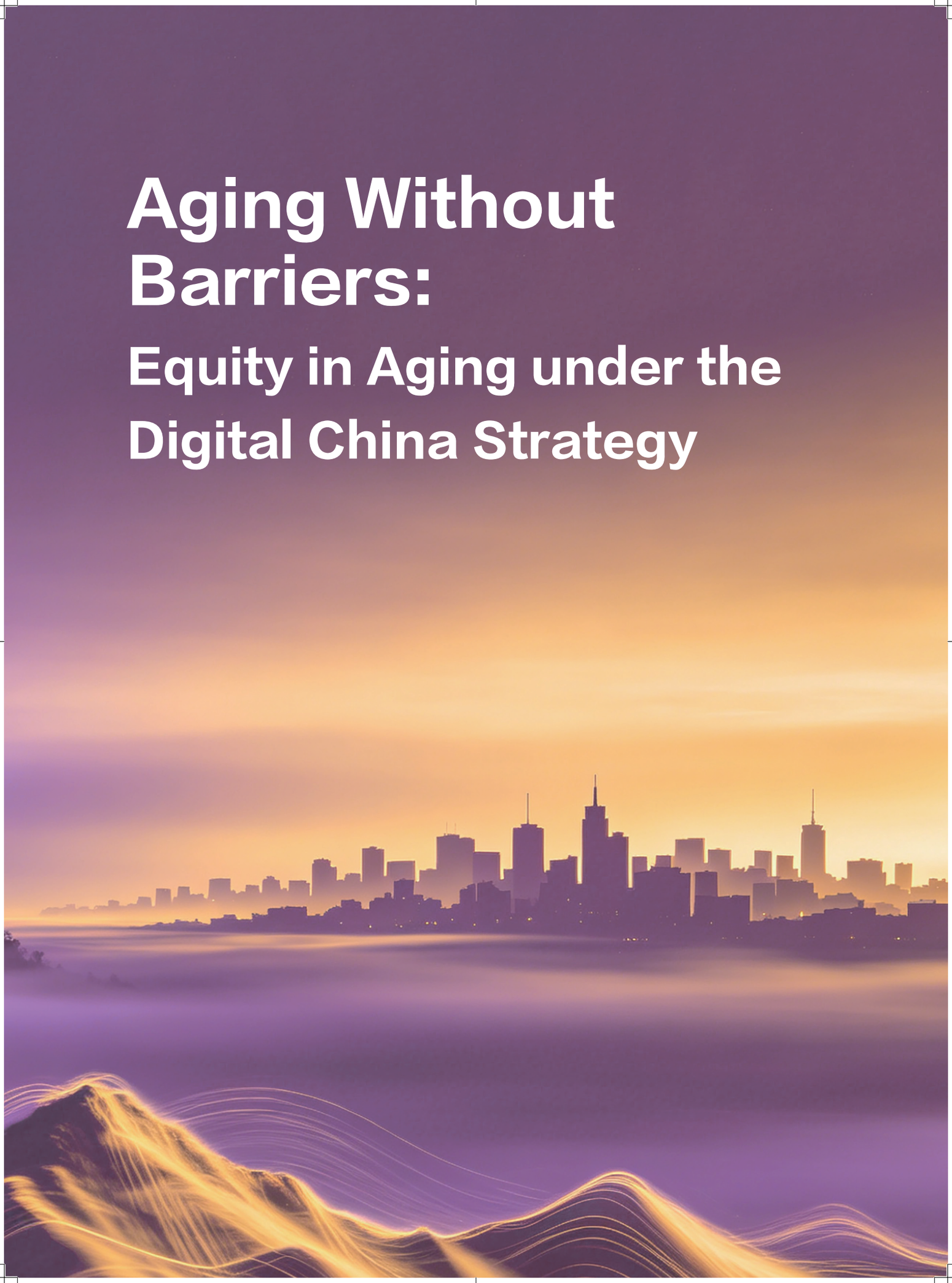
Aging Without Barriers:

Equity in Aging under the Digital China Strategy



Acknowledgments

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Usage Statement

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EXECUTIVE SUMMARY

Improving public well-being and advancing common prosperity for all are key pillars of China's 15th Five-Year Plan framework. The plan also calls for leveraging digital and intelligent technologies to support smart elderly care, ensure the elderly are well cared for and able to enjoy life, and strengthen the digital foundation of the silver economy.

Against the strategic backdrop of actively responding to population aging and building a Digital China, this report examines how age-tech can promote equity in aging—that is, ensuring the basic dignity, legitimate rights, and livelihood security of middle-aged and seniors across different economic conditions, geographic regions, and family circumstances. Age-tech plays a crucial role in advancing this equity. When seniors face functional impairments, chronic illness, living alone, cognitive decline, or difficulty using digital tools, age-tech can provide effective support. Its core mission is to ensure that essential safety, necessary care, and access to information are not compromised by disparities in income, location, service availability, or digital literacy.

The practical starting point for addressing equity in aging in China lies in three structural pressures. First, 'getting old before getting rich' shortens the window for building public protection systems, long-term care infrastructure, and household savings. Second, the urban-rural divide creates a spatial imbalance in aging pressures, service resources, and payment capacity. Third, a structural mismatch between supply and demand means many care needs remain locked within households, making it difficult to translate them into effective demand that can be purchased, delivered, and verified. Taken together, these three pressures have made aging an issue that urgently calls for coordinated responses across public institutions, industrial organizations, service providers, and technology firms.

In the multi-actor silver economy ecosystem—comprising public authorities, service providers, tech firms, payers, seniors, and families—age-tech creates value at every stage. A functioning product is only the starting point; what seniors truly need is a service process that can be arranged, delivered, and verified. The servitization of manufacturers, technology adoption by care institutions, and platformization of home care all reflect the integrated development of age-tech within this ecosystem. Long-term care insurance (LTCI) is a key payment driver, enabling age-tech to enter elderly care services sustainably. Through functional assessment, service standardization, administration, and cost settlement, LTCI transforms household care burdens into assessable, payable, and organizable service demand. LTCI should center on payments for care services, with technology tools integrated commensurate with their development stage: mature tools can be embedded into existing service items; assistive devices can be included via leasing or per-use models; and innovative solutions should be piloted within a well-defined scope. Experience from Japan and Germany also highlights the need to balance catalog stability with dynamic updating.

Age-tech still faces four institutional bottlenecks in moving from pilots to scale. First, product classification is unclear—intelligent care devices often fall into a gray area between medical devices, elderly care tools, rehabilitation aids, and digital systems. Second, institutional adoption lacks rule-based support: procurement, acceptance testing, training, and maintenance have no standards for providers to follow. Third, service data standards

are inconsistent, making it difficult for platform and device records to serve as evidence jointly recognized by payers, regulators, and families. Fourth, responsibility chains are incomplete—when incidents occur, there is no clear review pathway among devices, personnel, platforms, providers, and families. Local pilots can be replicated only when these issues become clear categories, standards, review procedures, and evidence rules.

Effectively addressing the bottlenecks in age-tech development is a key expectation for the future growth of China's silver economy. Empowering medical and nursing care with age-tech is an urgent task—one that improves the quality of elderly care services, narrows the urban-rural gap and digital divide among seniors, and advances equity in aging.

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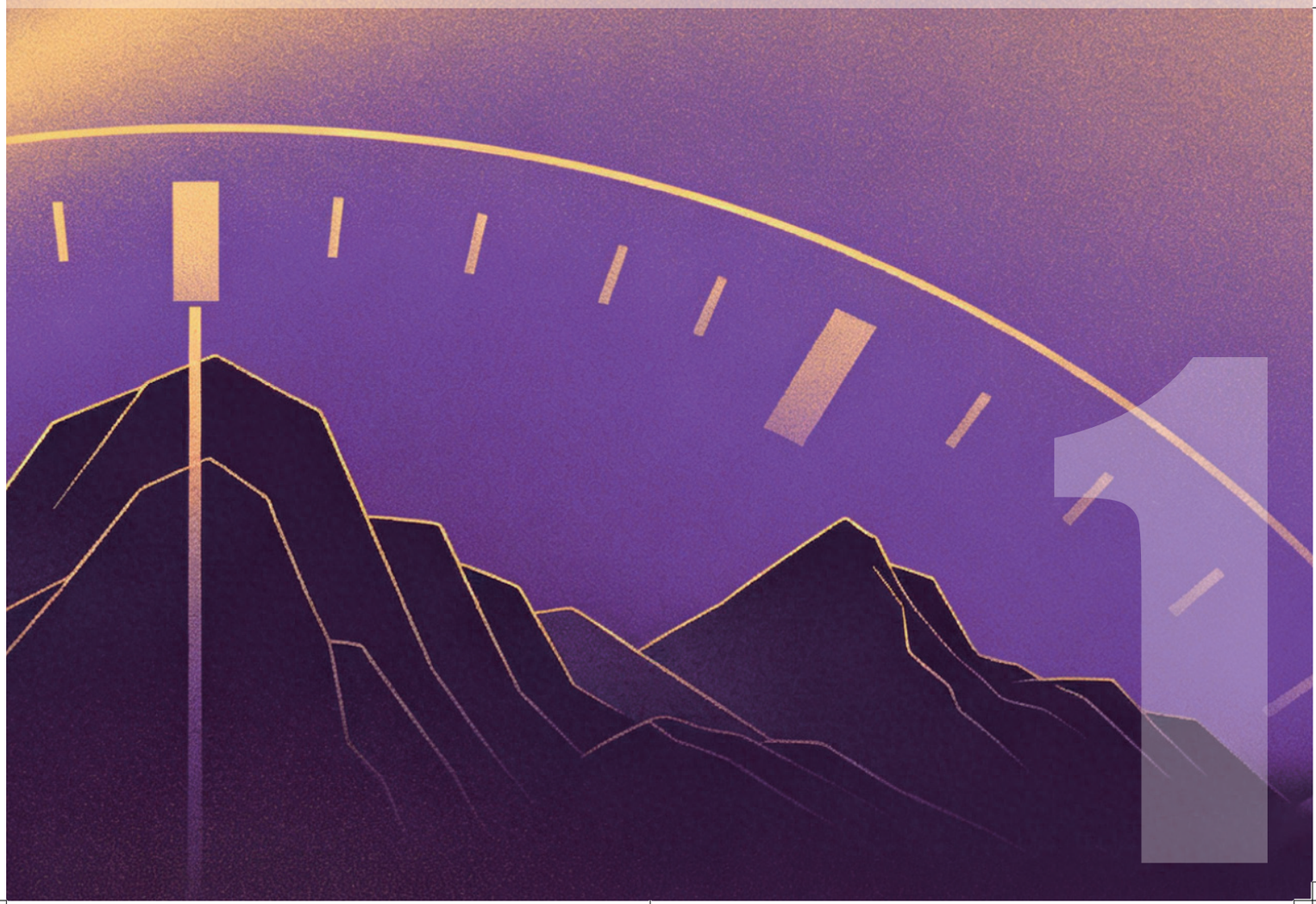
Starting Point:

Structural Pressures and Equity in Aging amid Advanced Population Aging



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1.1 Deep Population Aging as a Foundational Social Issue

Population aging is a defining marker of demographic transformation. As economies develop, healthcare improves, and life expectancy rises, a growing share of seniors has become a long-term trend shared by many countries.

Under the definition adopted by the National Bureau of Statistics, a country or region enters an aging society when the share of people aged 60 and above reaches 10% of the total population, or the share aged 65 and above reaches 7%; it becomes a moderately aged society when the share aged 60 and above exceeds 20%, or the share aged 65 and above exceeds 14% [1]. The 2025 National Economic and Social Development Statistical Communiqué shows that, by end-2025, China's population aged 60 and above had reached 323.38 million, accounting for 23.0% of the total, while those aged 65 and above reached 223.65 million, or 15.9% [2]. As Figure 1 illustrates, China has now crossed both thresholds and entered a stage of continuous growth in the older population and deepening of the age structure.

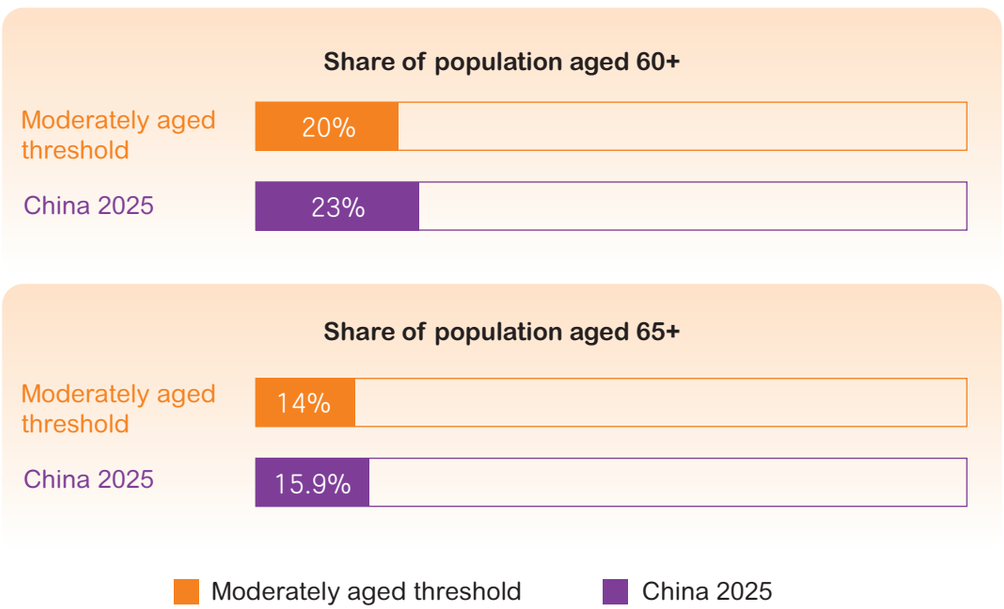


Figure 1 China's Aging Thresholds and 2025 Data

Source: National Bureau of Statistics, 2025 statistical communique.

This demographic shift is reshaping household care capacity, public finance, grassroots service supply, medical and rehabilitation demand, and industrial organization. Aging is no longer a difficulty confined to a small group of the oldest old, nor a care arrangement any single household can bear alone. It has become a foundational social issue.

At the national strategic level, China has responded with systematic arrangements. The 15th Five-Year Plan Outline elevates the national strategy of actively responding to population aging to a dedicated section, calling for stronger policy mechanisms to coordinate public services and industry development and to ensure that the elderly are well cared for, able to remain productive, and able to enjoy life. With respect to elderly care service networks, the Outline sets out a series of tasks: coordinated facility planning, optimized basic elderly care services, community-embedded care, professional, branded, and chain-based service institutions, home-based

care beds, age-friendly home modifications, mutual-aid elderly care, functional-impairment and dementia care systems, expanded nursing bed supply, integrated medical and elderly care, long-term care insurance, and a unified functional capacity assessment system for seniors[3]. These measures signal a fundamental shift: aging has moved from a matter of family care ethics and individual later-life arrangements into the macro-governance domain of basic public services, social security, long-term care, and the coordinated development of public and industrial elderly care systems.

Within the same strategic framework, the 15th Five-Year Plan Outline also prioritizes high-level scientific and technological self-reliance, new quality productive forces, the Digital China Strategy, and digital and intelligent development as key drivers of economic and social progress. New quality productive forces emphasize the deep integration of technological and industrial innovation. The Digital China Strategy stresses the application of data resources, digital and intelligent technologies, and AI Plus in livelihood protection, social governance, elderly care, and disability support. In elderly care, the pressures of long-term care and public service delivery demand stronger organizational capacity, while digitalization, networking, and intelligent technologies offer new tools for service connectivity, process documentation, grassroots responsiveness, and quality accountability. Age-tech has thus emerged as a vital application domain of the Digital China Strategy in elderly care services [3].

Yet the real starting point of China's aging society presents three structural pressures: first, the compressed development timeline, relatively limited economic foundation, and insufficient preparation for later life caused by aging before affluence; second, intensified population mobility, uneven resource distribution, and spatial inversion caused by the urban-rural divide; and third, the tension between continuously growing care needs and insufficient delivery capacity caused by structural mismatch between supply and demand. Together, these three pressures form the real foundation for understanding China's aging agenda, the silver economy ecosystem, and the role of age-tech.

1.2 Aging Before Affluence

Aging before affluence is the first economic constraint on China's aging response. It describes a mismatch between the speed of population aging and the accumulation of wealth, the expansion of social security, the financing of long-term care, and household retirement reserves. The share of seniors has risen rapidly within a short period, requiring public institutions and household financing to catch up simultaneously. This gives China's aging trajectory a fundamentally different starting point from that of economies that grew affluent before aging.

Time compression

China experienced a baby boom in early 50s. As those cohorts successively enter old age—compounded by longer life expectancy, declining fertility, and shrinking household size—the share of seniors has surged over a brief span. According to the 2000 Fifth National Population Census, people aged 65 and above numbered 88.11 million, or 6.96% of the total population, already approaching the aging-society threshold. By 2021, that figure had reached 200.56 million, or 14.2%, formally crossing into moderately aged society [4],[5]. China traversed this distance in roughly two decades. OECD research indicates that Japan took 24 years for the share of people aged 65 and above to rise from 7% to 14%, the United States 71 years, and France 115 years [6]. The left panel of Figure 2 illustrates this cross-national gap. Although China and Japan share a rapid-aging trajectory, China completed the transition on a far larger population base, imposing simultaneous expansion pressure on pension systems, long-term care, and grassroots service networks.

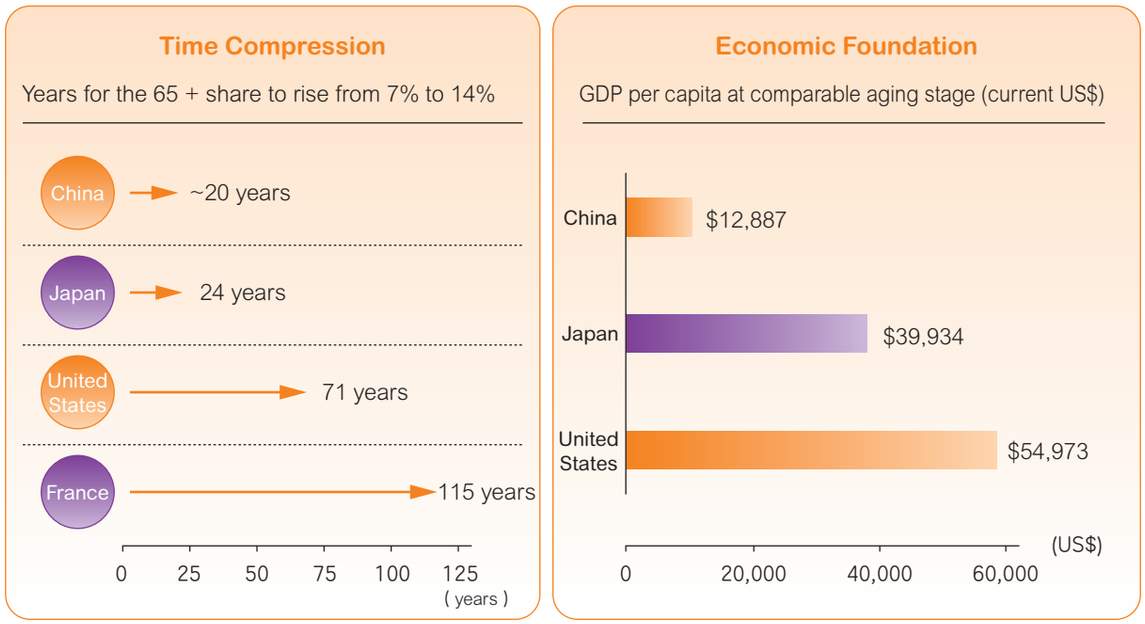


Figure 2 Aging Speed and GDP per Capita at Comparable Stages

Sources: OECD; World Bank WDI.

