

AI-Driven Longevity Health and Pension Business Model Innovation: Based on the Integration of Insurance and Health Care

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Abstract: Amid accelerating population aging and the advent of the longevity era, the traditional insurance and healthcare industries confront a host of prominent practical challenges. These mainly manifest as fragmented service systems, structural supply-demand imbalance, sluggish operational efficiency, and insufficient synergy in industrial value chain allocation. Powered by core digital technologies such as big data, machine learning, and intelligent perception, artificial intelligence is comprehensively reshaping the whole-industry chain logic of value creation, value delivery, and value capture in the integrated insurance and healthcare sector. It has further served as a core endogenous driver for the iterative evolution of business models in the industry. From an interdisciplinary perspective, this paper innovatively proposes the Longevity, Health, and Pension Life Symbiosis Theory and further constructs a systematic theoretical framework characterized by three-dimensional participants, double-loop nesting, and full-domain AI empowerment. Adopting the benchmarking comparative research method, this paper selects three globally leading health and pension institutions including Nippon Life (Japan), Brookdale (the United States), and ORPEA (Emeis) (France), and explores the localized practices of Taikang Life in the Chinese mainland. This paper systematically summarizes the operational features and development experience of domestic and foreign benchmark enterprises, explores the internal mechanism and typical application scenarios of AI-enabled business model innovation in the longevity, health, and pension sector, identifies key bottlenecks restricting industrial development, and accordingly puts forward targeted optimization approaches and operational countermeasures. The research conclusions can not only provide practical references for China's insurance industry to deepen the integrated development of the health care industry and realize high-quality development relying on digital technology, but also supplement original theoretical support for the improvement of the people's livelihood guarantee system in the longevity society.

Keywords: Artificial intelligence; Longevity era; Health and pension industry; Insurance-healthcare integration; Business model innovation; Longevity-Health-Pension Life Symbiosis theory

Online publication: July 14, 2026

1. Introduction

China has fully entered a deeply aging society, with the continuous expansion of the elderly population and the steady growth of the longevity group. The arrival of the longevity era has brought systematic challenges to social and economic operation, including shrinking labor supply, pressure on social capital allocation, weakening of social innovation momentum, increasing burden on the social security system, and intensified social differentiation between generations and groups ^[1]. At the same time, the pension demands of urban and rural residents have transformed from basic survival security to diversified needs covering health management, long-term care, high-quality pension services, and spiritual comfort. Traditional family pension, institutional pension, and basic social security models present obvious drawbacks such as single supply and backward formats, which can no longer adapt to the multi-level, differentiated, and high-quality pension demands in the new era ^[2]. The insurance industry possesses inherent advantages such as long-term capital reserves, professional risk management capabilities, and high-net-worth customer accumulation. On the liability side, insurance products can be organically matched with health care services; on the asset side, the long-cycle capital characteristics of insurance funds are highly compatible with the heavy-asset and long-return attributes of the health and pension industry, forming a core link connecting financial capital and the real economy of pension services. Therefore, the integrated model of “insurance plus health care” has gradually become the mainstream transformation direction of the domestic insurance industry ^[3]. Nevertheless, China’s insurance-healthcare integration still faces major bottlenecks, including widespread data silos, inadequate service standardization, rising labor and care costs, and imperfect closed-loop commercial operations. With the rapid development of cloud computing, big data, and artificial intelligence, the intelligent medical and health care service platform has realized multi-scenario applications including dynamic health monitoring, intelligent diagnosis assistance, emergency rescue response, refined actuarial pricing, and customer refined operation. Digital technology effectively connects upstream and downstream industrial resources such as insurance, pension, medical treatment, and health education, providing a new breakthrough to break the inherent difficulties of the industry and reconstruct the underlying commercial logic of the health and pension industry ^[4].

Existing domestic and foreign researches have formed abundant achievements in the fields of insurance-healthcare integration, pension business model construction, and industrial empowerment of artificial intelligence. First, most studies focus on the macro comparison of national pension systems, lacking horizontal benchmark analysis focusing on micro enterprise business models. Second, existing literature mainly focuses on the superficial application of technologies, neglecting in-depth exploration of the underlying commercial logic. Moreover, it fails to systematically interpret the whole-industry chain reconstruction mechanism of artificial intelligence in pension business models ^[5]. Third, the integration of mature overseas experience and domestic localized practices remains inadequate, and original theoretical frameworks tailored to the context of China’s longevity society are relatively scarce. Against the aforementioned research gaps, this paper innovatively proposes the original Longevity Health and Pension Life Symbiosis Theory and constructs a unique analytical framework to compensate for the deficiencies in existing theoretical research.

