion yuan by 2025. Policy-wise, fiscal subsidies and PPP models provide support, and projects have both strategic significance and social benefits, capable of reducing family care burdens by over 60%. Technologically, AI and the Internet of Things reduce labor costs, and technologies, such as health monitoring, form barriers, with leading enterprises having obvious advantages in data accumulation. Sub-sectors, such as integrated medical and elderly care and aging-friendly transformations have become investment hotspots due to rigid demand and policy benefits, with the "basic service capital preservation + value-added service profitability" model balancing public welfare and commercial attributes. However, the industry still faces multiple challenges. Technology iteration has brought issues, such as complex operation of intelligent devices and data silos, and the application of new technologies like brain-computer interfaces raises ethical controversies. At the market level, huge differences in urban-rural elderly care security, information asymmetry leading to "high configuration, low usage," and payment capabilities and habits restrict market-oriented expansion. In addition, the lack of industry standards has exacerbated device compatibility issues, and regional development imbalances have further amplified investment return cycle mismatches.

To address this, the policy side needs to improve technical standards and the medical insurance payment system, expand the coverage of long-term care insurance, and establish special guidance funds tilted toward the central and western regions. Market players should focus on aging-friendly technological innovation and build stratified service models. Government-enterprise collaboration should promote the PPP model and establish a mechanism of "incorporating public welfare indicators into credit evaluation + using market-oriented profits to support underdeveloped areas." In regional strategies, the east should focus on building market-oriented ecosystems, while the central and western regions should improve infrastructure led by the government, reducing rural application thresholds through "equipment leasing + remote services" to form a sustainable development pattern with shared responsibilities among multiple parties.

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