The Longevity Industry: A New Model Within Healthcare

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Abstract

The longevity industry, driven by advancements in biotechnology, AI-driven diagnostics, and digital health, is challenging traditional healthcare paradigms. This thesis analyzed funding trends in longevity-focused companies and identified emerging technologies poised to dominate the sector. Using data from platforms like PitchBook, along with expert interviews and surveys, the study explored the strategic focus of innovations that captured significant investor and consumer interest. Key technological advancements were evaluated for their growth potential and impact on the industry. The findings highlighted a shift from reactive to preventive care models, signaling strategic challenges for traditional healthcare providers. Longevity startups are leveraging innovations to integrate personalized care into existing systems rather than entirely revolutionizing them. New technologies and treatments transform healthcare into a more personalized, preventive model. Primary data from industry specialists and venture capitalists were combined with secondary research to present a comprehensive sector view. The study concluded that while longevity technologies hold transformative potential, their impact is more likely to complement and enhance traditional healthcare systems rather than replace them entirely.

Keywords: Longevity industry, Venture capital, Funding trends, Competitive advantage, Digital health, Gene therapy, Startups, Preventive care, Biotechnology, Disruption

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Sumário

A indústria da longevidade, impulsionada por avanços em biotecnologia, diagnósticos baseados em inteligência artificial e saúde digital, está desafiando os paradigmas tradicionais do setor de saúde. Esta dissertação analisou tendências de financiamento em empresas focadas na longevidade e identificou tecnologias emergentes com potencial de dominar o setor. Utilizando dados de plataformas como PitchBook, juntamente com entrevistas com especialistas e questionários, o estudo explorou o foco estratégico das inovações que captaram significativo interesse de investidores e consumidores. Os principais avanços tecnológicos foram avaliados quanto ao seu potencial de crescimento e impacto no setor. Os resultados destacaram uma transição de modelos reativos para modelos preventivos de cuidado, indicando desafios estratégicos para os provedores tradicionais de saúde. Startups de longevidade estão aproveitando inovações para integrar cuidados personalizados nos sistemas existentes, em vez de transformá-los completamente. Novas tecnologias e tratamentos estão remodelando o setor de saúde para um modelo mais personalizado e preventivo. Dados primários obtidos de especialistas da indústria e investidores de capital de risco foram combinados com pesquisas secundárias para apresentar uma visão abrangente do setor. O estudo concluiu que, embora as tecnologias de longevidade tenham um grande potencial transformador, é mais provável que seu impacto complemente e aperfeiçoe os sistemas de saúde tradicionais, em vez de substituí-los completamente.

Palavras-chave: Indústria da longevidade, Capital de risco, Tendências de financiamento, Vantagem competitiva, Saúde digital, Terapia genética, Startups, Cuidados preventivos, Biotecnologia, Disrupção

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Table of Abbreviations

AI - Artificial Intelligence

B2B - Business-to-Business

B2C - Business-to-Consumer

BoP - Base of the Pyramid

CEO - Chief Executive Officer

CFO - Chief Financial Officer

COO - Chief Operating Officer

COVID-19 - Coronavirus Disease 2019

CRISPR - Clustered Regularly Interspaced Short Palindromic Repeats

CSR - Corporate Social Responsibility

CTO - Chief Technology Officer

DTC - Direct-to-Consumer

EP - Epigenetic Clock

FTEs - Full-Time Equivalents

GLP-1 - Glucagon-Like Peptide-1

IPO - Initial Public Offering

IV - Interview ID

M&A - Mergers and Acquisitions

MD - Medical Doctor

OECD - Organisation for Economic Co-operation and Development

PIPE - Private Investment in Public Equity

PPPs - Public-Private Partnerships

QALY - Quality-Adjusted Life Years

RBV - Resource-Based View

VC - Venture Capital

1 Introduction

Longevity, the effort to extend lifespan and healthspan, has become a topic of increasing attention in healthcare and innovation. As populations grow older and healthcare systems face rising costs and the widespread impact of age-related diseases, existing approaches to managing health are being questioned (Nemitz, 2021; Chen, 2023). While people in OECD countries live roughly ten years longer than they did in 1970, many of these additional years are spent managing chronic conditions such as diabetes, cardiovascular disease, and neurodegenerative disorders (Chen et al., 2023). This reliance on reactive healthcare models shows the need for approaches that prevent health issues before they arise. The longevity industry offers a way forward by combining biotechnology, digital health, and preventive care.