This paper mainly adopts literature induction method, logical deduction method, and benchmark comparative analysis method. The core research innovations are reflected in three aspects: constructing a multi-dimensional micro benchmark system covering overseas leading enterprises and local Chinese institutions; putting forward the original Longevity Health and Pension Life Symbiosis Theory and establishing the theoretical model of “three-dimensional subjects, double-loop nesting and full-domain AI driving”; proposing localized high-quality development paths suitable for China’s longevity social reality.

2. Comparative research on domestic and foreign benchmark insurance and pension business models

2.1. Overseas benchmark enterprise pension operation modes

As the country with the highest aging degree in the world, Japan has formed a mature and complete industrial system of insurance and pension after long-term development ^[6]. As a leading life insurance enterprise in Japan, Nippon Life deeply lays out the pension track relying on its main insurance business and forms a stable and conservative integration mode featured by “pre-insurance allocation plus lightweight community pension services.” Taking life insurance and long-term care insurance as the traffic entrance, Nippon Life supports community home-based pension and daytime care services, strictly controls heavy asset investment, and adheres to stable risk control principles. Relying on Japan’s mature nursing insurance system, the enterprise establishes a hierarchical, precise care system and realizes normalized dynamic management of customer health data through digital platforms. Artificial intelligence is mainly applied in health risk screening and precise premium pricing, maintaining long-term sustainable operation and avoiding periodic risks brought by heavy asset expansion.

Brookdale is one of the largest professional pension service operators in North America, focusing on market-oriented high-end CCRC pension operation mode covering the whole life cycle. According to Brookdale’s 2024 Form 10-K annual report, its Continuing Care Retirement Community (CCRC) segment implements a full-cycle integrated elderly care model to accommodate seniors’ dynamic care needs ^[7]. As the company’s core business, CCRCs integrate independent living, assisted living, memory care, and skilled nursing services in one community, allowing middle- and high-income elderly residents to age in place and obtain continuous tiered care alongside changing physical conditions and service demands. In terms of revenue, CCRCs mainly generate income from residents’ monthly occupancy and service fees, supplemented by public Medicare, Medicaid, and commercial long-term care insurance, without the support of self-owned insurance businesses. Operationally, Brookdale leverages digital systems and artificial intelligence to monitor resident health risks, optimize nursing staffing, and improve refined community management. However, the CCRC model faces persistent operational pressures stemming from heavy asset investment, tiered service operation, and rising labor costs, resulting in high ongoing expenses, rigid cost structures, and limited public service accessibility relative to asset-light pension models.

ORPEA (renamed Emeis) is a leading European senior care group focused on institutional elderly care and rehabilitation medical services, forming a distinctive model of “professional institutional pension, supporting rehabilitation medical treatment, and digital intelligent operation” ^[8]. Backed by European social security systems and commercial supplementary insurance mechanisms, the group delivers highly professional integrated medical and elderly care services. It widely adopts intelligent nursing systems, remote diagnosis, and real-time vital sign monitoring devices to alleviate nursing labor shortages and enhance operational efficiency. Characterized by heavy asset investment and in-depth medical-pension integration, its business model adapts to European population aging and social security conditions, yet faces substantial upfront investment pressure and a long capital return cycle.

2.2. Domestic benchmark enterprise pension operation modes

Taikang Life is the benchmark enterprise promoting insurance-healthcare integration in China, forming a distinctive closed-loop ecological operation mode of “insurance advance payment plus physical CCRC communities plus self-built rehabilitation hospitals plus full-chain AI empowerment” ^[9,10]. Taking life insurance

and annuity insurance as a long-term cash flow entrance, Taikang lays out standardized pension communities nationwide and realizes the in-depth integration pattern of “one community matching one hospital.” Artificial intelligence has penetrated into customer portrait construction, full-cycle health monitoring, chronic disease early warning, intelligent pension care, and whole-process risk control. Supported by big data technology, Taikang constructs three-dimensional customer portraits to customize personalized pension schemes, realizes chronic disease active intervention through wearable terminal data collection and AI algorithm early warning, and reduces labor service costs through intelligent care systems, finally forming an integrated commercial closed loop of “payment end-service end-investment end.”

2.3. Enlightenment from cross-border benchmark comparison

First, commercial insurance constitutes the core payment cornerstone of the pension industry. All mature global pension modes take insurance products as the long-term capital support of pension services and realize the deep binding between the payment system and pension services. Second, digital and artificial intelligence empowerment is the inevitable trend of industrial cost reduction and efficiency improvement. Leading global pension enterprises have realized full-scale penetration of intelligent technology, which is also the inevitable transformation path of China’s insurance and pension industry. Third, the pension business model must fully adapt to local national conditions. The European and American high-end heavy asset mode, the Japanese stable conservative mode, cannot be directly copied. China should absorb global mature experience and explore a localized development path combining high-end characteristic pension and basic inclusive guarantee, digital technology empowerment, and industrial ecological closed loop. The differences of cross-border modes can be effectively explained and summarized by the three-dimensional subject and double-loop logical mechanism of the original Longevity Health and Pension Symbiosis Theory.