Limited economic foundation

Alongside time compression, China entered moderately aged society with a considerably lower per-capita economic base. Based on World Bank WDI data in current U.S. dollars, China's GDP per capita in 2021 was USD 12,887. By comparison, Japan's GDP per capita was USD 39,934 in 1994, when the 65+ share reached 14.15%, and that of the United States was USD 54,973 in 2014, when the 65+ share hit 14.01% [7]. The right panel of Figure 2 presents GDP per capita at comparable aging stages for the three countries.

Rapid aging, combined with a relatively modest per-capita economic foundation, concentrates pressure into a dual burden: social protection system and household long-term care.

(1) Basic pension and medical security face sustained investment pressure.

Over nearly three decades, the participation rate of China's basic pension insurance has risen above 76%, covering 1.076 billion people by end-2025. Basic medical insurance covered 1.331 billion people, with a participation rate consolidated at 95.0%. China has built the world's largest and most comprehensive social security system.

Yet the Ministry of Finance's 2024 national social insurance fund final accounts reveal heavy reliance on fiscal subsidies. Among the three basic pension insurance schemes—enterprise employees, urban-rural residents, and government and public-institution employees—fiscal subsidies amounted to approximately RMB 824.9 billion, RMB 434.6 billion, and RMB 667.3 billion, respectively, accounting for 14.5%, 59.6%, and 37.7% of each fund's revenue. Excluding these subsidies, all three funds ran current-year deficits: roughly RMB 120 billion for enterprise employees, RMB 230 billion for urban-rural residents, and RMB 660 billion for government-agency and public-institution employees [8],[9]. These figures underscore the role of fiscal subsidies as a critical pillar

of system stability, while also revealing divergent financing bases across schemes. The enterprise employee scheme rests primarily on employer and employee contributions, requiring relatively modest subsidies. The urban-rural resident scheme, serving rural residents and non-employed urban dwellers, relies on a weaker contribution base and thus receives a higher share of fiscal support. The government and public-institution scheme carries additional costs from institutional transition and fiscal realignment, warranting substantial support.

On the medical security side, basic medical insurance operates on the principle of balancing revenue and expenditure with a modest surplus. In 2020, total basic medical insurance expenditure, including maternity insurance, was RMB 2.1032 trillion; by 2024 it had risen to RMB 2.9764 trillion, and by 2025 to RMB 3.0009 trillion. From 2020 to 2025, the average annual growth rate was approximately 7.4%, reflecting continuous expansion [10],[11],[12].

As aging deepens, public finance must honor existing pension commitments while also funding expanding long-term care, community-based elderly services, and grassroots service capacity.

(2) Household is strained by care payment burdens.

Basic medical insurance now covers the vast majority of seniors. The Fifth Sample Survey on the Living Conditions of Urban and Rural Seniors in China shows that in 2021, 98.5% of seniors enjoyed some form of medical security [13]. However, basic insurance primarily shares the cost risk of disease diagnosis and treatment; functional impairment care largely takes the form of sustained daily living expenses. In 2021, 7.1% of China's seniors had partial difficulty with self-care, and 4.5% were fully unable to care for themselves—together, 11.6%. Among the oldest-old, this combined share reached 29.2% [13]. As advanced age and impairment risks rise, households will increasingly face long-term care costs such as assisted bathing, turning, toileting, night care, assistive-device leasing, consumables, and institutional care.

This strain is already visible in the affordability of institutional care. The same survey indicates that among seniors willing to move into an elderly care institution in 2021, only 15.8% could afford monthly fees of RMB 3,000 or above (equivalent to RMB 36,000 per year) [13]—a level roughly equal to the national median per-capita disposable income of RMB 36,231 in 2025 [14]. The comparison suggests that the majority of willing seniors and their families would struggle to sustain institutional nursing costs over the long term.

The core tension exposed by aging before affluence is a temporal mismatch between the pace of aging, the economic base, and the readiness of elderly support systems. Within a compressed timeframe, China must simultaneously build out pension security, long-term care financing, community-based elderly services, and household precautionary savings—all on a comparatively modest per-capita economic foundation and against rising demands on public finance.

1.3 The Urban-Rural Divide

The urban-rural divide is the second spatial constraint on China's aging society. At its core lies a fundamental mismatch: aging pressures and the social resources needed to address them are unevenly distributed across urban and rural areas. As urbanization draws young workers to cities, seniors left behind in rural communities face deepening aging, while cities remain comparatively young. Yet the resources that older populations depend on—professional care, rehabilitation support, age-friendly products, and continuing in-home services—hinge on

population density, service networks, and organizational capacity, all of which concentrate in urban areas. The divide thus reveals two starkly different starting points for aging support across spatial units.

Inverted age structure between urban and rural areas

Data from the Seventh National Population Census show that in 2020, people aged 60 and above accounted for 23.81% of the rural population, and those aged 65 and above for 17.72%—respectively 7.99 and 6.61 percentage points higher than in urban areas [15]. Urbanization continuously absorbs young and working-age people, while rural areas retain a growing share of seniors, producing an inverted age structure. The places bearing the heaviest aging burden are precisely those where social resources are most dispersed and service organization is weakest.

Erosion of rural family care due to labor migration

The 2025 Monitoring Survey Report on Migrant Workers shows that China's total migrant worker population reached 301.15 million, of whom 180.06 million were employed outside their home localities, and 130.92 million from rural areas were living in cities at year-end. The average age of out-migrant workers was 39.3, markedly younger than the 46.8 average for local migrant workers [16]. This out-migration spatially separates aging pressure from care capacity: the rural share of seniors grows, while the working-age population that would provide daily care gravitates toward cities and industrial employment.

Predominance of home-based care

The Fifth Sample Survey on the Living Conditions of Urban and Rural Seniors in China shows that in 2021, 91.7% of rural seniors chose to receive care at home, compared with 83.6% of their urban counterparts. Only 2.6% opted for daytime care centers and 5.7% for institutional care, both lower than the corresponding urban figures of 6.9% and 9.5% [13]. Rural eldercare is overwhelmingly household-based. For service providers, the key question becomes whether services can reliably reach the home setting.

Continuing home-visit nursing, assisted bathing, rehabilitation accompaniment, assistive-device maintenance, age-friendly home modifications, and emergency response all depend on service stations, care workers, transport logistics, and follow-up maintenance. The concentration of rural seniors in dispersed households means supply must overcome larger coverage radii, lower personnel density, and more complex scheduling and upkeep. For rural seniors living alone, chronically ill, or functionally impaired, the difficulty can no longer be captured simply as a shortage of institutions. Even where services nominally exist, their actual impact depends on whether care workers can arrive in time, equipment can be continuously maintained, households can bear long-term costs, and services remain genuinely stable—factors that together determine whether real needs convert into effective support.

Payment-capacity gaps

Differences in payment capacity compound the urban-rural spatial divide. Based on data from the 2024 Statistical Communiqué on Human Resources and Social Security Development and the China Statistical Yearbook, the average monthly pension under the urban employee basic pension insurance system is approximately RMB 3,825, while the average monthly benefit under the urban-rural resident basic pension insurance system is approximately RMB 246—a 15.5-fold gap. Placed against basic living costs, RMB 246 per month is less than half

the rural subsistence allowance standard and under 40% of rural residents' average monthly food consumption expenditure. Even accounting for lower rural income and consumption levels, resident pension benefits provide very limited capacity to cover sustained expenditures such as long-term nursing care, home-visit assisted bathing, medical escort and rehabilitation, assistive-device leasing, and home modifications.

Inadequate family and land resources in rural areas

Rural aging still rests on a foundation of family, land, and village-community ties, but these resources have limited convertibility into cash for care. The Fifth Sample Survey shows that in 2021, the annual per capita income of rural seniors was RMB 14,105.4, with a median of just RMB 5,640.0. Social-security income accounted for 42.7%, operating income 36.9%, property income 9.8%, and family transfers 10.6% [13]. Operating income (crop farming, livestock breeding, aquaculture, forest product harvesting and sales, etc.) fluctuates with labor capacity, agricultural returns, and seasonality; family transfers depend on their adult children's employment and household burdens; property income (rent from contracted farmland, woodland or fish ponds leased to large growers, cooperatives or agricultural enterprises, etc.) remains marginal. Faced with the costs of long-term care, home modifications, assistive-device leasing, continuing home-visit services, and institutional admission, family, land, and community ties cannot reliably substitute for institutional payment mechanisms and professional service supply.

Multiple, overlapping constraints

A rural elderly adult living alone, chronically ill, or functionally impaired may simultaneously confront limited pension security, adult children employed far from home for long periods, poor access to professional services, distant service points, difficulty using digital platforms, and inconvenient equipment maintenance. Figure 3 summarizes three dimensions of this divide: a higher rural share of seniors, out-migration that erodes daily care ca-

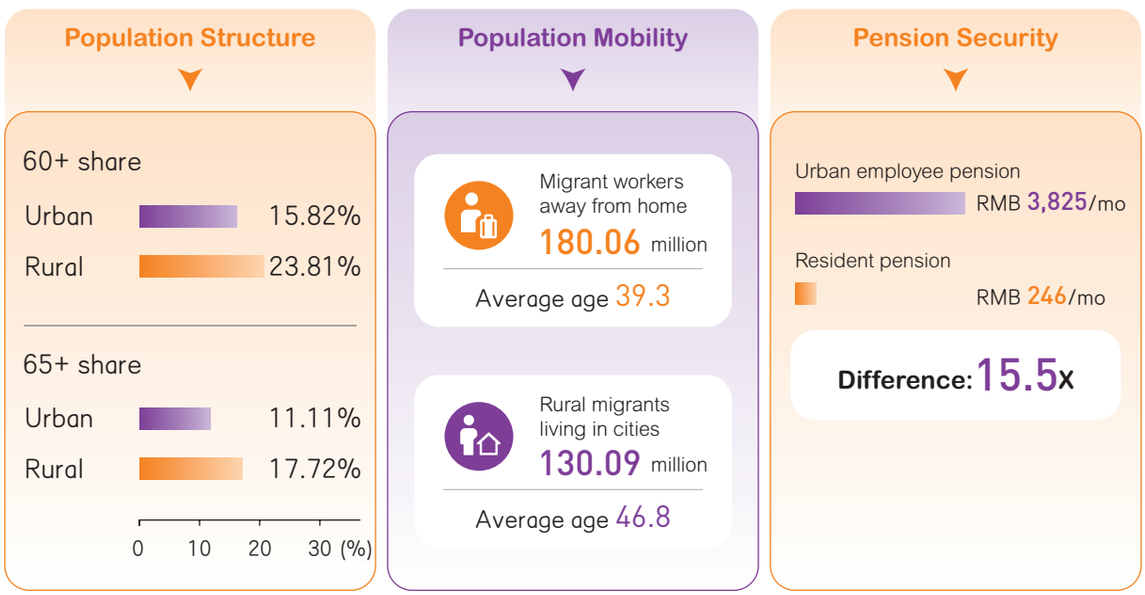


Figure 3 Urban-Rural Aging Pressure: Structure, Mobility, and Pension Security

Sources: Seventh National Population Census; migrant worker monitoring report; statistical yearbooks.

pacity, and pension gaps that restrict the ability to convert care needs into the purchase of professional services. What the urban-rural divide reveals is not simply an income gap between urban and rural areas, but a composite difference in the starting conditions for aging support—shaped together by population structure, family care, payment capacity, service organization conditions, and digital capability.

1.4 Structural Mismatch in Elderly Care Supply and Demand

Consider an older adult with moderate functional impairment. Family members spend four to six hours a day on turning, bathing, and toileting assistance, leaving them physically and mentally drained. Within a three-kilometer radius, two elderly care institutions charge around RMB 3,000 per month. In economics, demand requires both willingness and ability to pay at a given price. Care needs in the everyday sense must pass through the filters of payment, choice, and service delivery before they become effective demand [17],[18]. The mismatch in elderly care arises precisely at this point of conversion: seniors and their families have real care needs, and service supply is expanding, but whether costs can be sustained over time—and whether services can be trusted—determines whether professional care orders stabilize.

Long-term care pressure on the demand side

Estimates based on the Fifth Sample Survey on the Living Conditions of Urban and Rural Seniors in China indicate that in 2021, around 35 million seniors experienced full or partial functional impairment, accounting for 11.6% of the older population. An additional 15 million lived with dementia, and more than 42 million were among the oldest-old. These needs are inherently continuous. A single fall, one hospitalization, or a decline in cognitive function can push an older adult and their family into sustained caregiving. Bathing, turning, toileting, medical escort and rehabilitation, and nighttime response shift from occasional help to long-term arrangements [19].

Preference for home care

In 2021, 87.3% of people aged 60 and above in China chose to receive care at home, while only 7.7% opted for institutional care [13]. Long-term care pressure first surfaces in households and communities. What genuinely needs to be organized extends far beyond institutional beds—it includes the assessment, home visits, nursing, rehabilitation, maintenance, emergency response, and payment arrangements embedded in home-based settings.

Supply expansion not met with effective utilization

On the supply side, elderly care facilities have reached significant scale. The 2024 National Bulletin on Aging Undertakings reports that by end-2024, China had 406,000 elderly care institutions and facilities of various types, with a total of 7.993 million beds [20]. Among these, registered institutions held 5.077 million beds and served 2.307 million people at year-end [20]. Public reports citing Ministry of Civil Affairs data indicate that the average occupancy rate nationwide in 2024 was below 50% [21]. This demonstrates that supply has a foundation, yet beds, facilities, and service capacity do not automatically translate into steady use. Figure 4 maps long-term care needs, institutional beds, occupancy rates, and the conditions for conversion onto a single process, highlighting the barriers that block conversion and the outcomes that result.

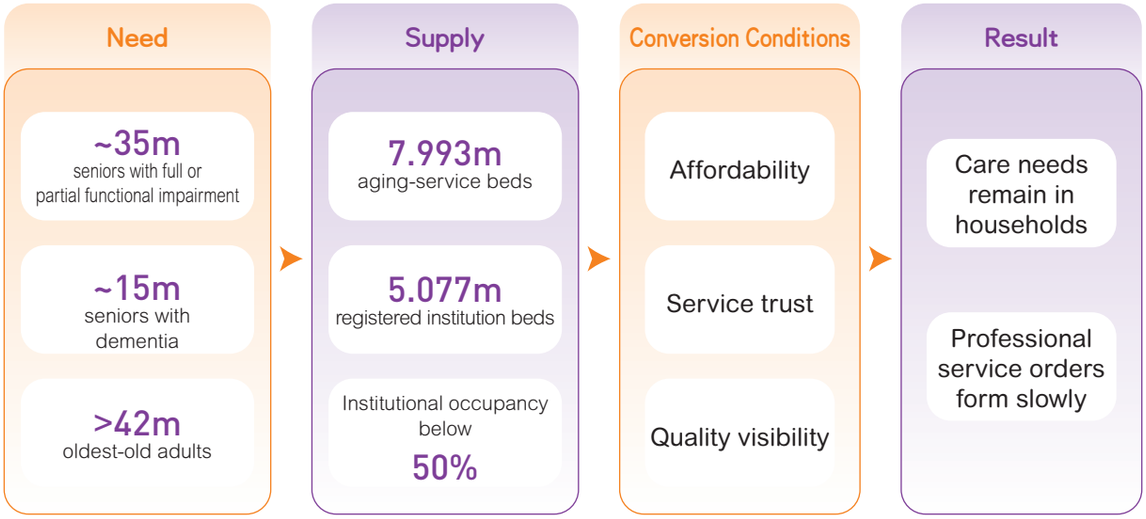


Figure 4 Conversion of Long-Term Care Need into Service Use

Note: Effective demand requires affordability, trust, and service delivery capacity.

Barriers to conversion:

(1) Insufficient payment capacity constrains the formation of effective demand.

Insufficient payment capacity is the first reason care needs fail to translate into effective demand. Long-term care is repetitive and sustained. Assisted bathing, medical escorts, rehabilitation, nighttime care, assistive-device leasing, consumables, and home modifications can all generate recurring costs. Even when families recognize an older adult's need for help, cost pressures may lead them to postpone purchasing services or to settle for low-cost, non-professional, or temporary alternatives. For service providers, unstable willingness to pay makes it difficult to stabilize orders. And without stable orders, sustained investment in caregiver training, service-station development, service documentation, and quality management becomes equally difficult.

(2) Information asymmetry undermines trust in services.

Information asymmetry is the second reason care needs struggle to convert into effective demand. Elderly care services are professional in nature, and it is difficult for families to judge in advance whether a caregiver is competent, whether service processes are standardized, or whether unexpected situations will be handled properly. Signaling theory in information economics holds that when service quality is hard to observe directly, external signals shape transaction trust. Certificates, institutional credentials, platform ratings, service records, and explanations of how incidents are handled can all serve as external signals for families assessing service quality [22],[23].

The public survey component of the 2025 Research Report on the Occupational Status of Elderly Care Workers shows that 68.82% of respondents believe care workers should hold professional certificates related to elderly care. Over one-third are willing to pay more for more professional services, while nearly half believe current services suffer from a mismatch between quality and price [24]. These findings point to identifiable demand for professionalism and a degree of willingness to pay. Whether that willingness translates into actual orders, however, depends on families' ability to recognize professionalism, verify service quality, and obtain reviewable explanations when things go wrong. When quality is opaque and lines of responsibility are blurred, trust in services is hard to establish.

At its core, the structural mismatch in elderly care supply and demand lies in the failure to consistently convert

needs into effective demand. Needs related to functional impairment, dementia, advanced age, and home-based care continue to grow, and the supply of institutional, community-based, and home-care services is also expanding. Yet insufficient payment capacity and information asymmetry leave a portion of these needs trapped inside households. Families with stronger financial resources, greater access to information, and denser service networks are more likely to secure professional support. Seniors who are very old, functionally impaired, living alone, on low incomes, or residing in underserved areas are more likely to rely on informal family care, low-cost non-professional care, or remain in a state of waiting. In this way, supply-demand mismatch transforms the challenge of aging needs into a question of service access—and brings equity in aging into sharp relief at the level of service delivery.