Wearable devices, artificial intelligence (AI), and early detection technologies are innovations transforming this field. These technologies allow continuous health tracking and offer personalized guidance, helping individuals manage potential risks before they become serious (Fleisch et al., 2021; World Economic Forum, 2023). For instance, AI-powered wearables can monitor vital signs, identify irregularities, and recommend health adjustments, integrating these practices into everyday life (Statista, 2023). Unlike traditional healthcare, which often responds to problems once they escalate, these technologies prioritize prevention and earlier intervention. Startups have significantly made these innovations more accessible, designing tools that align with modern lifestyles and encourage proactive health management.

Despite their potential, these advancements face significant hurdles. Regulatory systems often lag behind technological developments, slowing the approval and implementation of new solutions (Sinclair, 2024). Financial challenges also present barriers. While venture capital has supported much of the innovation in this sector, its short-term timelines are often incompatible with the years of research, clinical trials, and regulatory processes required in healthcare (Michaud & St. Amour, 2023). To address these challenges, public-private partnerships and government funding have become increasingly essential for supporting long-term projects and helping these technologies reach broader audiences (OECD, 2024).

Studying the longevity industry is essential, as its innovations could reduce pressure on healthcare systems, decrease costs, and improve lives on a large scale (Fleisch et al., 2021; Chen, 2023). Despite these possibilities, many uncertainties remain about how investment trends, regulations, and public adoption influence the development of these technologies.

Bridging these gaps could make it easier to unlock the full potential of these solutions and extend their benefits to more people.

This research investigates the driving forces behind the changes in the industry and the challenges that remain. It also analyzes innovations and emerging technologies in the longevity market to understand its current state and assess whether it is positioned to fundamentally disrupt the healthcare system or if these advancements will be integrated into existing systems.

Research Question: How is the Industry of Longevity disrupting traditional healthcare systems?

2 Literature Review

2.1 Definition of the Longevity Industry

The longevity industry is a multidisciplinary and rapidly advancing field situated at the intersection of biotechnology, medicine, and digital health technologies. Its primary objective is to extend both lifespan and healthspan, the period of life spent in good health, through innovative scientific and technological solutions (Chen, 2023). In contrast to traditional healthcare, which predominantly focuses on diagnosing and treating diseases after their onset, the longevity industry adopts a preventative approach, addressing the biological and environmental factors that contribute to aging and age-related diseases. The longevity industry seeks to redefine traditional healthcare paradigms by integrating biological and technological advancements. Its proactive and preventative focus addresses the biological drivers of aging and aims to optimize health outcomes across the lifespan.

2.1.1 Biological Innovations

Recent advancements in biomedical research have unveiled transformative strategies to address the underlying mechanisms of aging, offering potential solutions to reverse cellular decline, repair damaged tissues, and target the physiological processes contributing to age-related diseases and degeneration.

Gene Therapy focuses on modifying or replacing defective genes to treat or prevent diseases. In aging, Gene Therapy demonstrates the potential to mitigate genetic disorders associated with aging and reverse cellular aging processes (Florea et al., 2023).

Stem Cell Research investigates the regenerative capabilities of stem cells, which can differentiate into various cell types. Researchers aim to utilize stem cells to repair damaged tissues and organs, thereby counteracting the physiological effects of aging (Neves, 2017).

Senolytic Therapies are designed to selectively eliminate senescent cells, cells that no longer divide but remain active, often contributing to chronic inflammation and tissue damage. Removing these cells could reduce the burden of age-related diseases and slow the progression of aging (Sinclair, 2024).

Precision Medicine represents an individualized approach to healthcare that utilizes genetic information and biomarkers to develop tailored anti-aging treatments. This approach can transform how age-related conditions are treated and managed (Chen, 2023).

2.1.2 Technological Enablers

This category breaks down into the following general categories:

AI-Powered Diagnostic Tools employ artificial intelligence to analyze complex health data, enabling the early detection of diseases and the creation of personalized treatment strategies. These tools enhance the precision and effectiveness of interventions in longevity (Fleisch et al., 2021).

Wearable Devices facilitate continuous monitoring of health parameters such as heart rate, sleep quality, and physical activity. By providing real-time health data, these devices enable the implementation of preventive strategies that support healthspan extension (World Economic Forum, 2023; Statista, 2023).