3. Theoretical foundation and original model construction: Longevity Health and Pension Symbiosis Theory

3.1. Core connotation of the original theory

The arrival of the longevity era has completely reconstructed the traditional life cycle logic and fundamentally changed the operating rules of the insurance and pension industry ^[1]. Traditional pension security theory, insurance life cycle theory, and industrial symbiosis theory have limitations such as separated research perspectives and a lack of digital technological support, failing to explain the coordinated evolution law of individual life, pension enterprises, and social industrial ecology under the background of artificial intelligence application ^[11]. Based on interdisciplinary research and the realistic demands of insurance-healthcare integrated development, this paper originally proposes the Longevity Health and Pension Symbiosis Theory, forming a standardized unified analysis paradigm for cross-border case research and industrial mechanism research. The original theory takes three major life bodies as the basic carrier, constructs a double-loop nested dynamic closed-loop system with endogenous growth and external empowerment, and regards artificial intelligence as the full-domain underlying driving kernel running through the whole system ^[11,12].

3.1.1. Three-dimensional main subject foundation

The three-dimensional subjects constitute the logical origin and basic foundation of the whole theory, featuring mutual interdependence and symbiosis. First, individual human life subject. It corresponds to the whole

life cycle evolution of natural persons, covering health maintenance, aging intervention, chronic disease management, long-term professional care, and end-of-life care, and is the original source of all pension market demands. Second, pension enterprise organizational life subject. Insurance and pension enterprises are regarded as organic organizations with natural growth and iterative development characteristics, connecting individual pension demands and social industrial resource allocation. Third, social industrial ecological life subject. It covers macro longevity policies, regional pension industrial clusters, public medical and pension supporting resources, and industrial supervision environment, forming the external soil and potential source for the survival and development of the whole pension ecology^[13].

3.1.2. Double-loop nested closed-loop system

The original theory constructs two mutually nested and mutually linked circulation loops. The endogenous growth inner loop follows the circulation path of “individuals–enterprises–society–individuals.” Driven by individual pension demands, pension enterprises optimize products and iterate business modes, promote industrial agglomeration and public supporting improvement, and finally feed back residents’ health quality improvement to complete natural value accumulation. The external empowerment outer loop follows the path of “society–enterprises–individuals–society.” Driven by macro policy dividends and industrial development potential, superior social resources continuously empower pension enterprises, promote enterprises to upgrade service capacity and improve individual health quality, and finally feed back social high-quality human capital and industrial upgrading to realize high-level ecological iteration.

3.1.3. Full-domain artificial intelligence driving kernel

Artificial intelligence is not an independent fourth subject, but runs through all three-dimensional subjects and the whole double-loop circulation. In the endogenous growth loop, AI plays the role of acceleration and catalysis to accurately identify differentiated pension demands and improve overall operational efficiency. In the external empowerment loop, AI undertakes the function of potential amplification, realizing accurate penetration of social superior resources and promoting continuous upgrading of the whole industrial ecology.

3.2. Internal mechanism of AI empowering pension business model innovation

From the three dimensions of value creation, value transmission, and value acquisition, artificial intelligence comprehensively reconstructs the underlying commercial logic of the insurance and pension industry. In terms of value creation, AI focuses on individual life demands and realizes precise personalized pension services, promoting industrial transformation from supply orientation to demand orientation. In terms of value transmission, pension enterprises act as the core hub to break data-isolated islands among insurance, medical treatment, and pension industries through digital platforms, realize efficient industrial resource connection, and strengthen ecological coordination effects. In terms of value acquisition, relying on macro social industrial potential and intelligent risk control capabilities, insurance and pension enterprises transform from single premium income to diversified profit systems of “insurance payment plus pension service plus asset investment,” realizing symbiotic prosperity of the three major life subjects.

4. Typical application scenarios of artificial intelligence in longevity pension industry

First, AI plus customer operation. Big data algorithms construct high-precision customer portraits to tap

potential pension demands and realize accurate matching of products and services. Intelligent service robots reduce manual operation costs, and dynamic health operations improve customer stickiness and incremental customer growth. Second, AI plus health management. Wearable monitoring terminals collect real-time vital sign data to establish lifelong electronic health archives. The AI early warning model realizes active prevention and early intervention of chronic diseases, transforming health management from passive post-treatment to active pre-prevention. Third, AI plus intelligent pension care. Intelligent falling detection, bed leaving monitoring, and automatic ability evaluation systems effectively relieve the shortage of nursing personnel, realize hierarchical classified care and one-person customized pension schemes, and guarantee the safety of elderly living. Fourth, AI plus insurance risk control. Artificial intelligence builds refined actuarial pricing models and realizes efficient automatic underwriting. In the claim settlement link, AI effectively prevents false claims and excessive medical treatment, and consolidates the steady operation bottom line of insurance enterprises.