1.5 The Emergence of Inequities in Aging: Why Basic Support Differs

Aging before affluence, the urban-rural divide, and the structural mismatch between elderly care supply and demand reveal, respectively, the economic constraints, spatial disparities, and service-conversion barriers that China's aging response confronts. As these three pressures compound, gaps in equity in aging begin to surface: seniors facing similar circumstances—functional impairment, chronic illness, living alone, or long-term care needs—do not have equal opportunities to access basic support. The divergence stems not only from income, but also from whether services can physically reach them, whether costs can be sustained over time, whether quality can be discerned, whether information can be understood, and whether necessary procedures can be navigated. Figure 5 groups these divergences into three sources: differences in economic capacity, differences in spatial and service-conversion conditions, and differences in the capacity to know and act.

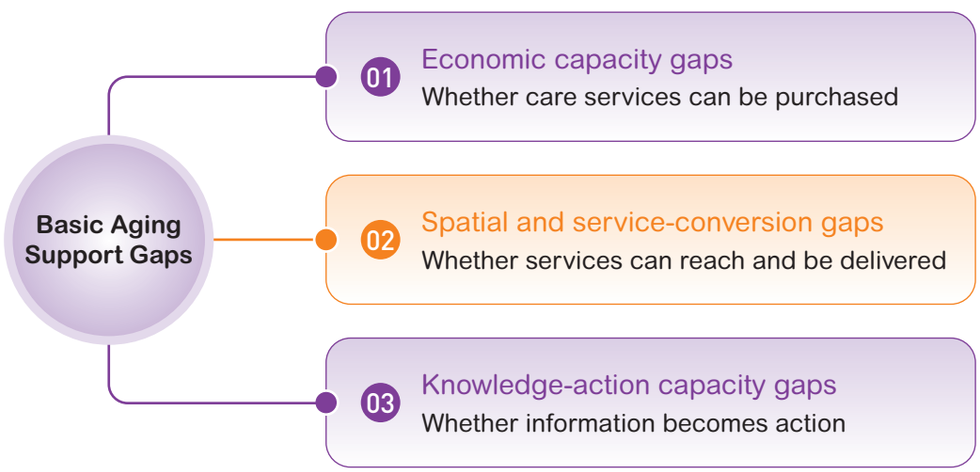


Figure 5 Three Sources of Aging Support Gaps

Three overlapping sources shape whether basic aging support reaches seniors.

Differences in economic capacity determine whether care can be purchased on a sustained basis.

Families with greater resources can convert care needs into concrete service arrangements—institutional admission, home-visit nursing, medical escort and rehabilitation, assistive-device leasing, or age-friendly home modifications. Families with limited resources, even when they fully recognize an elderly adult's care needs, are more likely to postpone the purchase of professional services and to continue relying on family members, low-

cost non-professional help, or temporary stopgaps. Disparities in aging support thus extend beyond income gaps into differences in care quality, response speed, and continuity of service.

Spatial and service-conversion differences determine whether services can be reached and delivered.

Cities and county seats more readily concentrate elderly care institutions, care workers, medical and rehabilitation resources, service platforms, and equipment-maintenance networks. Rural areas are more likely to simultaneously face deeper population aging, out-migration of adult children, longer service radii, and weaker pension coverage. Although the supply of institutions, community facilities, and home-based care continues to grow, the shift from nominal availability to stable access still depends on a chain of steps: physical reach, payment, maintenance, quality review, and trust-based judgment. Households situated in resource-dense areas, with stronger payment capacity and better access to information, are better positioned to convert care needs into reliable services. Seniors who are very old, functionally impaired, living alone, on low incomes, or left behind in rural communities are more likely to remain reliant on family care, low-cost non-professional services, temporary help, or indefinite waiting.

Differences in the capacity to know and act further shape equity in aging.

Moving from the availability of an elderly care service to its actual utilization often requires seniors or their families to gather information, understand rules, assess costs, and complete procedures. Applying for long-term care insurance, selecting an institution, purchasing home-based care, arranging home modifications, and making sense of commercial insurance or personal pensions all demand a sequence of *knowing, understanding, judging, and acting.* As digital access points proliferate, the ability to navigate digital tools directly affects this sequence. An analysis accompanying the Fifth Sample Survey on the Living Conditions of Urban and Rural Seniors in China indicates that in 2021, 36.6% of seniors could use a smartphone, and only 12.5% used the internet regularly [25]. A significant share of older people lack the basic conditions to make stable use of digital portals. When offline explanations, in-person assistance, and family support are insufficient, policies and services—however well-intentioned and formally available—may fail to translate into actual support for the seniors who need them.

It is a foundational question for equity in aging: when economic conditions, place of residence, and the capacity to know and act differ, can basic aging support still reliably reach seniors? Basic safety should not vary dramatically by income or location. Necessary care should not face prolonged delays because of payment constraints or service distance. The ability to understand information and take action should not be eroded by digital thresholds. High-quality aging, and personalized services can all be offered through tiered market choices. But basic support requires government, institutions, market, family to jointly hold the line. In this report, we use the term *equalization in aging* to suggest measures that should be taken to ensure basic aging support for seniors *despite* differences in income, region, service distance, and digital capability.

> Equalization in aging refers to the coordinated efforts of government, markets, society, and families working together to make the benefits and protections for older people fairer, more inclusive, and more accessible. Within the domain of age-tech examined in this report, the central question is whether older adults—despite significant differences in health status, family support, place of residence, payment capacity, and digital capability—can still secure a baseline of support: basic safety, essential care services, and the ability to comprehend information and take action, all of which underpin their dignity and well-being.

1.6 A Four-Dimensional System for Equalization in Aging

In a broad sense, equalization in aging can be understood as a four-dimensional system: improved social protection, reconstructed economic contracts, renewed social culture, and enhanced knowledge-action capacity. As Figure 6 illustrates, these four dimensions address a progressive sequence of needs—the social security institutions that deliver basic support, the market mechanisms that match service supply with demand, an inclusive culture that respects diverse ways of living, working, and contributing social value, and the capacity to prepare for elderly life and translate that preparation into action. Together, the four-dimensional system transforms the goal of equity in aging into a set of support conditions that can be discussed, observed, and put into practice.

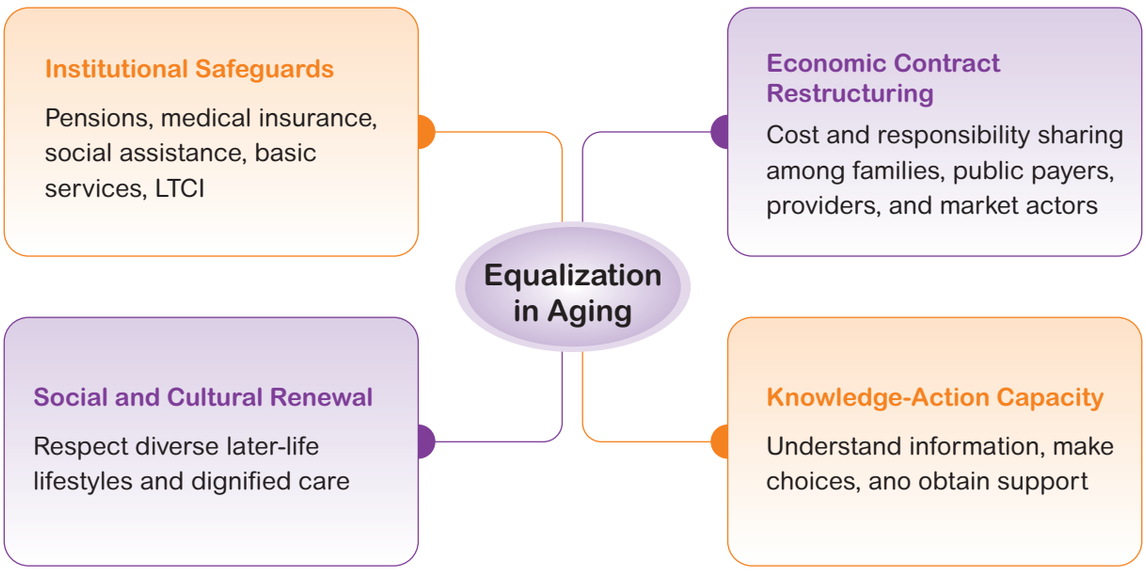


Figure 6 Four-Dimensional System for Equalization in aging

The four dimensions translate equity into observable support conditions.

Improved Social Protection: The Institutional Foundation of Basic Support

Improved social protection addresses a fundamental question: when seniors face declining income, illness, functional impairment, living alone, or insufficient family support, can they enter a stable institutional support network? Pensions, medical insurance, social assistance, basic elderly care services, community-based care, age-friendly home modifications, and long-term care insurance (LTCI) together form the bedrock on which older people weather the risks of later life. Within the national policy framework, basic elderly care provision, home-based care beds, functional-impairment and dementia care, nursing beds, LTCI, unified functional capacity assessment, and home modifications have all been incorporated into systematic planning [3].

A recent State Council policy extends basic public services—including elderly care and social assistance—to permanent residents regardless of household registration and to seniors who have relocated with their families. This directly addresses the inequity faced by the "drifting elderly," who live away from their registered hometowns while their benefits remain tied to them [26].

In the context of functional-impairment care, long-term care insurance plays a particularly significant role. Through functional assessment, benefit payments, designated service providers, administrative management,

and cost settlement, LTCI transforms the long-term care burden previously contained within households into service demand that can be identified, paid for, and organized. Its institutional function is concentrated on identifying and financing essential services in impairment care, thereby offering seniors a relatively stable source of support when they face sustained care risks.

Reconstructed Economic Contracts: Mechanisms for Sharing Costs and Responsibilities

Reconstructing economic contracts means rethinking how the costs of aging and care responsibilities are distributed among households, service providers, payers, and technology firms. Traditional family-based elderly care rests on close co-residence, care by adult children, and intra-family negotiation. Under the combined pressures of population mobility, shrinking household size, and the growing risk of long-term functional impairment, families can no longer shoulder the full care burden alone. What is needed is a workable sharing arrangement that brings together public payment, community services, market institutions, and commercial insurance.

Cultivating the silver economy market hinges on stable payment expectations and clear lines of responsibility. Household out-of-pocket spending can support personalized, quality-oriented choices. LTCI and government-purchased services can generate a baseline of service orders. Savings, investment, insurance, and individual pensions can supplement advance preparation. Once these boundaries are clear, service institutions are better positioned to build professional supply around home-visit nursing, assisted bathing, medical escort and rehabilitation, assistive-device leasing, home modifications, and platform-based services. Technology firms, in turn, find it easier to provide devices, maintenance, and documentation support embedded in real care processes. The function of economic contracts, ultimately, is to prevent care needs from remaining trapped in ad hoc arrangements and to foster sustainable service relationships over time.

Renewed Social Culture: Diverse Elderly Lives and Dignified Care

Urbanization has brought a steady rise in the number of left-behind rural and “empty-nest” seniors in cities. In a low-fertility society with shrinking households, vulnerable groups—single-person households, single-parent families, DINK families, and families who have lost their only child—have become more common. Society must show greater respect for and attentiveness to diverse forms of elderly-life living, and the elderly should not face discrimination because of their family conditions. At the same time, society should champion the idea of retirement as the beginning of a “second stage of life” and safeguard seniors’ opportunities for flexible employment and continued contribution to society.

Post-retirement life is inherently diverse. Healthy, younger seniors may pursue learning, travel, social engagement, and continued work of social value. Those with chronic conditions require sustained health management. And those experiencing functional or cognitive decline care most deeply about privacy, safety, comfort, and dignity in care. Social culture must evolve to embrace this diversity and to ensure that, when seniors’ physical function, cognitive ability, or self-care capacity declines, they remain visible, understood, and respected—able to express themselves with dignity within care relationships.

Enhanced Knowledge-Action Capacity: Understanding Information, Making Choices, and Securing Support

Enhancing knowledge-action capacity is about whether seniors and their families can translate aging-related information into actionable arrangements. Decisions about later-life care routinely involve policy eligibility, cost

burdens, service quality, risk judgments, family negotiation, and future planning. Applying for long-term care insurance, selecting an institution, purchasing home-based care, arranging home modifications, and making sense of commercial insurance or individual pensions all require seniors and their families to read and understand information, compare options, assess risks, and express their genuine needs. The more complex the information, the greater the need for explanation, accompaniment, and hands-on human assistance. When such support is missing, elderly care services may formally exist yet never reach the people who need them.

Under the national strategy of Digital China, access points for elderly care services are increasingly tied to online applications, eligibility verification, payment settlement, service reviews, and risk alerts. While digitalization can enhance the efficiency of service delivery, it may also raise the cognitive and operational barriers for some older adults. Strengthening their capacity to understand and act requires complementing digital portals with age-friendly interfaces, voice interaction, offline consultation, community-based assistance, family coordination, and human customer service. Age-friendly adaptation must extend beyond housing and public spaces to include information gateways, user interfaces, and service processes themselves. Only when older adults can understand, ask questions, choose appropriate services, and access the assistance they need can aging support truly reach them.

1.7 From Equalization in Aging to the Silver Economy Ecosystem

The four-dimensional system for equalization in aging must ultimately be realized through concrete processes of service organization. Institutions supply the source of basic support; economic contracts set expectations for payment and responsibility; social culture shapes the mode of care; and knowledge-action capacity determines whether seniors and families can interpret information and make informed choices. Only when these four dimensions are operationalized across seniors, families, care workers, institutions, technology tools, and payment arrangements do they translate into real support.

Whether basic support can reliably reach seniors depends on whether services can be organized in a sustained manner. An established institution still requires an accessible service entry point. A product deployed in a care setting still depends on human operation, maintenance response, and process documentation. A family's expressed needs still demand transparent cost explanation, quality assessment, and accountability review. A weak link at any point in this chain makes the support seniors receive fragile.

The silver economy ecosystem provides the structural foundation for this kind of continuous organization. It connects public rules, service supply, technology tools, payment arrangements, and household decision-making, thereby enabling aging support to be identified, organized, paid for, understood, and sustained within real care scenarios. It is within this structure that the value of age-tech becomes visible: technology can strengthen connectivity, record-keeping, responsiveness, and accountability, but its contribution to equity in aging ultimately depends on whether it can be embedded in stable, ongoing service relationships.

Ecosystem Foundation

The silver economy encompasses the full spectrum of products, services, and related economic activities provided specifically for seniors and those preparing for later life. Age-tech refers to the technologies, products, and solutions developed and applied to address social needs in health, daily living, social engagement, and safety within the silver economy. As a catalyst for the silver economy's development, age-tech draws on intelligent hardware, the Internet of Things, artificial intelligence, and big data to improve product performance and service quality while reducing costs and risks. Yet for age-tech to fulfill this role, it must be embedded within public institutions, service supply, consumer choice, payment mechanisms, and household decision-making. A fall-detection device requires public rules to define access conditions, an institution or community to arrange a response, families to understand the boundaries of alerts, and payers to recognize service records. A home-visit assisted-bathing service demands that personnel, equipment, cost, quality control, and accountability all be in place simultaneously.

The silver economy should first be understood as both a supporting structure and a social order. It provides demand scenarios—preparation for later life, active enjoyment of aging, and care support—while bringing together public authorities, service institutions, technology enterprises, payers, seniors, and their families. Only by clarifying these demand scenarios and actor relationships can we determine whether age-tech can move from standalone tools to reliable sources of aging support.

2.1 The Broad Scope and Demand Levels of the Silver Economy

From a demand-side perspective, the silver economy can be grouped into three types of scenarios: preparation for later life, active enjoyment of aging, and medical and care services. Table 1 delineates these scenarios by typical content, functional emphasis, and defining characteristics.

Table 1: Three demand scenarios in the silver economy

Demand Scenario	Typical Content	Functional Focus	Scenario Characteristics
Preparation for later life	Individual pensions, commercial insurance, retirement wealth management, age-friendly housing modification, long-term health management, voluntary guardianship, future care arrangements	Risk identification, long-term planning, fund preparation	Occurs before aging risks truly arrive; focuses on converting future aging risks into arrangements that can be understood, planned, and acted upon today
Active enjoyment of aging	Learning, travel, exercise, social interaction, culture and entertainment, wellness travel, quality consumption, health management	Lifestyle choice, social participation, experience enhancement	Faces healthy or relatively healthy seniors; focuses on expanding lifestyle choices, social participation, and consumption experiences in later life
Medical and care services	Medical services, chronic disease management, functional-impairment care, dementia support, assisted bathing, transfer assistance, toileting care, rehabilitation training, night response, age-friendly home modification	Physical and mental health, basic safety, continuing services, professional care	Faces disease and care risks after health capacity declines; focuses on service delivery, quality confirmation, and service trust

These three sets of demand scenarios make clear that the silver economy extends well beyond general older-adult consumption. Preparation for later life centers on arranging risks in advance; active enjoyment of aging, on lifestyle choices; and medical and care services, on direct responses to disease, functional impairment, advanced age, and home-care risks. For equity in aging, medical and care services lie closest to baseline concerns—physical and mental health, basic safety, service continuity, and cost affordability—while preparation for later life and active enjoyment of aging speak to the silver economy's market breadth and the range of lifestyle choices it can offer.

2.2 Five Actors in the Silver Economy Ecosystem

The silver economy ecosystem is composed of five actors: institutional governance and public service actors; scenario operation and service provision actors; product and technology suppliers; funding and payment actors; and older consumers and their families. Whether aging support can be delivered with stability depends on whether each group assumes a clear function within concrete scenarios. With "stable aging support" at its center, Figure 7 presents these five actors and their basic functions, making the ecosystem's supporting structure visible at a glance.

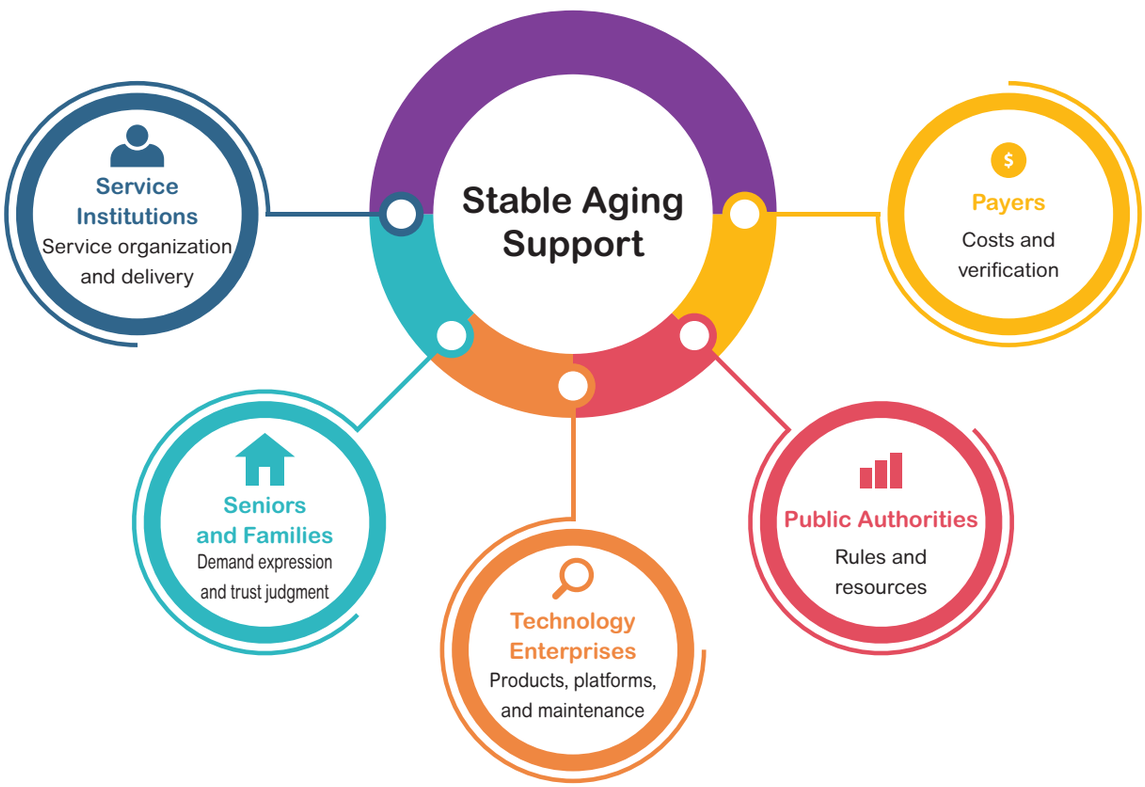


Figure 7 Five Ecosystem Actors and Their Relationships

Stable support depends on connections among rules, services, tools, payments, and household decisions.

(1) Institutional Governance and Public Service Actors

Institutional governance and public service actors define the public boundaries of the silver economy. The

silver economy spans basic elderly care services, geriatric health, long-term care, service facilities, care workforce development, product quality, consumer protection, digital application, and industrial development—areas whose rules are dispersed across the functions of different public authorities.

At the central level, the National Working Commission on Aging provides overall coordination, while relevant departments advance their work according to their respective mandates. The National Development and Reform Commission oversees silver economy planning, elderly care facility construction, and major projects. The Ministry of Civil Affairs is responsible for basic elderly care services—home-based, community-based, and institutional—along with the safety-net for seniors in hardship and service quality supervision. The National Health Commission covers geriatric health, primary care, chronic disease management, and integrated medical and elderly care. The National Healthcare Security Administration manages basic medical security and the long-term care insurance system. The Ministry of Human Resources and Social Security oversees basic pension insurance and care workforce training. The Ministry of Finance supports public resource allocation through budgets, subsidies, and government procurement of services. The Ministry of Industry and Information Technology, the Ministry of Science and Technology, the State Administration for Market Regulation, and standardization bodies are involved, respectively, in smart devices, elderly products, digital applications, and quality standards. The National Financial Regulatory Administration, housing and urban-rural development authorities, transport authorities, agriculture and rural affairs authorities, and the China Disabled Persons' Federation also contribute to specialized areas—tax-preferred pension finance regulation, accessible environments, age-friendly mobility, rural elderly services, and assistive device support, among others.

- Rule boundaries

Public actors establish the operating rules for basic elderly care services, long-term care, geriatric health, service quality, safety management, product standards, and data use. Whether elderly care services can be delivered in a standardized manner, whether smart products can enter service settings, and whether institutions can develop stable expectations for adoption all hinge on these rule boundaries.

- Resource redistribution

Through fiscal subsidies, government procurement of services, long-term care insurance, basic medical security, assistance for vulnerable groups, and assistive device support for persons with disabilities, public actors redistribute social resources. The purpose is to channel limited public resources toward those who need them most—seniors who are very old, functionally impaired, on low incomes, left behind in rural areas, or otherwise with limited support capacity—thereby mitigating the inequalities produced by disparities in household wealth, place of residence, and access to services.

- Industrial guidance

Public actors also steer enterprises and service institutions into real-world aging scenarios through demonstration projects, facility construction, equipment renewal, service quality evaluation, talent development, standards setting, and the cultivation of key industries. The 15th Five-Year Plan Outline calls for fostering and expanding the silver economy across the full chain, concentrating on four priority areas—R&D of age-friendly products, smart elderly care software and hardware, wellness and residential tourism, and rehabilitation assistive devices for the elderly—and encouraging deeper participation by social capital in the aging industry. The role of institutional governance and public service actors here is to align industrial priorities with public service needs: priority areas sharpen R&D and supply focus; demonstration projects and equipment renewal offer application-validation settings; certification standards lower the cost of assessing quality in procurement and use; and

public programs connect demonstration applications to sustained service demand. Together, these arrangements provide a clearer policy environment for the silver economy and steer technology supply toward the service scenarios that seniors genuinely need.

(2) Scenario Operation and Service Provision Actors

Scenario operation and service provision actors connect institutional conditions with seniors' needs. Elderly care institutions, nursing homes, integrated medical and elderly care facilities, rehabilitation institutions, community elderly care service centers, elderly care stations, home-visit service enterprises, meal-assistance and bathing-assistance providers, older adult education institutions, wellness and cultural tourism institutions, health management institutions, and age-friendly home modification providers each convert distinct types of demand into concrete services [27].

Their core function is to turn abstract needs into executable processes. When an elderly adult needs assisted bathing, this entails physical assessment, scheduling, personnel dispatch, equipment preparation, safety protection, and cost settlement. Institutional care involves admission assessment, care-level classification, meal arrangements, rehabilitation support, family communication, and risk management. Home modification calls for on-site assessment, design, construction and installation, and follow-up maintenance. The organizational capacity of service providers directly determines whether a need can move from household anxiety to stable service delivery.

The operating logic differs markedly across scenarios. High-end retirement communities emphasize experience management, zone-based services, and long-term customer relationships. Publicly built but privately operated inclusive institutions prioritize cost control, baseline public support, and operational safety. Home-care enterprises depend on service station networks, care worker dispatch, in-home quality control, and assured payment sources. Community elderly care centers and stations handle daily outreach, policy explanation, and basic response functions. Together, actors across these varied settings underpin the service supply of the silver economy.

(3) Product and Technology Suppliers

Product and technology suppliers provide the tools that support service operations. Rehabilitation assistive device enterprises, care equipment enterprises, health monitoring device enterprises, age-friendly home furnishing enterprises, smart terminal enterprises, software platform enterprises, AI interaction product providers, and providers of older adult education and digital content all fall into this category [27].

The value of these actors depends on how well their products fit aging scenarios. Once deployed, nursing beds, wheelchairs, walkers, smart mattresses, millimeter-wave radar, bathing-assistance equipment, toileting-care equipment, service management platforms, and AI interaction tools typically require installation, training, maintenance, consumable supply, after-sales response, and service coordination. A functioning product is merely the starting point for entering an aging scenario; what determines whether it becomes a source of sustained support is whether it can be understood by seniors, operated by care workers, maintained by institutions, and accepted by families.

Products and technologies also reshape the visibility of service processes. Equipment operation, platform dispatching, in-home services, family feedback, and cost settlement generate service records, alarm records, evaluation data, and fulfillment information. These records can serve as the basis for quality verification, cost validation, and accountability. In this way, data emerges as a by-product of the service process, running through public governance, service supply, product operation, payment settlement, and family authorization.

(4) Funding and Payment Actors

Funding and payment actors determine whether aging needs can be continuously converted into services.

Sources of funds in the silver economy include public finance, basic medical insurance, long-term care insurance, and government procurement of services, as well as household savings, wealth management products, funds, insurance, individual pensions, and philanthropy. These sources serve distinct functions: some share basic risks, some build advance reserves, some supplement higher-quality services, and some provide buffers for seniors facing special hardship.

- Converting aging risks into sustainable payment.

Functional-impairment care, home-visit nursing, medical escort and rehabilitation, assistive device leasing, and home modifications are not one-time expenses. Relying solely on ad hoc household payments often confines services to low-frequency purchases or short-term trials. When services are covered by long-term care insurance, government procurement, or commercial insurance, service institutions gain stable order support and are thus better positioned to organize care workers, build service stations, conduct training, and implement quality management. Greater payment stability enables elderly care services to shift from sporadic purchases to sustained orders.

- Creating channels for reserve accumulation and value growth.

Financial arrangements such as individual pensions, commercial insurance, and retirement wealth management products serve as personal preparation tools for future aging risks—inflation, medical expenditures, and nursing costs. They convert income and savings from working years into funds available in later life, affecting whether households can complete preparation for aging, age-friendly home modifications, and long-term care choices.

- Supporting intergenerational resource flows.

Aging-related payments often occur within intergenerational relationships: seniors bear care risks, while children or spouses share the costs. The working-age population supports social insurance operations through contributions and taxes, and also supports their parents' later-life needs through intra-family transfers. Funding flows in the silver economy are not limited to seniors' individual consumption; they also encompass household negotiation, intergenerational sharing, and social risk pooling.

(5) Older Consumers and Their Families

Older consumers and their families are central actors in expressing demand, choosing services, bearing costs, and forming trust judgments. Seniors and families are not a passive endpoint of an industrial chain; they actively participate in decisions throughout the formation of elderly care services. Whether a service is needed, whether costs are affordable, whether outside personnel can enter the home, whether equipment is accepted, and whether service outcomes are trusted—all of these questions ultimately require judgments made by seniors and their families.

Older consumers display significant internal diversity. Healthy younger-old adults may prioritize learning, travel, exercise, social engagement, and quality consumption. Those with chronic conditions may emphasize health management, medication reminders, and follow-up appointments. Those living alone may value regular visits, safety response, and emergency contact. Functionally impaired seniors may place the highest value on physical care, privacy protection, and the preservation of dignity. Those approaching old age may focus on retirement preparation, financial planning, and future care arrangements. Family members often play roles in cost-sharing, care negotiation, service supervision, medical decision-making, and risk management.

Families are a source of support, but they also face capacity constraints. Geographic distance of children, household income, caregiving experience, digital capability, and risk awareness all shape service choices. For elderly care services to truly take place, seniors need to express their needs, and families need to understand costs,

quality, and the boundaries of responsibility. Older consumers and their families thus form the most direct source of demand—and the endpoint where trust is ultimately judged—within the silver economy ecosystem.

2.3 Key Relationships Among the Five Actor Categories

The relationships among the five actor categories can best be understood by examining whether a care service is actually delivered. Seniors and families express needs; service institutions translate those needs into assessment, dispatch, home visits, nursing, and review; technology enterprises supply equipment, platforms, records, and maintenance; payers determine affordability and verifiability; and public authorities set rules on access, quality, data, and accountability. The absence of any single actor leaves aging support in a state of instability.

The conversion of demand into services depends, first, on the connection between service institutions and families. An older adult's "difficulty bathing" becomes home-visit assisted bathing, bathroom anti-slip modifications, bathing-equipment leasing, or caregiver assistance only once it enters the service system. A child's worry that a parent may fall at night translates into bed-exit reminders, night visits, emergency calls, or age-friendly lighting only when channeled through that same system. The core function of service institutions is precisely to transform the care difficulties of daily life into service tasks that can be arranged, delivered, and reviewed.

Whether services can be sustained further depends on the connection between payers and service institutions. When services rely too long on ad hoc out-of-pocket payments, they tend to remain low-frequency purchases or short-term trials. Once long-term care insurance, government procurement, commercial insurance, and household spending form a more stable mix, service institutions are better positioned to deploy care workers, build service stations, run training programs, and manage quality. The clearer the payment arrangements, the more readily services shift from sporadic purchases to stable orders.

The connection between technology enterprises and service institutions determines whether products become genuinely embedded in care processes. Assisted-bathing equipment must be integrated with home-visit services; smart mattresses require personnel to respond to alerts; rehabilitation assistive devices demand assessment, leasing, and maintenance; home modifications call for on-site surveys, construction, and follow-up inspections. The value of technology lies not merely in product functionality, but in its operability by staff, its absorption into workflows, its comprehensibility to families, and its capacity to generate necessary records throughout service delivery.

The connection between public authorities and other actors supplies the operating rules for the entire ecosystem. For institutions procuring intelligent equipment, product categories, quality standards, and liability for faults must be clearly specified; for communities introducing meal assistance, bathing assistance, or visitation services, entry conditions, service frequency, safety requirements, and complaint channels must be explicit; for payers relying on service records, data scope, privacy protections, and cost-verification criteria must be clear. The clearer the rules, the stronger the basis for institutional procurement, the more standardized service delivery becomes, and the easier it is for families to build trust.

Together, these relationships converge on a single outcome: fragmented aging needs must be converted into support that is deliverable, payable, and verifiable.

2.4 Ecosystem Embedding of Age-Tech

Age-tech's entry into the silver economy ecosystem manifests, above all, as the conversion of everyday difficulties into service arrangements that are executable and supervisable. Take "bathing difficulty" as an example. To address it, a service institution must carry out a safety assessment, schedule an appointment, match personnel, and dispatch a home-visit assisted bathing service; a technology enterprise supplies portable bathing equipment, consumables, and maintenance support; and the family needs to know whether the service is safe, satisfactorily completed, and worth continued purchase. Portable bathing devices can be introduced into home-visit services through third-party institutions, and home-care enterprises have formed digital service loops through automated dispatch, scheduling, supervision, and evaluation. Scenarios like these illustrate that technology, once it enters elderly care, must pass through personnel, processes, and service records before it can be perceived by seniors and their families.

Cost confirmation and automatic settlement represent another, more routine form of embedding. After services such as meal assistance, assisted bathing, home visits, and rehabilitation accompaniment are completed, the system logs the dispatch, arrival, service content, incident handling, and family feedback. Payers verify costs against these records, institutions use them for quality management, and families rely on them to confirm service outcomes. This addresses three fundamental questions: Did the service take place? What was done? And why was the cost incurred? For LTCI administrators, government purchasers, and commercial insurers, such records help convert a multitude of dispersed home-visit services into verifiable processes.

Risk-warning technologies follow the same logic. Fall alerts, smart mattresses, emergency calls, and AI companionship can detect anomalies earlier, but once an alert is triggered, someone must still assess the situation, arrive on site, notify family members, and document the response. Institutions and communities deploy these technologies to strengthen their capacity for timely response, process transparency, cost accountability, and risk review.

What these three scenarios share is that technology does not stop at the device. Smart assisted bathing links physical care needs to home-visit services; automated settlement links service processes to cost verification; fall warning links risk detection to human response. The significance of age-tech in the ecosystem is first revealed in these concrete connections: channeling aging needs into service arrangements, capturing service processes in records, and enabling families, institutions, and payers to confirm outcomes.

Practical Pathways

The entry of age-tech into elderly care services does not automatically turn a standalone product into support that seniors and their families can perceive. An alarm signal requires human assessment and response; assisted-bathing equipment introduced into a home demands assessment, scheduling, trained operation, safety protection, and follow-up maintenance; and an order generated on a home-service platform calls for a care worker to arrive, the service process to be documented, costs to be verified, and family members to confirm the outcome. A functioning product merely demonstrates that the technology is ready to enter an aging scenario; genuine aging support hinges on whether it becomes embedded in the service process.

This imperative stems from the nature of elderly care itself. Confronting complex circumstances—advanced age, functional impairment, chronic illness, living alone, cognitive decline—service outcomes typically require products, personnel, and processes to work in concert. Without human operation, maintenance response, process documentation, payment verification, and clear accountability, devices risk remaining one-time purchases, platforms risk staying as internal management tools, and data risk falling short of being recognized as service evidence by families and payers.

3.1 From Usable Products to Accessible Services

Product-service integration is the necessary pathway for age-tech to contribute to aging support. In aging scenarios, risk detection, physical care, emotional reassurance, cost confirmation, and accountability review can rarely be performed by a single device acting alone. What seniors and families ultimately receive is a service—one that can be arranged, delivered, and verified.

The limitations of standalone products are most apparent at the point of use. Physical care devices, which frequently come into direct contact with seniors' bodies, are deployed in bathrooms, at the bedside, in bedrooms, and during home-visit services. Users may be care workers, family members, or service personnel; seniors themselves may live with functional impairment, dementia, skin sensitivity, limited mobility, or communication difficulties. Even after the equipment is delivered, it still requires operational guidance, personnel training, consumable supply, maintenance response, and incident handling. Absent such support, a fully functional product may sit unused, untrusted, poorly maintained, or rejected by the family.

Standalone services face boundaries of their own. Home nursing, assisted bathing, medical escort, and rehabilitation training are typically dispersed across different households, where service recipients are scattered, the arrival process is hard to observe, service quality is difficult to assess, and cost verification poses a persistent challenge. When coordination depends entirely on manual effort, services tend to remain low-frequency, fragmented, and resistant to review. Digital platforms, device-generated records, automated dispatch, and service documentation can help providers connect demand, personnel, process, and costs, enabling a shift from ad hoc arrangements to organized delivery.

In practice, product-service integration has already coalesced around three typical pathways: product manufacturers extending from equipment sales into usage support and maintenance coordination; elderly care institutions linking device signals, platform records, and care workflows; and home-care service enterprises using digital systems to organize dispersed demand, care workers, service processes, and cost settlement. Figure 8 condenses these pathways into manufacturer servitization, technology adoption by care institutions, and platformization of home-care service enterprises. Though their starting points differ, all three converge on the same imperative: product functionality must be embedded in service organization to move from "usable products" to "accessible services".

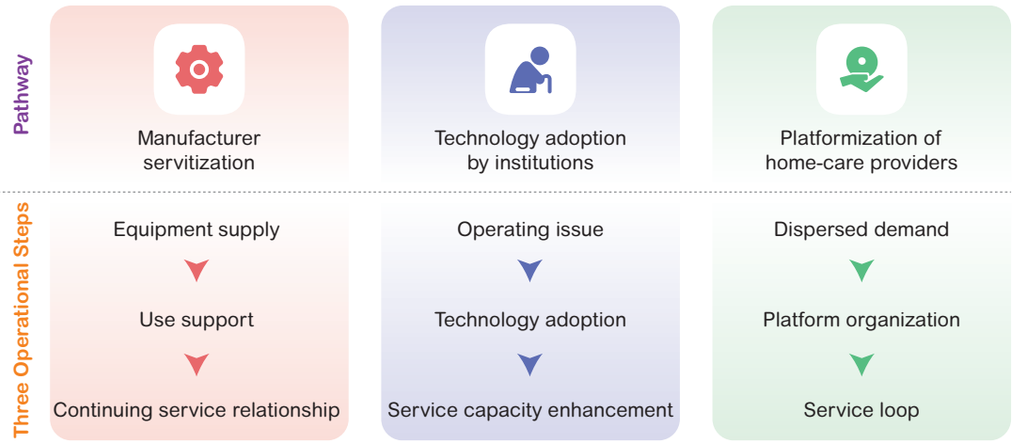


Figure 8 Three Product-Service Integration Pathways

Product functions create support after they are absorbed into service organization.