5. Realistic challenges restricting AI-driven pension industrial development

Firstly, the industrial data system is imperfect, with prominent cross-industry data isolated islands. Unified national data collection standards have not been formed, and data barriers among insurance, medical treatment, and pension institutions are difficult to break ^[5]. Restricted by personal privacy compliance constraints, high-quality algorithm training data is insufficient, weakening the actual empowerment effect of artificial intelligence. Secondly, digital technology brings high landing costs and obvious industrial differentiation. The research and development of intelligent equipment, independent algorithms, and digital platforms require huge early investment. Leading large-scale enterprises take the lead in completing intelligent layout, while small and medium-sized institutions face capital pressure and are difficult to realize digital transformation, forming a polarized industrial pattern. Thirdly, the supply of interdisciplinary compound talents is seriously insufficient. The insurance and pension industry involves finance, clinical medicine, pension management, and artificial intelligence technology. The backward talent training system of universities leads to a long-term talent gap, which has become an important bottleneck restricting industrial upgrading. Fourthly, the age-adaptive transformation of intelligent products is insufficient. Most digital products are designed for young and middle-aged groups with complex operation logic and interface. Limited digital literacy of the elderly reduces the popularization efficiency of intelligent pension services and weakens the actual empowerment effect of digital technology.

6. Countermeasures for promoting AI-driven pension business model innovation

First, unify industrial data standards and build a safe data sharing system. Industry associations and regulatory authorities should formulate unified standards for data collection, storage, and application. Relying on federated learning and blockchain technology, build an industrial sharing platform featuring “available but invisible data,” break data isolated islands while strictly protecting personal privacy, and provide high-quality data support for artificial intelligence iteration, so as to promote the interconnection of three-dimensional symbiotic subjects. Second, optimize the industrial overall layout and develop diversified combined modes of heavy assets and light assets. Leading insurance groups focus on building high-end heavy asset pension ecological clusters, while small and medium-sized institutions focus on inclusive home-based and community lightweight pension tracks,

forming a complementary and coordinated industrial pattern and consolidating the operation foundation of the double-loop symbiosis system. Third, strengthen interdisciplinary talent training and consolidate industrial talent reserves. Universities are encouraged to set up interdisciplinary majors related to insurance pension and intelligent aging research. Enterprises improve internal digital training systems to improve the artificial intelligence application ability of on-the-job employees and build a complete talent echelon. Fourthly, promote comprehensive age-adaptive transformation of intelligent products. Optimize product operation interfaces and simplify operating procedures, retain manual service channels as a backup guarantee, and strengthen digital literacy training for the elderly to enhance user experience and social recognition of intelligent pension services. Fifth, improve the policy supporting system and optimize the external industrial development environment. Regulatory authorities introduce industrial guidance specifications for technological application, implement tax incentives, financial subsidies, and land supporting policies, reduce enterprise research and development and operating costs, and promote the in-depth integrated development of the insurance industry, pension entities, and artificial intelligence industry^[14,15].

7. Conclusion and prospects

The longevity era brings unprecedented historical opportunities for China's insurance and pension industry^[1], and artificial intelligence provides a continuous core driving force for industrial business model innovation. The core academic contribution of this paper lies in the original proposal of the Longevity Health and Pension Symbiosis Theory and the construction of the unique analytical paradigm of "three-dimensional subjects, double-loop nesting and full-domain AI driving." Through the comparative analysis of three overseas and domestic benchmark enterprises, this paper verifies that insurance foundation, technological empowerment, and ecological coordination are the common development laws of the global pension industry. Artificial intelligence reconstructs the industrial operating logic from value creation, value transmission, and value acquisition, and promotes the high-quality transformation of the pension industry towards precision, intelligence, and ecologization. At present, the industry still faces realistic constraints including data barriers, high transformation costs, talent shortage, and insufficient age adaptation. Joint efforts of enterprises, regulatory authorities, and scientific research institutions are required to break industrial development bottlenecks. In the future, with the continuous iteration of artificial intelligence technology, deepening cross-industry integration, and gradual improvement of supporting policies, China's insurance and pension industry will become more mature and perfect. It will play an increasingly important strategic role in responding to national population aging strategies, promoting high-quality development of longevity economy, and improving the happiness and life dignity of the elderly.

Disclosure statement

The author declares no conflict of interest.

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