3.2 Servitization of Product Manufacturers

When product manufacturers enter aging scenarios, the limits of the equipment-sales model quickly become apparent. Physical care devices tend to be relatively expensive and carry steep usage thresholds. The actual user is rarely a single purchase decision-maker: seniors are the direct beneficiaries, families bear costs and form trust judgments, care workers perform day-to-day operations, and institutions or home-service enterprises are responsible for service delivery. A device's ability to perform its technical functions merely demonstrates that it is ready to enter an aging scenario; whether it is used continuously hinges on how cost barriers are lowered, how personnel are trained in its operation, how consumables and maintenance keep pace, and how service institutions embed the device into specific care tasks.

Manufacturers turn to servitization first out of business-model necessity. Devices for functional-impairment care cannot rely solely on one-time household purchases. When prices are high, families hesitate. When institutions procure equipment, budget constraints, liability concerns, and follow-up maintenance all shape decisions. When government or project-based procurement ends, equipment without operational support tends to remain a short-term display. Servitization changes this dynamic: through leasing, installment payments, consumable supply, maintenance services, third-party operation, and institutional partnerships, equipment enters sustained-use scenarios, and the object of purchase shifts from "a device" to "a period of sustainable care support." Manufacturers thus extend beyond single sales into training, maintenance, consumables, technical support, and channel coordination, forming more stable revenue structures and customer relationships.

Servitization of physical care devices is also driven by the demands of continuous use in real care settings. Toileting care, assisted bathing, transfers, feeding, and wearable assistive devices enter the most intimate zones of bodily care, where safety risks, privacy sensitivities, seniors' acceptance, and care workers' operational competence are all at play. Once a device enters a home or institution, the manufacturer must translate its technical functions into service arrangements that care workers can operate, families can understand, and institutions can embed into daily care routines. Without these conditions, a delivered device may sit unused, be handled with hesitation, go without maintenance, or fail to produce service outcomes that can be clearly explained to families.

Case 1 The Servitization Pathway of Care Equipment

Shenzhen Zuowei Technology Co.,Ltd. develops intelligent care equipment for functional-impairment care scenarios, with a product portfolio covering toileting, bathing, feeding, transfers, and dressing. Its portable bathing machine is currently the product line with the clearest commercial pathway. Beyond household purchases, the device can be bought by third-party institutions such as housekeeping service companies and deployed for home-visit assisted bathing. Under this model, what families receive is not a standalone device but a service—one that combines personnel arrival, bathing operation, safety protection, equipment maintenance, and cost arrangements.

The intelligent toileting-care robot illustrates an alternative servitization pathway for high-cost equipment. Interviews indicate that the home version costs approximately RMB 30,000, while the institutional network version costs around RMB 60,000. For households facing financial strain, third-party agents offer leasing at a typical monthly rate of RMB 1,500 to 2,000, with consumables adding roughly RMB 200 to 300 per month. The device performs the technical tasks—excretion detection, suction, flushing, and drying—but families and care workers must still handle water replenishment, wastewater disposal, consumable replacement, and daily observation. Price, leasing, consumables, and after-sales service together determine whether the product can gain long-term entry into households or institutions.

This case demonstrates that the significance of manufacturer servitization lies in lowering the barriers for equipment to enter aging scenarios. The portable bathing machine is converted into a household-purchasable assisted-bathing arrangement through third-party home-visit services. The intelligent toileting-care device eases one-time purchase pressure through leasing, consumables, and maintenance. Product value, in turn, expands from "whether the device works" to "whether families and institutions can sustain its use."

Product lines remain at different stages of maturity. The portable bathing machine has already established a relatively clear home-visit service pathway. The intelligent toileting-care device requires leasing and maintenance mechanisms to sustain adoption. Assisted feeding robots and intelligent wearable assistive devices remain in the cultivation or R&D phase. These differences underscore that manufacturer servitization is not simply a matter of adding after-sales services; the key is finding a stable fit among product, payment capacity, user capability, and service scenario.

3.3 Technology Adoption by Elderly Care Institutions

Elderly care institutions already provide care services, yet manual patrols leave blind spots that are difficult to eliminate. Nighttime bed exits, fall risks, abnormal vital signs, wandering by residents with dementia, emergency calls, and mood fluctuations often occur in the intervals between care workers' rounds. Manual patrols can identify problems, but with a time lag. Seniors' active calls for help can trigger a response, but are constrained by their mobility, state of consciousness, and ability to communicate. Institutions adopt technology first and foremost to fill these blind spots—so that anomalies can be detected sooner, and duty personnel can know more quickly where to go, what to check, and how to respond.

Once technology enters an institution, its value depends on whether signals translate into service actions. Pull-cord alarms, millimeter-wave radar, smart mattresses, voice terminals, and location-alert cards generate data on alerts, location, bed exits, sleep, and vital signs. Only when this information enters the workflows of central control, nursing, medical, security, housekeeping, or social work teams does it result in on-site response, risk review, care adjustments, and family communication. Installing devices in rooms completes the configuration;

technology becomes part of institutional service capacity only when signals enter workflows and trigger action.

Institutional technology adoption is also linked to operational efficiency. The efficiency gains come mainly through more precise identification of anomaly locations, fewer untargeted patrols by care workers, more complete response records, and stronger evidence for family communication. Intelligent monitoring can direct limited human resources toward high-risk, high-dependency, and communication-intensive tasks. Service records help institutions explain their response process and reduce information asymmetry with families. The role of technology in institutions is to supplement human experience-based judgment with a service chain of "signal detection—personnel response—process documentation—outcome explanation."

Technology adoption also reshapes how institutions manage risk. Once monitoring devices enter rooms, families may interpret them as a heightened safety commitment, forming greater expectations around alarm accuracy, response timeliness, equipment maintenance, and incident accountability. When institutions deploy technology, they are both strengthening their ability to detect risks and establishing service rules through which risks can be explained, processes reviewed, and responsibilities shared.

Case 2 Technology Adoption by Elderly Care Institutions

Taikang Community — Yan Garden is Taikang Insurance Group's first large-scale, full-function, international-standard, high-quality flagship medical and elderly care community, located in Beijing's Changping District. It provides residents with one-stop medical, wellness, care, and rehabilitation services across the full life cycle. Its use of age-tech reflects the technology-adoption approach of a high-quality elderly care community. Yan Garden residences are equipped with pull-cord alarms, millimeter-wave radar, Xiaotai smart speakers, and mobile alert cards. No cameras are installed in rooms; non-intrusive monitoring is primarily achieved through radar and infrared. Field research found that in 2024, the average time from a pull-cord alarm to the arrival of the first responder was under five minutes. Yan Garden operates a zone-based, tiered service system comprising independent living, assisted living, professional nursing, and memory care. Smart mattresses are used primarily in nursing areas for vital-sign and bed-exit monitoring, and are also being piloted in independent living areas to detect potential risks through nighttime rising, prolonged absence from bed, and sleep abnormalities. On one occasion, smart mattress data helped the service team identify continuous nighttime sleep disruption in a resident, prompting intervention by housekeeping and social work staff to address anxiety stemming from family conflict. Here, technology entered the institution's zone-based service, personnel response, social work intervention, and client communication processes.

Kangning Jinyuan is a large-scale elderly care community with a state-owned enterprise background. Operating for nearly a decade, it houses an on-site hospital, an elderly care institution, a training school, and a central kitchen, and has contributed to the development of local, industry, and national elderly care service standards. This operational and standards background means its assessment of smart devices places a premium on real-world utility. Kangning Jinyuan's management observes that some smart devices see limited institutional use, that false-positive and false-negative rates still require control, and that a gap persists between R&D and frontline application. This assessment serves as a reminder that institutional technology adoption must pass the test of frontline use and process fit. Equipment becomes part of institutional service capacity only when it is used consistently by care workers, absorbed into service workflows, and accounted for by incident response mechanisms.

Changping District Nursing Home is Beijing's first publicly built, privately operated demonstration project adopting a

dual-institution model combining an elderly care home and a nursing facility. Characterized by inclusive integrated medical and elderly care, it provides professional services while fulfilling a regional safety-net function. Residents are predominantly seniors with full or partial functional impairment. The institution has established relatively stable use of millimeter-wave radar for monitoring heart rate, respiration, and bed-exit status. Its director is notably positive about alerting and assistive technologies, which can reduce nighttime risks, ease pressure on care workers, and provide evidence for family communication. Fall-monitoring functions have not yet been activated, as the pressures of false alarms, missed detections, and follow-up explanations remain high. In inclusive institutions, technology typically enters first through more controllable functions—nighttime monitoring, bed-exit alerts—before being progressively embedded in more complex care processes.

The three cases collectively illustrate that institutions adopt technology in response to demands arising from their own service processes. Taikang Community — Yan Garden deploys technology to strengthen zone-based service delivery, risk identification, and client communication. Kangning Jinyuan underscores that technology must pass the test of frontline use and process fit. Changping District Nursing Home begins with controlled functions such as nighttime monitoring and bed-exit alerts. What institutions need to strengthen is the capacity to convert device signals into service actions: earlier anomaly detection, faster response mobilization, fuller process documentation, and clearer explanation of outcomes.

3.4 Platformization of Home-Care Services

Home-care service enterprises are driven toward platformization by the simple fact that services take place in widely dispersed households, where the enterprise cannot directly observe the site in the way an institution can. Platforms connect demand identification, personnel scheduling, process documentation, and cost confirmation into a closed loop. Only then can home care shift from a series of home-visit arrangements into stable aging support.

The platform's role is first evident in task translation and personnel scheduling. When a family reports that "the older adult needs help," the enterprise must determine whether the need corresponds to assisted bathing, toileting care, medical escort and rehabilitation, assistive-device maintenance, or nighttime care. Once the task is specified, dispatch must match care workers' competencies, service location, station radius, and time slots. Fushoukang notes in interviews that its service process now operates as a fully digital closed loop spanning automatic order transfer, city-level order acceptance, automatic dispatch, care worker home visits, service supervision, and client evaluation. The firm distinguishes the value of digitalization along two dimensions: quantity and quality. Automatic dispatch and scheduling improve organizational efficiency; the in-home supervision system focuses on verifying that services actually occurred and safeguarding service quality. This shows that the platform not only speeds up dispatch, but also performs service confirmation and quality review.

Platformization also strengthens home-care providers' capacity to interface with multiple payment sources. Home care may simultaneously involve long-term care insurance, government-purchased services, commercial insurance, and household out-of-pocket payments. Payers care about whether services truly occurred, whether items complied with rules, and whether costs can be settled. Families care about whether the care worker arrived, whether the older adult received help, and whether any incidents were handled. Platform records—covering dispatch, arrival, service content, incident handling, and family feedback—can convert a multitude of dispersed home visits into confirmable service processes. Without such systems, the larger the scale of service, the harder it becomes for enterprises to synchronize personnel management, quality control, and settlement.

Case 3 Organizing Dispersed Home Services into a Closed Loop

Tianjin Xiaocheng Group Co., Ltd. (Xiaocheng Group) illustrates a pathway from device supply to service integration. The company began by supplying devices such as nursing beds before evolving into the comprehensive organization of nursing services, rehabilitation assistive-device leasing, commercial insurance oversight, age-friendly home modifications, and smart aging products. Nursing services now account for 55% of its business, rehabilitation assistive-device leasing for 15%, commercial insurance oversight services for 20%, and age-friendly home modifications and smart aging products for 10%. This trajectory suggests that home-care enterprises cannot long sustain themselves on single-device sales or scattered home-visit services. Devices, assistive devices, care workers, service stations, and payment rules must be organized within a single service process.

As scale grows, the platform becomes the infrastructure for service organization. Xiaocheng Group employs 907 managers and 29,700 full-time care workers, operating 217 offline service stations across 37 cities nationwide. At this scale, the enterprise must use systems to connect demand, personnel, location, and time. Once seniors and families raise a need, the platform uses client tagging, intelligent dispatch, route management, location-based check-in and check-out, and care plan review to ensure that care workers follow dispatch plans and that services are delivered in accordance with care plans. The platform's function is to convert care needs within households into service tasks that are dispatchable, trackable, and confirmable.

Xiaocheng's experience also demonstrates that in home-care services, products and services are already mutually embedded. Once nursing beds, rehabilitation assistive devices, and age-friendly products enter homes, they require assessment, leasing, maintenance, and service follow-up. Once care workers arrive at a home, service records, plan review, and cost confirmation are needed. The platform links these elements, enabling the enterprise to manage nursing services, assistive-device leasing, commercial insurance oversight, and age-friendly home modifications simultaneously. Platformization in home-care services thus transforms the platform from an internal management tool into a mode of service delivery in its own right.

3.5 From Service Access to Sustained Operation

The three pathways examined above converge on a single insight: product functionality must be embedded in service organization before it can truly move from "usable products" to "accessible services." Manufacturers build sustained-use relationships through leasing, maintenance, and usage support. Elderly care institutions channel technology-generated signals into defined roles and response workflows. Home-care enterprises integrate dispersed demand, personnel, and cost verification through digital platforms. Though their starting points differ, all three lead to the same conclusion—age-tech creates aging support not through the isolated features of any single product, but through the ongoing coordination of products and services.

Yet service access does not automatically mean sustained operation. Long-term care is recurrent by nature. Personnel, equipment, maintenance, documentation, and review all generate recurring costs. Without stable payment arrangements, equipment upkeep and service organization become difficult to sustain over time. Without verifiable service process records, payers in turn find it difficult to confirm costs. In practice, product-service integration inevitably extends into the question of payment.

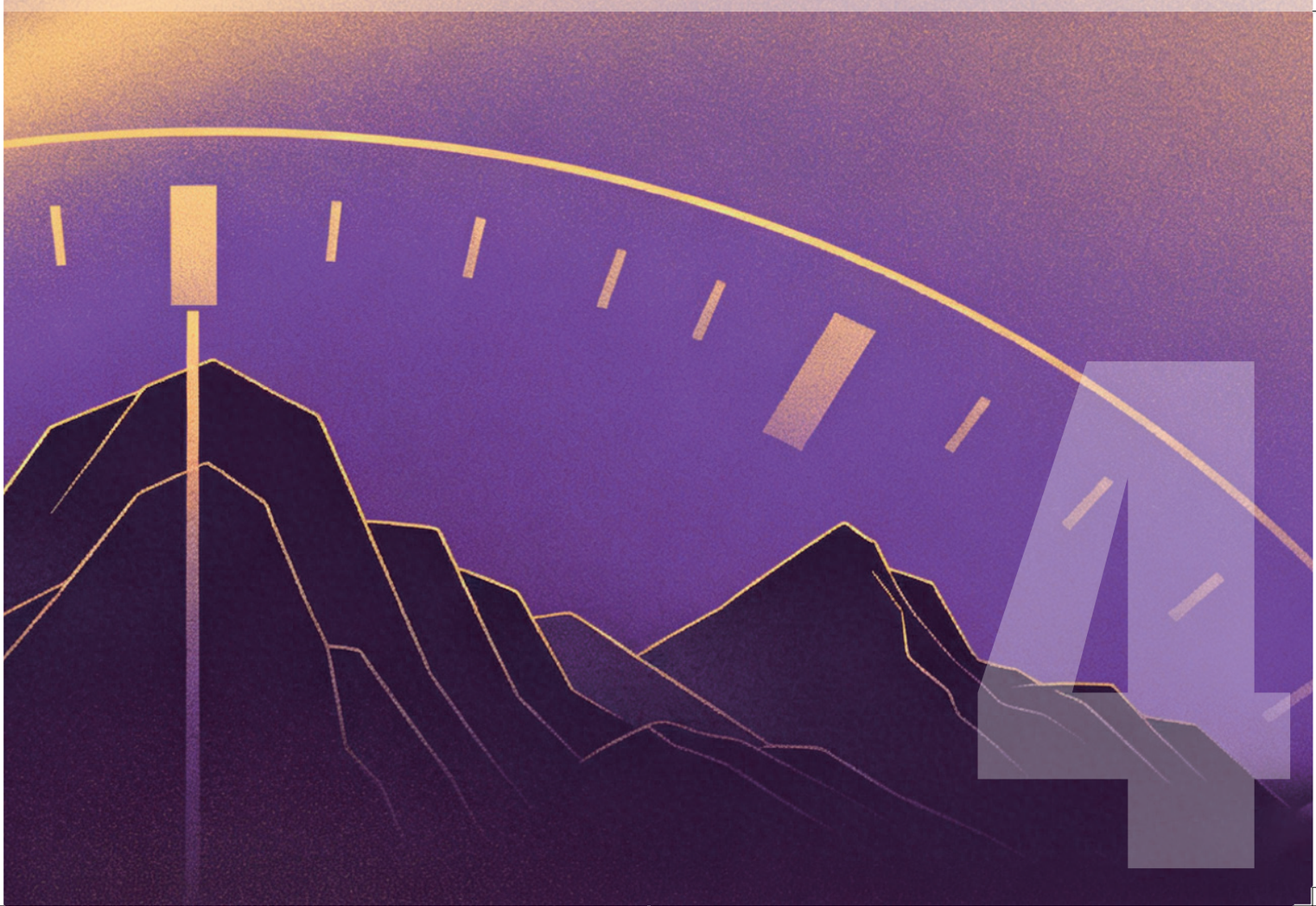
The role of payment mechanisms is to convert dispersed, episodic care needs into service orders that can be

assessed, paid for, and organized. When long-term care insurance, government-purchased services, commercial insurance, and household out-of-pocket spending form a stable combination, service institutions gain the conditions to deploy care workers, build service stations, develop training systems, and implement quality management. Conversely, where services rely primarily on ad hoc household payments, they tend to remain low-frequency purchases or short-term trials, failing to coalesce into sustained aging support.

It follows that whether age-tech can be continuously embedded in elderly care services depends, crucially, on whether payment systems can translate care needs into stable, verifiable service demand. Only when payment, services, and technology form a closed loop can fragmented sources of aging support move toward sustainable operation.

Payment as a Driver:

How LTCI Shapes the Industrialization of Age-Tech



The significance of long-term care insurance lies, above all, in how it organizes functional-impairment care services. The caregiving burden long shouldered within families, once channeled through LTCI, must pass through functional assessment, service-item confirmation, delivery by designated institutions, administrative management, and cost settlement before it crystallizes into a sustained service arrangement. For age-tech, LTCI shifts the focus from selling standalone devices to embedding tools in the service process—specifically, whether those tools can enter real care delivery alongside service items, care workers, institutional records, and cost settlement.

Figure 9 maps the payment-driven pathway through which household care pressure is converted into sustained service orders, and through which age-tech, in turn, gains entry to care services. Once service orders become stable, institutions are positioned to deploy personnel, formalize processes, and integrate tools; digital platforms, service records, assistive-device leasing, and care equipment likewise find the stable usage settings they need to function.

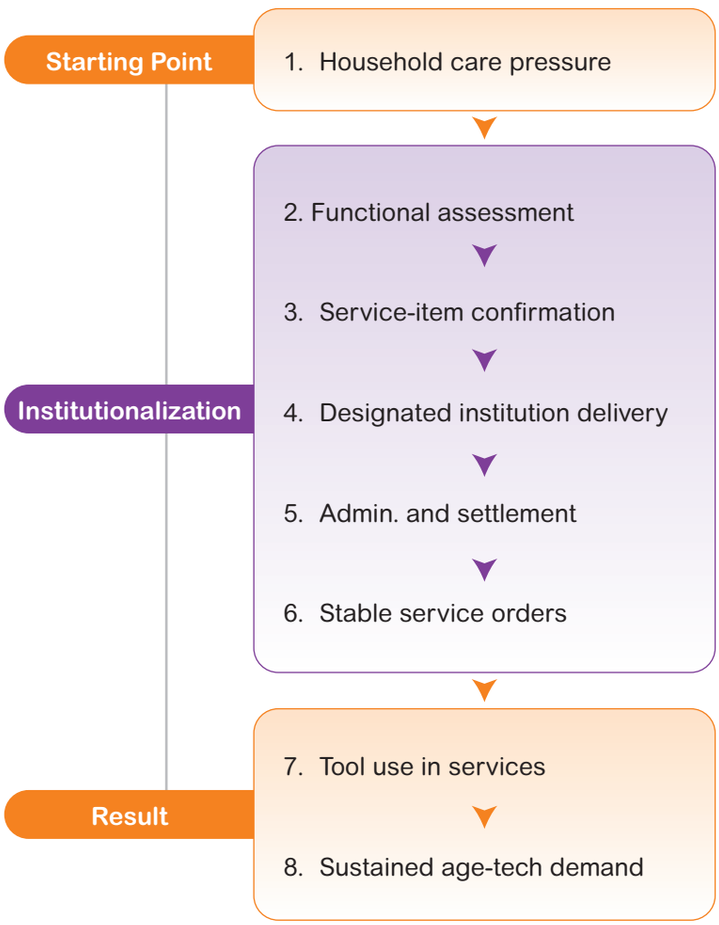


Figure 9 LTCI Payment-Driven Pathway for Age-Tech Industrialization

Stable service orders create recurring scenarios for platforms, records, assistive devices, and care equipment.

4.1 From Implicit Household Demand to Institutionally Effective Demand

The need for functional-impairment care is usually first felt within the household. An older adult may already require help with bathing, turning, toileting, or nighttime supervision, and the family may recognize that care by relatives is unsustainable over the long term. Yet households continue to manage as best they can, relying on spouses, adult children, domestic helpers, or ad hoc services. At this stage, the care need is real, but stable orders for professional services have yet to materialize.

For care to enter the professional service system, several conditions must be met: costs must be affordable, services must be readily accessible, quality must be discernible, and institutions or care workers must be capable of sustained delivery. When any one of these conditions is weak, care needs tend to remain stuck in relative-provided care, low-frequency purchases, low-cost non-professional services, or indefinite postponement—hardly a foundation for building a care workforce, service stations, training systems, or quality management.

LTCI changes the conditions under which effective demand forms. Cost-sharing eases the pressure on families to purchase services continuously. Clear service entry points lower the cost of finding professional personnel. Defined service rules improve families' ability to assess quality and price. And stable reimbursement strengthens service institutions' incentives to invest. For the industrialization of age-tech, the significance of this shift lies in the continuous usage scenarios it provides: care equipment, service systems, and documentation tools will be consistently deployed, maintained, and improved by service actors only when they are used across recurring care tasks.

4.2 How LTCI Creates a Care Services Market

Once the conditions for effective demand are in place, that demand must still be converted into concrete service orders. For LTCI to create a functioning care services market, four questions must be answered in sequence: Who is eligible? Which care services are covered? Who delivers them? And how are services confirmed and settled after delivery?

- Functional impairment assessment answers the question: Who is eligible, and who needs services?

Care difficulties within households typically present themselves as concrete challenges—whether an older adult can bathe independently, turn over, requires toileting care, or needs supervision at night. Payers require a more stable basis for eligibility determinations, and service institutions need a commensurate way to calibrate care intensity. The assessment process converts physical function, capacity for self-care in daily living, and care intensity into a relatively uniform set of graded results. Families, service institutions, administrators, and payers can then interpret demand against the same benchmark.

- LTCI service items answer the question: Which care services are covered?

Service items translate household caregiving activities into services that institutions can execute, payers can settle, and families can understand. The National Long-Term Care Insurance Service Item Catalog, issued by the National Healthcare Security Administration, contains 36 items—20 for daily living care and 16 for medical nursing—and standardizes item codes, names, definitions, and key service points. Through this catalog, household care tasks such as assisted bathing, toileting care, turning, and vital-sign observation are converted into service items for which care workers can be trained, institutions can manage delivery, and costs can be settled [28],[29].

- Designated institutions answer the question: Who delivers the services?

Once LTCI confirms that an older adult has care needs, it must also confirm which institutions will provide the

services, whether their personnel possess the requisite capabilities, and whether service delivery can be effectively managed. Designated-provider management integrates dispersed care institutions into a coherent service network and gives families a reasonably clear entry point. The Measures for the Designated Management of Long-Term Care Insurance Service Institutions, issued by the National Healthcare Security Administration in September 2024, require designated institutions to maintain professional service teams, comply with pricing and charging policies, and meet the conditions for interfacing with the healthcare security information platform [30].

⊙ Administrative management and cost settlement answer the question: How are services confirmed and settled after delivery?

LTCI pays for care services that have been delivered and that comply with program rules. After each service episode, records, review, and settlement are required to convert repeated care activities into stable reimbursement. For service institutions, stable reimbursement makes it possible to continuously organize care workers, set up service stations, conduct training, and manage quality. For families, the combination of cost-sharing and clear service entry points makes long-term care arrangements far easier to sustain.

Pilot program data already bear out this market-shaping effect. LTCI pilot areas expanded from 15 at the program's inception in 2016 to 92 by the end of 2025, covering 308 million people. Cumulative fund expenditure has exceeded RMB 100 billion, supporting nursing services for more than 3.3 million people with functional impairment. Nationwide, there are now 12,000 designated LTCI service institutions and approximately 370,000 practitioners. The growth in covered populations, the sustained inflow of funds, and the expansion of designated institutions and practitioners all indicate that LTCI has begun converting care needs once confined within households into stable orders within a professional service market [31].

4.3 From a Care Services Market to Demand for Age-Tech

Once LTCI generates a care services market, demand for age-tech shifts from scattered procurement to the demands of sustained service operations. Stable orders repeatedly generate three types of requirements: services must be organized, care labor requires tool support, and service processes must be verifiable.

⊙ Service organization requires digital scheduling.

Home-based and community-based care services are dispersed across different households. Care workers must travel between homes, and service times and contents may shift as seniors' conditions change. Relying on manual coordination alone, service institutions struggle to simultaneously maintain dispatch efficiency, confirm arrivals, and track processes. Digital platforms and service systems connect household demand, personnel matching, route planning, and service records, enabling dispersed services to be brought within a manageable organizational process.

⊙ Care labor requires tool support.

Turning, transfers, toileting care, bathing, and nighttime supervision in functional-impairment care are repetitive and physically demanding. The 2025 Research Report on the Occupational Status of Elderly Care Workers shows that care workers' demand for devices is concentrated in assisted turning and transfer assistance, cited by 76.15% and 62.16% of respondents respectively. Toileting management and hair washing/bathing were also cited by 36.38% and 29.18%. These figures point to a shared reality: demand for assistive devices and care equipment arises directly from frontline care tasks, particularly those that are high-frequency, physically strenuous, or high-risk [24].

⊙ Service verification requires records as evidence.

As service orders run continuously, families want to know whether the care worker arrived, whether the service was completed, and whether any incidents were handled. Service institutions are concerned with personnel scheduling, quality review, and complaint resolution. Payers need to verify whether services actually occurred and whether costs comply with program rules. Service records, process feedback, and quality-management tools convert a stream of home visits into a process that can be reviewed, verified, and audited. Technology's role here is to make the service process visible.

The service market created by LTCI provides ongoing usage scenarios for age-tech to enter care services. Technology tools will sustain demand only if they become embedded in service organization, care labor, and service verification. Detached from these service links, devices and systems risk remaining confined to project procurement or short-term pilot programs.

4.4 The Payment-Recognition Challenge in LTCI

LTCI creates a care services market that offers age-tech sustained application scenarios, yet the payment side continues to recognize care services as its object. When service institutions use digital platforms, assistive devices, care equipment, and maintenance support in the course of service delivery, what they present to payers at settlement is still service items and service prices. Once technology enters the service process, payment recognition confronts two successive questions: whether a given tool is necessary to complete the care service, and whether its cost should be absorbed into the service price. The first concerns the correspondence between tools and service items; the second, the boundaries of cost.

⊙ The correspondence between tools and service items is easily obscured.

When a family purchases a home-visit assisted bathing service, what they see is the care worker's arrival and the bathing outcome. Yet the service institution may need portable bathing equipment, transfer-assistance tools, anti-slip supplies, and cleaning and disinfection materials to complete the service. When settlement is processed under "assisted bathing," the tool costs are invisible; when tool fees are charged separately, they can easily become detached from the specific service episode and its follow-up maintenance. Toileting care presents a similar problem: cleaning, skin observation, and incident handling are service actions, while suction, flushing, drying, consumable replacement, and equipment maintenance are supported by technology tools. The difficulty for payment recognition is that the relationship between tools and service actions is not always clearly legible within the service item as currently defined.

⊙ The boundary for technology costs entering service prices remains unstable.

Care worker labor, station scheduling, and institutional management are costs already covered by care services. Equipment depreciation, consumable replacement, cleaning and disinfection, fault repairs, and personnel training are new and ongoing costs introduced by the technology. Some of these costs are incurred within a single service episode; others span multiple seniors and service cycles. When boundaries are unclear, service prices may underestimate the role of technology tools in supporting service delivery, or conversely, hardware expenditures without genuine care necessity may be packaged into service fees. Whether technology tools can legitimately enter service prices depends on their relationship to essential care actions, the continuity of their use, and whether the associated maintenance costs can be clearly explained within the service process.

LTCI recognizes care services, not technology tools per se. Tools must be assessed by placing them back

within the service items they support. Service items define the tool's necessity; service prices define the boundaries of cost. Only then does payment recognition rest on a stable foundation. When these explanations remain unclear, equipment may well be present on site yet still remain dependent on household out-of-pocket spending, institutional self-funding, or short-term pilot arrangements.

4.5 Institutional Arrangements in Japan and Germany

Once LTCI generates a care services market, whether care technology can achieve stable adoption depends on both product capability and the way the payment system recognizes it. Japan and Germany offer two contrasting models. Japan centers its approach on service benefits, welfare equipment leasing, and purchase support—the categories are stable, cost control and service standards are strong, but the introduction of intelligent functions faces persistent pressure to update catalogs. Germany, through cash benefits, in-kind benefits, combined benefits, an assistive-device catalog, and dedicated digital care applications, provides more elastic institutional space for different forms of care technology.

Japan's Long-Term Care Insurance (LTCI) is built around service benefits. Seniors receive institutionally recognized care services, welfare equipment leasing, or purchase support, with costs settled under LTCI rules. Care technology occupies its clearest institutional position within welfare equipment lending and the sale of specified welfare equipment. Welfare equipment lending—essentially assistive-device leasing—covers 13 categories, including wheelchairs, special beds, walkers, transfer-assistance devices, and automatic excretion-treatment devices, enabling certain assistive devices to be used consistently within long-term care [33].

Care services and welfare equipment serve distinct payment functions within Japan's LTCI. Service items convert care actions—assisted bathing, turning, toileting care—into payable services. Welfare equipment lending and sales of specified welfare equipment convert the tools needed in the care process into institutional support that can be leased or purchased. Mature assistive devices can thus be used consistently through leasing or purchase. However, new devices that add communication functions, positioning, usage-status notifications, or data feedback must be re-evaluated to determine whether these added functions still fall within the scope of welfare equipment benefits.

The excretion-prediction support device DFree offers a concrete illustration. By sensing bladder status, the device helps care workers determine when an older adult needs to use the toilet or change care supplies—an intelligent assistive tool within toileting care. Review materials from Japan's Ministry of Health, Labour and Welfare and publicly available corporate information indicate that DFree's manufacturer was founded in 2015, the product entered commercial sales in 2017–2018, and after entering the LTCI welfare equipment evaluation process in 2021, it was still required to undergo further assessment. Beginning in April 2022, it was included within the scope of sales of specified welfare equipment as an excretion-prediction support device. From product commercialization to insurance coverage took roughly four years; from company founding to insurance coverage, approximately seven [34].

This case illustrates that while Japan's LTCI can provide stable payment pathways for mature assistive devices, intelligent devices seeking to enter established categories face a lengthy review and explanation process. Stable welfare equipment lending categories aid cost control and service standardization; yet once care equipment incorporates intelligent functions, the original category must be re-examined to clarify the relationship between the new functions and care tasks. Review records from the Ministry of Health, Labour and Welfare's

Welfare Equipment Evaluation Committee on communication-enabled welfare equipment show that discussions have already incorporated communication functions—location information, battery status, abnormality or fault notification, and usage-status notification—into the scope of benefit determinations. The Japanese experience thus demonstrates that stable categories help establish payment order, but the expansion of intelligent functions continuously tests the system's capacity for institutional renewal [33].

Germany's care insurance is distinguished by its separation of benefit modalities and tool channels. German care insurance provides cash benefits, in-kind benefits, and combined benefits based on care grades. Cash benefits are paid by care funds directly to the person in need of care, enabling self-organized care at home. In-kind benefits are delivered by professional care service providers, with costs settled between the care fund and the provider. Combined benefits allow families to use a mix of professional services and cash benefits, with cash benefits reduced in proportion to the share of professional services utilized. The 2025 benefit table issued by Germany's Federal Ministry of Health shows that care grades 2 through 5 correspond to different cash and in-kind benefit amounts, and explicitly permits the two to be combined [35],[36].

The flexibility of cash benefits is underpinned by eligibility assessment, home-care arrangements, and regular consultation. Article 37 of Book XI of Germany's Social Code defines cash benefits as "cash benefits for self-procured care assistance," applicable to persons with care grades 2 to 5 who opt for home care. The premise of cash benefits is that the person in need of care can, with this benefit, adequately secure the necessary physical care, caregiving support, and household assistance. The Federal Ministry of Health further clarifies that receiving cash benefits requires ensuring appropriate home care, which may be provided by relatives or other informal caregivers [35],[36].

Families receiving only cash benefits are also required to receive regular in-home care consultation. These consultation visits serve to safeguard the quality of home care and to provide family caregivers with advice on nursing, the use of assistive devices, service coordination, and risk management. Under Article 37 of Book XI, recipients of cash benefits at care grades 2 to 5 must receive in-home consultation every six months; those at care grades 4 and 5 may continue to receive quarterly consultations. Failure to receive consultations as required may result in reduction or cancellation of cash benefits in cases of repeated non-compliance [36].

The institutional logic of Germany's cash benefits lies in recognizing and supporting the foundational role of family care in long-term care, while maintaining the link between cash benefits and care tasks through care-grade assessment, the requirement that home care be adequately ensured, regular consultation, and proportional reduction under combined benefits. For care technology, cash benefits offer limited room for use within families' autonomous arrangements. More stable institutional entry points remain the assistive-device catalog, professional service items, and digital care application channels.

Germany's assistive-device system further strengthens the capacity to recognize technology tools. The assistive-device catalog maintained by the GKV-Spitzenverband identifies assistive devices falling within the remit of statutory health insurance and care insurance. According to GKV-Spitzenverband's 2024 materials, over the preceding five years, the catalog added 17,703 products, revised 42 product groups, and updated 9,170 product entries, bringing the total number of assistive devices available to statutory insured persons to approximately 44,000. The value of this mechanism is that technology tools can gain recognition through the established assistive-device framework, while the payment system can adjust its scope as products are updated [37].

Germany has also created a dedicated institutional channel for digital tools. Digital Care Applications (DiPA) target software and application tools used in care settings, and are subject to application, review, and manage-

ment by Germany's Federal Institute for Drugs and Medical Devices. Upon approval by care funds, DiPA can receive cost support and, where necessary, complementary support delivered by care service providers. This arrangement demonstrates that digital platforms and service systems can be recognized as care support tools, and that software and application tools can secure payment arrangements independent of single home-visit services [38],[39].

The experiences of Japan and Germany converge on a shared insight: for payment systems to recognize care technology, the key is to evaluate the value of technology within the care service process and to configure institutional arrangements appropriate to tools at different stages of maturity and with different risk profiles. Japan's service benefits and welfare equipment leasing and purchase support offer stability and standardization, but fixed categories face renewal pressure as intelligent functions emerge. Germany's benefit modalities, assistive-device catalog, and digital care application channels enable differentiated recognition of different forms of technology tools. The lesson for China's LTCI is to uphold the payment-based nature of care services while preserving updatable space for technology tools to enter the service. The payment system must first assess whether a tool contributes to delivering basic care, and then determine whether its costs can be justified within the service process.

4.6 Incorporating Age-Tech into China's LTCI

China's long-term care insurance is moving from pilot programs toward a formal institutional framework. The national LTCI service item catalog already includes 36 long-term care services within the payment scope, with unified item codes, names, definitions, and service points. Relevant 2026 policy documents further propose studying and exploring the inclusion of LTCI-related intelligent services and supportive assistive devices within the payment scope [28],[29],[32]. The practical significance of this policy window lies in recognizing the service value of technology tools within the care service payment framework. LTCI funds primarily cover the costs of basic long-term care services delivered by qualified institutions and personnel; in principle, they do not issue cash directly to persons with functional impairment [32].

Device names, as such, cannot directly become payment objects within the service item catalog. For technology tools to enter LTCI, they must pass through service links: technology enterprises supply equipment and maintenance support; service institutions, county-level service actors, or qualified providers configure tools through purchase, leasing, or partnership; care workers use the tools in services such as assisted bathing, transfers, toileting care, and nighttime patrols; and the payment side confirms costs by service item, service package, leasing cycle, or per-use basis. Based on tool maturity, care necessity, and maintenance complexity, three entry pathways can be defined: mature tools configured as service-delivery tools; supportive assistive devices provided through leasing or per-use models; and intelligent services and innovative equipment first verified in defined scenarios. For these three pathways to operate sustainably, further questions must be resolved—including who conducts home visits and maintenance in counties and rural areas, on what basis the payment side confirms that services have occurred, and how rules adjust as technology matures.

⊙ Mature tools configured as service-delivery tools

Assisted bathing, transfers, toileting care, turning, safety care, and vital-sign observation already occupy recognized positions within the LTCI service catalog. These items pay for care services; tools serve merely as necessary support in the service-delivery process. When mature tools enter the service process, technology en-

terprises typically provide equipment, consumables, and maintenance support; service institutions or qualified providers handle configuration, personnel training, and routine maintenance; and care workers use the tools during actual service delivery.

This pathway suits tools that are already mature, used at high frequency, and clearly linked to care actions. Portable assisted-bathing equipment, transfer-assistance tools, bedside safety devices, and basic monitoring tools can be deployed alongside service items such as assisted bathing, transfers, nighttime patrols, and vital-sign observation. What the family receives is a completed care service. The service institution is responsible for organizing personnel, tools, and maintenance. The payment side verifies whether the service actually occurred, whether the content matched the item, and whether the tool was necessary to complete the service. Only on this basis do technology costs acquire a service-based rationale.

- Supportive assistive devices provided through leasing and per-use models

Mature categories such as nursing beds, wheelchairs, transfer-assistance tools, assisted-bathing aids, and bedside safety devices function more as supportive assistive devices for sustained use. They have longer use cycles and involve disinfection, inspection, fault replacement, and multi-user reuse—making it unrealistic to absorb all costs into single-service pricing. A more prudent approach is for designated institutions, county-level service actors, or qualified leasing providers to assume responsibility for configuration, disinfection, maintenance, replacement, and user guidance, with settlement based on leasing cycles, service cycles, or per-use counts. This converts the pressure of lump-sum household purchases into periodic service fees.

For households facing ongoing long-term care expenditures, expensive one-time equipment purchases are difficult to accommodate within ordinary budgets. Leasing, per-use arrangements, and service packages shift the burdens of equipment procurement, maintenance, and replacement to service actors, while families receive support on a per-cycle or per-service basis. Seniors with severe functional impairment, those of advanced age living alone, those on low incomes, and those left behind in rural areas can first gain access to basic tool support in scenarios such as bedside safety, mobility and transfer, assisted bathing, and toileting care. Related costs can subsequently be aligned with policies such as subsidies for economically disadvantaged seniors with functional impairment and nursing subsidies for persons with severe disabilities.

- Intelligent services and innovative equipment verified in defined scenarios

Tools such as home monitoring systems, smart mattresses, toileting-care equipment, digital care applications, and service-record systems must typically demonstrate their value in real care settings. Verification in defined scenarios should examine four factors: whether care workers are willing to use the tool consistently, whether the care burden is reduced, whether maintenance and consumable costs are manageable, and whether abnormal alerts can be translated into concrete service responses. Projects that yield stable results can expand their scope; those with low usage frequency, high maintenance difficulty, excessive false-alarm pressure, or limited household acceptance should adjust their conditions of use or be phased out.

The focus in evaluating innovative equipment should shift from product-function demonstration to service-outcome verification. That a device can be installed merely signals that it meets the threshold for entering a care setting; whether it can reduce care workers' repetitive labor, minimize wasted trips, keep maintenance costs under control, and support payment verification determines whether it becomes part of LTCI service capacity.

- Counties and rural service nodes to organize technology use

Compared with urban areas, seniors in counties and rural areas are more dispersed, home-visit radii are longer, and families find it harder to manage equipment inspections, fault replacement, and usage guidance on their own. For age-tech to enter these settings, it is better suited to incorporation within county-level service

packages: county-level designated institutions assume responsibility for equipment configuration, maintenance response, and fault replacement; township service stations handle home-visit coordination and day-to-day assistance; and village and community organizations help seniors with applications, appointments, and feedback. In this way, equipment is supported by service personnel, stations, and maintenance networks.

In county and rural scenarios, LTCI can prioritize support for three more readily replicable applications: necessary assistive-device use in regular home-visit care for seniors with severe functional impairment; basic monitoring equipment for nighttime safety alerts for seniors living alone or left behind; and device leasing and maintenance services for assisted bathing, transfers, and toileting care. Digital platforms can handle dispatch, location-based check-in, and service-completion confirmation, while offline service nodes connect home-visit services, equipment maintenance, and user guidance for seniors.

⊙ Service-oriented settlement records

Settlement records should serve the needs of payment judgment. Routine home-visit nursing requires confirmation of the service recipient, arrival time, service item, and completion status. Services involving device leasing or consumable use require confirmation of the use cycle, maintenance status, and replacement status. Projects still in the verification stage, or those with relatively high costs or maintenance requirements, may incorporate periodic evaluation. The national healthcare security information platform has already launched an LTCI subsystem supporting full-process digital management—functional impairment assessment, designated provider management, and cost settlement—while advancing applications such as online dispatch, smart check-in for home-visit services, and automatic recording of service duration [31].

The function of these records is to help the payment side confirm that services were genuinely delivered, that tools were actually used for care, and that costs correspond to services. The clearer the records, the more readily technology tools are understood as part of service capacity. Excessively elaborate records, however, would add to the burden on care workers and institutions, undermining the sustainability of the services themselves.

⊙ Updatable payment rules

Incorporating age-tech into LTCI requires balancing stability with renewal. Mature tools can be configured as service-delivery tools. Supportive assistive devices can achieve sustained maintenance through leasing and per-use models. Intelligent services and innovative equipment can first be verified in defined scenarios. Rigidifying rules too early would raise entry costs for new tools; absorbing innovations too hastily risks pushing products lacking care necessity into fund expenditure.

A more prudent approach is to first incorporate tools that are mature in use, necessary for care, and manageable in maintenance into service items, service packages, or assistive-device leasing arrangements, and then allow new equipment to accumulate payment evidence through real-world deployment. At its core, incorporating age-tech into China's LTCI means treating deliverable services as the unit of payment recognition, thereby enabling technology tools to enter long-term care processes alongside assessment, services, personnel, maintenance, and settlement.

Along this pathway, LTCI's recognition of age-tech ultimately focuses on whether seniors can obtain sustained care support. Families with limited income reserves can reduce one-time burdens through leasing, per-use arrangements, and service packages. Seniors in counties and rural areas can access home-visit care, equipment configuration, maintenance response, and usage guidance through service nodes. And functional-impairment care long trapped inside households can, through assessment, service items, designated institutions, and settlement, crystallize into stable service orders.

Institutional Optimization

5

Age-tech products—millimeter-wave radar and smart mattresses for nighttime monitoring and anomaly detection, toileting-care equipment that eases high-burden care tasks, and home-service platforms for dispatch, documentation, and quality control—have already entered trial use in select elderly care institutions and home-care enterprises. Yet they have not been adopted into routine services nationwide, and scaled application remains out of reach.

5.1 From Pilots to Scaled Application: Four Institutional Bottlenecks

For a technology under trial to enter routine services, four questions must first be answered clearly: what product category it belongs to, on what basis institutions can procure and deploy it, how responsibilities among parties during use can be delineated, and whether records from platforms, devices, care workers, and family confirmations can support service verification and cost settlement. Figure 10 distills these four questions into product classification, procurement and deployment, responsibility delineation, and record admissibility.

Unclear product classification leaves enterprises without clear channels for procurement, payment, and support; insufficient procurement and deployment criteria keep institutions cautious even when they recognize a technology's value; ambiguous responsibility delineation confines higher-risk functions to token or low-level use; and weak record admissibility denies a stable basis for confirming service delivery, verifying costs, or helping families understand outcomes. Only when these four issues are adequately resolved can age-tech move from pilots into broader routine services.

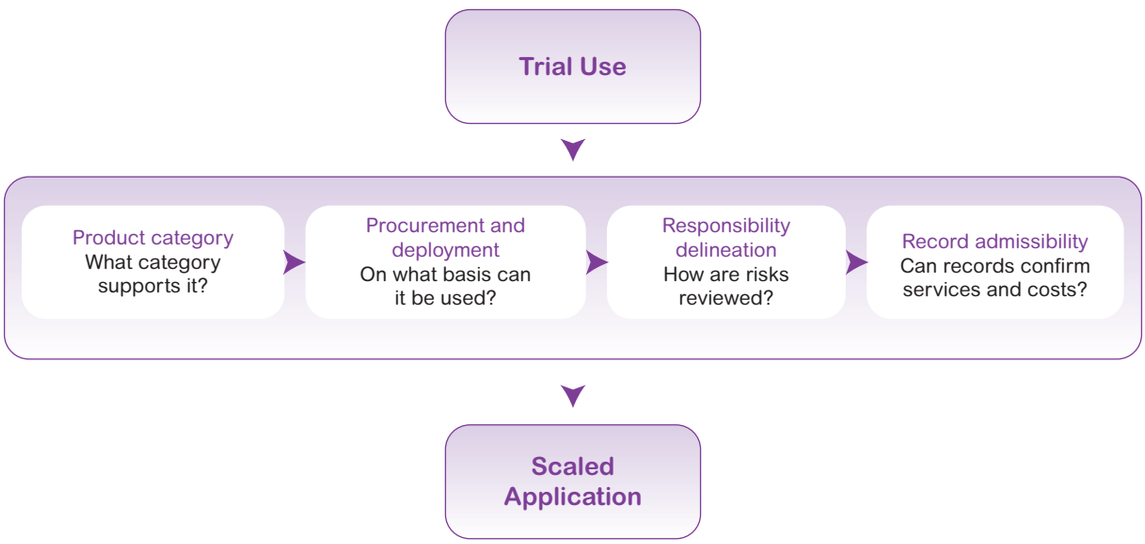


Figure 10 Four Institutional Bottlenecks from Trial Use to Scaled Application

Four bottlenecks must be clarified before trials can become routine services.

5.2 Product Classification: Securing a Recognized Category for Support

When age-tech products first enter the market, they typically need policy backing, subsidy channels, and stable application scenarios. Currently, government funding, subsidies, and catalog-based management are mostly

tied to existing product catalogs or lists—such as those for medical devices, age-friendly products, rehabilitation assistive devices, daily-living aids, and LTCI service items. Smart aging products, upon entry, often struggle to determine which category best supports them.

This difficulty arises from the inherently cross-category nature of these products. Intelligent care equipment, rehabilitation assistive devices, age-friendly products, health-monitoring devices, service platforms, and AI interaction tools frequently overlap in their usage scenarios. Toileting-care devices, smart mattresses, millimeter-wave radar, and home-service platforms exist as physical products but may also function as service tools; they involve quality and safety considerations, yet are also tied to care actions, ongoing maintenance, service records, and family understanding. When product categories are ambiguous, enterprises and local authorities lack a shared language for discussing market access, applicable scenarios, and risk boundaries.

These cross-category attributes become even more apparent when mapped onto existing support channels. Home age-friendly modification lists primarily target residential environment upgrades and the configuration of elderly-use products. Subsidies for assistive-device fitting from Disabled Persons' Federations focus on the needs of persons with disabilities. The medical-device pathway suits products with strong diagnostic, therapeutic, monitoring, or clinical nursing attributes. The LTCI service-item catalog recognizes care service items, meaning a standalone device must be situated within a specific service process before it can be assessed. Many intelligent care devices fall squarely between these channels: they support functional-impairment care without necessarily qualifying as medical devices; they ease caregiving tasks without being ordinary elderly-use products; they generate service records but cannot simply be equated with platform systems.

The medical-device pathway is where disputes most readily surface. Medical-device regulation emphasizes registration review, clinical evidence, indications, and adverse-event traceability—all essential for products used in diagnosis, treatment, monitoring, and clinical nursing. Yet the primary function of many intelligent care devices lies in daily-living assistance and nursing-process support: excretion management, bathing assistance, bed-exit alerts, service documentation, and caregiver burden reduction. Routing such products entirely through the medical-device pathway can create difficulties with certification timelines, evidence requirements, pricing mechanisms, and product iteration speed. In interviews, technology enterprises report that some localities require a medical-device certificate, while others cannot define the product due to a lack of standards. Products may find partial entry via civil affairs subsidies for age-friendly modifications, but still encounter classification barriers when seeking inclusion in healthcare security or LTCI frameworks. Each time an enterprise enters a new city, it often must repeatedly explain the product's functions, applicable scenarios, and safety parameters.

Catalogs themselves also create thresholds. Existing catalogs have been shaped by past policy objectives, procurement habits, and established product types. Over time, they form stable pathways built around familiar categories, entrenched standards, and existing supplier relationships. New age-tech manufacturers must demonstrate not only that their products are useful, but also that they belong among the tools that elderly care services need. When catalogs lack room for renewal, innovative products—even those capable of solving real care problems—can remain stuck in enterprise promotion or institutional trials, unable to access stable support.

The key to product-entry rules is to give intelligent care devices a clear, citable categorical position. Products with strong diagnostic and therapeutic attributes should follow the medical-device pathway. Those whose primary role is functional compensation and daily-living assistance should be classified under rehabilitation assistive devices or geriatric care tools. Products that operate in tandem with caregiver actions, consumable maintenance, and care workflows should be accounted for within elderly care service items or service packages. Plat-

forms and AI interaction tools should define their boundaries around data authorization, alert parameters, and human review. With product categories clarified, government support, LTCI payment recognition, and service application all gain a common reference point.

5.3 Institutional Adoption: From "Reluctance to Procure" to "Reluctance to Deploy"

Elderly care institutions typically pass through two gates when adopting smart equipment: procurement must be compliant, and deployment must be sustained. Equipment that reduces nighttime patrol burdens and eases caregivers' physical load may attract institutional interest for trials. But once formal procurement begins, the institution must articulate its selection rationale, acceptance standards, maintenance arrangements, and cost-accounting treatment. Once the equipment is on site, activating its functions alters caregiver patrol routines, alarm-response protocols, and family communication processes. Only when both the procurement basis and the deployment boundaries are clear can installed equipment translate into routine service capacity.

A large elderly care community with a state-owned enterprise background, studied in our field research, illustrates procurement-side pressures. Procurement by state-owned institutions must navigate annual budgets, fixed-asset management, competitive bidding, quality acceptance, and audit justification. When smart aging equipment lacks citable catalogs, standards, and application guidelines, its value is difficult to convert into defensible procurement decisions. Even when the person in charge recognizes the equipment's service-improvement potential, they must still answer: why this device, on what basis was it accepted, and how will subsequent maintenance be expensed? Without such underpinnings, procurement is easily deferred.

An inclusive publicly built, privately operated nursing home, also examined in our research, illustrates deployment-side pressures. The institution has achieved relatively stable use of millimeter-wave radar for monitoring heart rate, respiration, and bed-exit status, yet has not activated the fall-detection function. Its concerns have moved beyond technical specifications to family expectations and management workflows. Once fall detection is switched on, families may interpret the alert capability as an institutional safety guarantee. After an alert, they will ask whether a caregiver checked promptly; when a fall occurs without an alert, the institution must explain whether the device was functioning, whether installation was appropriate, whether the detection range covered the event, and whether caregivers were still conducting required rounds. The more alerts there are, the denser the demands for patrol, response, documentation, and family communication become—amplifying management pressure.

Procurement and deployment influence each other. When the procurement basis is inadequate, equipment struggles to be captured in budgets and asset registers. When deployment boundaries are unclear, equipment may remain in display, trial, or low-risk modes even after purchase. Institutional adoption cannot be reduced to equipment installation. Technology tools become part of an institution's routine services only when they are integrated into caregiver patrols, incident response, maintenance schedules, and family notification.

For different types of smart-function equipment, institutions should advance adoption step by step, aligned with the realities of their nursing and management processes. Heart-rate, respiration, and bed-exit alerts map relatively clearly onto existing patrol workflows and are suited for earlier routine deployment. Functions such as fall recognition place higher demands on accuracy, response times, and family communication, and are better introduced in limited settings—by floor, by resident group, or by time window. Phased deployment reduces the

pressure on institutions to commit to full functionality all at once, while leaving space for technology enterprises to refine products in real-world settings and for institutions to improve their processes.

5.4 Delineating Responsibility: Reviewing Incidents After Risks Materialize

Building trust in technology-enabled elderly care ultimately depends on whether the service process and the allocation of responsibility can be clearly articulated after an incident. Nighttime alerts, bed-exit reminders, sleep monitoring, voice-activated calls for help, and home-service platforms can help institutions and families detect anomalies earlier. But after an alert is triggered—who checks it, how quickly someone arrives, how the situation is handled, and how the family is notified—these still depend on people, processes, and rules. Trust in technology-enabled care rests not only on a device's ability to detect anomalies, but also on the institution's ability to explain how those anomalies were addressed.

What institutions fear most is that device capability will be interpreted as a safety guarantee. The inclusive publicly built, privately operated institution mentioned above has steadily used millimeter-wave radar for heart-rate, respiration, and bed-exit monitoring, but has not activated fall detection. Once fall detection is enabled, management issues multiply: a false alarm forces caregivers to check, document, and explain; an actual fall without an alarm requires the institution to account for whether the device was functioning, whether installation was adequate, whether the detection zone covered the incident, and whether caregivers were still patrolling as required; and families may construe the alert capability as an institutional warranty of safety outcomes. For the institution, risk ceases to be merely a matter of false positives or missed detections; it translates into daily pressure around patrol, response, documentation, and family communication.

Incident review must examine three links. The equipment link asks whether the function was enabled, whether installation was appropriate, whether network connectivity and power supply were stable, and whether maintenance was performed on time. The response link asks who received the alert, whether it was checked, whether someone arrived on site, and how the situation was handled. The notification link clarifies what the device can detect, what it cannot guarantee, and which circumstances still rely on manual rounds and human judgment. Only by tracing through these links can a post-incident review determine whether the risk originated in equipment failure, installation and maintenance, personnel response, or family misunderstanding of functional boundaries.

Responsibility delineation also requires product traceability. One frontline institutional director noted that medical devices carry filing numbers and can be reported through adverse-event platforms, allowing problems to be traced back to the manufacturer. When smart aging devices lack comparable mechanisms, the institution more readily becomes the party under direct pressure. Whether a device is traceable determines whether incident review can extend backward to product quality, algorithmic alerts, installation and maintenance, and service response. In the prolonged absence of traceability standards on the product side, institutions—even those willing to use the equipment—will prefer to activate functions with clearer links to existing patrol routines, such as heart-rate, respiration, and bed-exit monitoring, while remaining cautious about higher-risk functions such as fall detection.

When responsibilities are clearly delineated, technology products can move from "usable" to "safe to use." Institutions know which risks fall within the device's remit and which fall under service response. Enterprises know whether they need to improve algorithms, installation, maintenance, or functional descriptions. Families

understand that the device is a risk-alert tool, not a substitute for human care and institutional management. If responsibilities remain murky over time, devices may well enter institutions or homes yet still be confined to low-risk functions, demonstration projects, or short-term trials—never becoming part of sustained service capacity.

5.5 Data Admissibility: Service Records as the Basis for Service Verification and Cost Settlement

Home nursing, home-visit assisted bathing, rehabilitation accompaniment, wellness checks, and assistive-device maintenance mostly take place inside seniors' homes. Care workers make independent home visits, while payers, regulators, and families cannot observe the scene simultaneously. Platforms, devices, care workers, and families may all leave records, but these records serve different purposes: enterprises use them for dispatch and quality control; payers, to verify services; regulators, to inspect quality; and families, to confirm that the older adult received help. Whether these records can be jointly relied upon has become a concrete bottleneck now that technology has entered routine services.

Different records answer different questions. Platform records can show who accepted the order, when they arrived, and when they departed. Device records can indicate whether equipment operated and whether any abnormal prompts were generated. Care-worker records can document what service was performed and what conditions were observed on site. Family confirmation can attest to whether the older adult received help and whether the outcome was understandable. Only when these records are brought together can a dispersed home-visit service be clearly described. When standards are misaligned, the very same service may be interpreted differently by the enterprise, the payer, and the family.

For service records to be admissible, they must clearly establish three things: that the service occurred, that its content corresponded to the agreed item, and that any abnormalities were addressed. Payers need this for cost settlement. Regulators need it for quality inspection. Families need it to know that care was actually delivered. At the same time, the degree of detail in records poses a trade-off: too little detail leaves insufficient basis for cost verification and service oversight; too much detail increases the burden on care workers and overexposes the older adult's domestic space and physical condition.

A home-service enterprise examined in our research offers an instructive example. In its early phase, the enterprise used video recognition to match caregivers' movements to assessment criteria, supporting training, quality control, and reporting for commercial insurance oversight. Later, it switched to abstract body-recognition technology, replacing real video with dynamic three-dimensional silhouettes to mitigate household privacy concerns. This shift demonstrates that more complete records are not necessarily better suited for external admissibility. Enterprise-internal quality control can draw on finer-grained process materials, but payment verification and family confirmation should remain limited to the scope necessary to assess the service.

Once service records are accepted as evidence, the contribution of technology products to service delivery becomes easier to see. Payers can confirm that services actually took place. Institutions can review care processes. Families can understand what help the older adult received. Enterprises can use the records to improve dispatch, training, and quality control. When the sources, meanings, and permissible uses of records remain unclear, data only amplifies privacy concerns and the cost of explanation. Once these parameters are clarified, platform logs, device data, and caregiver records can be transformed from internal management tools into a shared basis for service verification and cost settlement.

5.6 Foundational Conditions for Full Adoption

Product classification, procurement and deployment, responsibility delineation, and record admissibility each bear directly on whether age-tech can enter routine services. Enterprises need clarity on the category under which their products can access support. Institutions need a compliant basis for procurement and sustained deployment. Families need clear explanations when risks materialize. Payers and regulators need to verify both services and costs. Only when these four judgments stabilize can a technology move beyond trials in a handful of institutions into broader geographies and service scenarios.

Japan's experience suggests that a disjuncture can open between industrial promotion and payment absorption. Japan's Ministry of Economy, Trade and Industry and Ministry of Health, Labour and Welfare have long designated priority areas for care technology, and related programs have supported the R&D, efficacy evaluation, and standardization of care robots [40],[41]. Industrial agencies can drive device development and on-site introduction, but when a product seeks entry into LTCI benefits, it must loop back through welfare-equipment evaluation, care planning, and benefit rules. What the payment side cares about is which care task the product serves, which seniors it applies to, whether it has been trialed, and which personnel are involved in its use [42]. If evidence generated during the trial phase cannot be translated into a basis usable for payment and care planning, a product that has completed a demonstration rollout will still require fresh justification before routine application.

Germany's experience is instructive in showing that different technology forms can follow relatively distinct entry pathways. Nursing beds, wheelchairs, and care assistive devices can secure a categorical position through the assistive-device catalog [37]. Software-based care tools must pass a digital care application review, demonstrate care benefit, quality, and safety, and be listed in the catalog before receiving care insurance support [38],[39]. Care technologies still at the R&D stage can be tested for everyday usability at care practice centers [43]. The HAL exoskeleton falls under occupational-injury rehabilitation rather than long-term care, but it illustrates a broader point: when high-cost equipment enters public payment, there must first be a clearly defined insurance purpose; professional institutions must then organize service delivery; and costs are settled as treatment services rather than converted into one-time equipment purchases by households or institutions [44],[45]. Together, these pathways demonstrate that product classification, usage scenarios, payment objects, and review criteria must be aligned end to end.

For age-tech to achieve scaled application, these four judgments must remain consistent across a technology's entire entry trajectory. Before a product enters service, it must be clear which category it falls under for support. When an institution prepares to use it, the procurement basis and deployment boundaries must be clear. During operation, it must be clear how alerts, anomalies, and incidents are reviewed link by link. And when records enter payment, regulatory, and family confirmation processes, their sources, meanings, and permissible uses must be clear. Figure 11 presents these four foundational judgments.

Once these four judgments stabilize, enterprises entering new regions can reduce the repeated work of explaining the same product category and its applicable scenarios. After procurement, institutions gain a clearer sense of which functions can be routinely activated and which require restricted use. When risks materialize, the incident can be traced through product condition, installation and maintenance, personnel response, and family notification. And payers, regulators, and families can verify services and costs against a shared body of records. Age-tech can thereby move, with greater ease, from short-term trials into routine service delivery.

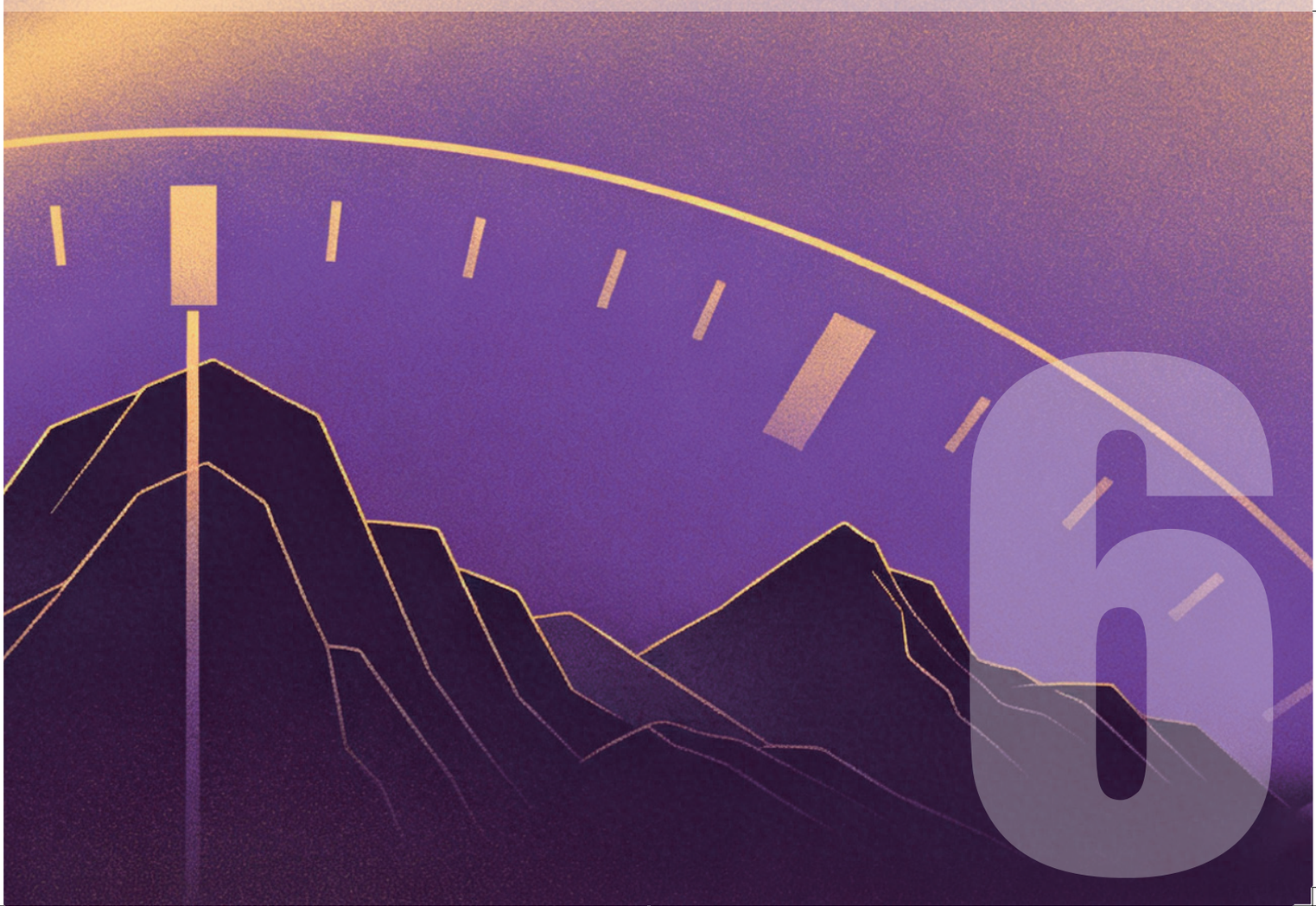
Issue	Who Needs to Explain?	What Must Be Clarified?
Product category	Technology enterprise + local departments	Support channel and standards; risks and service boundaries
Procurement and deployment	Institution + technology enterprise	Procurement basis; acceptance standards; activation boundary
Responsibility delineation	Product, institution, personnel, and family	Device status; personnel response; family notification after risk event
Record admissibility	Platform, device, care worker, and family	Record source and meaning; use boundary for service and cost

Figure 11 Four Foundational Judgments for Scaled Age-Tech Application

Stable judgments reduce repeated explanation and help technology move from pilots into routine service.

Future Vision:

From Disparities to Equity—Universal Reach of Basic Aging Support



Aging before affluence, the urban-rural divide, and the structural mismatch between supply and demand ultimately translate into three forms of disparity in aging support. Families with limited income reserves, when facing expensive care equipment and the cost of long-term services, are more likely to postpone purchasing professional care. Seniors in counties and rural areas, confronted with longer home-visit distances, thinner maintenance networks, and higher procedural hurdles, find it harder to obtain services reliably—even where services nominally exist. And functional-impairment care that remains long confined within the household is far more difficult to convert into stable service arrangements. The real test of equity in aging is whether basic safety, necessary care, and the capacity to understand information can consistently reach seniors and their families across these divides.

For age-tech to achieve inclusive access, three concrete arrangements are needed. On the cost side, care equipment and assistive devices should lower one-time household burdens through service-based payment, leasing, and per-use models. Spatially, county-level designated institutions, township service stations, community care posts, and village and community organizations must jointly support the delivery of elderly care services and age-tech in county and rural settings—bringing home-visit care to seniors where they live, integrating equipment configuration and fault response into service networks, and helping seniors and families understand what devices do, what results they produce, and where their limits lie. On the demand-conversion side, long-term care insurance, through assessment, service items, designated institutions, documentation, and settlement, transforms household care burdens into demand for deliverable services and into practical use scenarios for smart aging technologies. Table 2 lays out the three pressures, the practical difficulties they create, and the corresponding service pathways side by side, showing how the three pathways of cost, reach, and sustained orders together underpin the new vision for equity in aging.

Table 2: Three pressures, real difficulties, and equity in aging

Structural Pressure	Practical Difficulty	Service and Institutional Pathway	Implications for Equity in Aging
Aging before affluence	Ordinary families struggle to pay for expensive equipment, continuing care services, and age-friendly home modifications	Service-based payment, assistive-device leasing, per-use models, and consumption subsidies, prioritizing basic care tools and necessary services	Seniors should have fair access to basic public services and necessary care support regardless of economic foundation
Urban-rural divide	Service resources differ across urban and rural areas; rural areas face wider service radii, limited personnel supply, and slower response	County-level designated institutions, township service stations, community service stations, village and community organizations, institutions, and platforms organize home-visit services, equipment maintenance, and use explanation	Narrow the urban-rural service gap and protect seniors who require sustained support, including those who are very old, living alone, functionally impaired, or living with dementia
Supply-demand mismatch	Limited payment capacity leaves care needs inside households, making it difficult to form service demand that can be purchased, delivered, and verified	LTCI uses assessment, service items, designated institutions, records, and settlement to convert care pressure into deliverable services and technology use scenarios	Convert care needs into real service demand, enabling medical and care support in later life

6.1 Cost Thresholds: Making Technology Affordable in Care Services and Home Modifications

For age-tech to enter elderly care services, it must first clear the cost threshold. Nursing beds, transfer equipment, basic monitoring devices, and intelligent toileting-care equipment offer real practical value, yet one-time purchases impose significant pressure on many households. The higher the price, the more likely families are to postpone adoption. Before such devices achieve mass production and inclusive application, their high costs often restrict access to high-income families and premium care institutions, concentrating technological resources among these groups.

Long-term care is better served by embedding tool support within service delivery. Mature tools are deployed alongside service items such as assisted bathing, transfers, toileting care, and nighttime patrols. Mature assistive devices—nursing beds, wheelchairs, transfer aids, assisted-bathing aids—are supported through leasing, per-use models, and service packages. For equipment whose prices are higher or whose use boundaries still require validation, trials can first be conducted under clearly determined functional-impairment grades, fixed service scenarios, and designated institutional responsibility. What households purchase is a period of care support; equipment configuration, maintenance, and replacement are borne by the service provider.

Cost arrangements should be prioritized starting from basic care needs. For seniors with severe functional impairment, those of advanced age living alone, low-income seniors, and left-behind rural seniors, basic needs center on bedside safety, mobility and transfers, assisted bathing, toileting care, nighttime alerts, and necessary maintenance. Once these scenarios are covered by LTCI service items, assistive-device leasing, government-purchased services, and elderly subsidies, age-tech stands a far better chance of shifting from high-end consumption to foundational care capacity.

Age-friendly home modification is another foundational scenario for age-tech to enter household spaces. Most families choose to age in place. The thresholds, floors, lighting, bathrooms, bedsides, and kitchens that seniors navigate daily directly affect fall risk, mobility, and self-care. Some believe that “seniors can just make do,” some think that “modifications are only for the very old,” and others worry that modifications are too expensive to be worth the investment. These cognitive biases have long kept market demand latent rather than explicit.

Government subsidies can lower the threshold for households to undertake modifications. For example, the Wuxi municipal government effectively activated residents’ willingness to modify their homes through a consumption-subsidy policy for age-friendly home renewal, converting latent household safety needs into actual assessment, purchase, installation, and maintenance. At the same time, policy incentives stimulated business growth among local age-friendly modification enterprises and advanced industry standardization.

6.2 Service Reach: Integrating Counties and Rural Areas into the Service Network

The urban-rural divide manifests most directly in whether services can reach seniors at all. In cities, service populations are relatively concentrated, making care workers, institutions, maintenance networks, and digital platforms easier to organize. In counties and rural areas, seniors are more dispersed, home-visit radii are longer, and equipment maintenance and usage guidance are harder to sustain. Whether personnel can arrive, equipment can be maintained, costs can be sustained, and seniors can ask questions and receive clear answers—all

of this determines the real accessibility of technology-supported care.

Deploying age-tech in counties and rural areas requires an organizational backbone of service nodes. County-level designated institutions should assume responsibility for equipment configuration, inspection and maintenance, and fault replacement. Township elderly care service stations, community care posts, and primary healthcare institutions should conduct need discovery, home-visit coordination, and in-person explanations. Village and community organizations should assist seniors and families with applications, appointments, confirmations, and feedback. Digital platforms improve the efficiency of dispatch, location tracking, documentation, and settlement; offline nodes provide service connections that seniors can see, find, and consult with confidence.

This pathway fundamentally changes how technology reaches lower-tier settings. Simply handing equipment to seniors and families shifts the burdens of maintenance, operation, and explanation back onto the household. Only when equipment is embedded in county-level service packages do personnel, stations, and maintenance networks share the load. For rural seniors who are very old, living alone, chronically ill, or functionally impaired, what matters is having someone to identify needs, to visit the home, to handle faults, and to explain results. Technology accessibility thus shifts from “whether a product exists” to “whether a sustained service exists”.

6.3 Demand Conversion: From Household Strain to Stable Service Orders

The structural mismatch between supply and demand stems from care needs remaining trapped within households for extended periods. Seniors require turning, assisted bathing, toileting care, medical escort and rehabilitation, and nighttime response; families recognize that reliance on relatives is unsustainable. Yet cost, quality, trust, and service availability all determine whether professional service orders materialize. Many households continue to depend on relatives, domestic helpers, low-cost non-professional services, or makeshift arrangements.

The institutional role of LTCI is to channel this household strain into an operational service process. Functional impairment assessment identifies actual needs; service items define the care content; designated institutions deliver the services; and service records together with cost settlement confirm that services occurred. Once orders stabilize, care workers, service stations, assistive-device leasing, digital platforms, and smart equipment all gain sustained use scenarios. The entry of age-tech into long-term care is thus contingent on the steady formation of these service orders.

Payment arrangements must be complemented by clear responsibility delineation and reliable service records. Clear product classification and procurement grounds make institutions more willing to embed equipment into routine services. Reviewable incident processes give families and institutions greater confidence and more stable expectations. Admissible service records allow payers and families to confirm outcomes more readily. LTCI generates the service orders; responsibility delineation and record admissibility ensure those orders are confirmable, reviewable, and sustainable. Together, they enable technology tools to move from pilot trials into routine care.

6.4 Equity in Aging Under the Digital China Strategy

Digital China provides a new organizational foundation for building a more equitable aging system. China’s 15th Five-Year Plan Outline explicitly calls for accelerating the Digital China Strategy, leveraging intelligent technolo-

gies to strengthen the smart elderly care system, and actively developing the silver economy. Enabled by these technologies, processes such as online assessment, platform dispatch, smart check-in, service documentation, cost settlement, and anomaly alerts can effectively integrate care needs that are otherwise dispersed across households. At the same time, age-friendly interfaces, offline service counters, community-based assistance, and human customer support help seniors with weaker digital capabilities clear the operational hurdles. The value of digitalization lies not only in efficiency gains, but more profoundly in its ability to extend the reach of basic services.

The social value of age-tech, at its core, lies in helping people perform care work better. Alert devices help care workers detect risks earlier. Service platforms help institutions consolidate fragmented orders. Process records help payers and families verify services. Assistive devices ease the physical strain on care workers. And human assistance helps seniors understand information and make informed choices. Only when technology is woven into these service relationships can seniors and their families tangibly feel its support.

The baseline of equity in aging finds concrete expression in age-tech. Continuous improvements in social protection ensure that seniors facing functional impairment can access medical and nursing services, guaranteeing basic care for every older person. The reconstruction of economic contracts encourages the market to build a commercial ecosystem suited to China's aging society and responsive to the real needs of seniors and their families, shifting the responsibility of aging from the household to market-based products and services. Driven by industrial policy and payment systems, costs and responsibilities are reasonably shared among families, public payers, service institutions, and market actors. The renewal of social culture reflects progress in social awareness, fostering respect for the diverse lifestyles of seniors. Age-tech enhances the caregiving capacity of nursing staff, allowing seniors to retain dignity, voice, and choice within the care process. And through the empowerment of age-tech, enhanced cognitive and action capacities enable seniors to understand, inquire, complete procedures, and comprehend both the boundaries and the role of technological support.

Ultimately, the three pressures test whether basic aging support truly reaches those who need it. Families with limited incomes can reduce one-time burdens through service-based payment, leasing, and per-use models. Seniors in counties and rural areas can gain access to equipment configuration, home-visit services, maintenance response, and offline guidance through service nodes. And long-term home-based functional-impairment care can be transformed, via assessment, service items, designated institutions, and settlement, into stable service arrangements. Inclusive age-tech rests precisely on these conditions of service, payment, and rules. Only when basic safety, necessary care, and access to information can transcend differences in income, wealth, geography, service distance, and digital capability will the new landscape of equity in aging under the Digital China Strategy be built on solid ground.

Aging Without Barriers, Care Without Bounds. Age-tech will continue to energize medical care, nursing, and the silver economy, bringing care and dignity to every elderly adult.

Appendix: Notes

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