2.2 Traditional Healthcare Challenges

Traditional healthcare faces a significant paradox: while human longevity has increased, the quality of health during these extended years has not kept pace (Nemitz, 2021). This discrepancy between *lifespan and healthspan* presents a challenge for healthcare providers and policymakers alike. One of the primary issues is the prevalence of chronic conditions such as diabetes, heart disease, and neurodegenerative disorders, which tend to dominate the later years of life. These conditions impact the quality of life and place an enormous strain on healthcare resources. Studies indicate that although life expectancy in OECD nations has risen by ten years since 1970, a significant portion of this extended time is spent managing age-related health problems (Nemitz, 2021). The current healthcare model predominantly focuses on treating illnesses after they occur rather than preventing them. This reactive approach is less effective and costly (Neves, 2017). Recent data suggests that 75% of healthcare expenses in the United States are attributed to chronic illnesses, a figure expected to increase with the aging population (Chen et al., 2023). The aging demographic exacerbates this financial burden, as older individuals typically require more frequent and expensive medical interventions. Rising costs and scarce resources further intensify the strain on healthcare systems. The conventional healthcare approach prioritizes treatment over sustained prevention methods and is increasingly insufficient in addressing these challenges (Fleisch et al., 2021). The current system often treats symptoms or specific conditions in isolation rather than taking a holistic view of patient health. This approach can lead to inefficiencies, redundancies, and sometimes conflicting treatments, especially for patients with multiple chronic conditions.

The financial implications of these challenges are stark. It is reported that 80% of individuals in the United States deal with at least one chronic ailment, while 77% have two or more conditions (Chen et al., 2023). This high prevalence of chronic diseases translates into substantial healthcare expenditures, both for individuals and healthcare systems as a whole. Moreover, the traditional healthcare model struggles to leverage technological advancements effectively. While digital health and personalized medicine innovations offer promising solutions, their integration into existing healthcare structures often faces resistance due to regulatory hurdles, privacy concerns, and the need for significant infrastructure changes (Mikhailova, 2018). The COVID-19 pandemic has further exposed the vulnerabilities of traditional healthcare systems. It highlighted the importance of preventive care, the need for robust public health infrastructure, and the potential of telemedicine and remote monitoring technologies (National Academy of Medicine, 2022). In response to these challenges, there is a growing recognition of the need to shift towards a more proactive, preventive approach to healthcare. This involves promoting health across all stages of life rather than just addressing illnesses as they occur (World Economic Forum, 2023). Such a shift can potentially enhance health outcomes and reduce expenses, but it necessitates significant modifications in healthcare policies, financial structures, and societal attitudes toward health and aging (Marino et al., 2023). However, integrating these innovations into existing healthcare systems requires overcoming entrenched practices, regulatory barriers, and public skepticism. (World Economic Forum, 2023)

In sum, while traditional healthcare has significantly expanded the human lifespan, it now faces the complex challenge of improving the quality of these extended years. Addressing this issue will require a fundamental shift in approach, from reactive treatment to proactive prevention, and a willingness to embrace new technologies and care models that can better meet the needs of an aging population. (Marino et al., 2023)

2.3 Future Directions and Implications

The longevity industry is poised to significantly impact various aspects of society, fundamentally altering healthcare systems, economic models, social structures, and environmental considerations. In healthcare, the shift towards preventive and personalized care

is anticipated to alleviate the burden on traditional systems and potentially reduce long-term costs. This transformation is propelled by advancements in geroscience and healthy longevity medicine, which integrate biological aging processes into clinical settings to optimize health throughout life (Bonnes et al., 2024). Economically, extended healthspans could significantly alter retirement age, career patterns, and productivity. As people remain healthier for longer, they may work beyond traditional retirement ages, necessitating a reevaluation of economic models and retirement planning (National Academy of Medicine, 2022). This shift requires adapting financial products and policies to accommodate longer working lives and the associated financial implications (Aging Analytics Agency, 2024). Socially, longer and healthier lives could transform family structures, educational systems, and social support networks. The longevity industry promotes lifelong learning and adaptability to technological advancements, enhancing older adults' societal engagement (Abecassis-Moedas, 2024). This may lead to multigenerational living arrangements and necessitate changes in educational curricula to prepare individuals for extended careers. Environmentally, the impact of a potentially larger, longer-lived population must be carefully considered. The demographic shift could strain resources unless sustainable practices are adopted across industries (National Academy of Sciences, 2023).

In conclusion, the longevity industry represents a paradigm shift in approaching health, aging, and human potential. From a strategic management perspective, the longevity industry offers opportunities for innovation and competitive advantage. Companies that navigate the complex scientific, regulatory, and ethical landscape stand to gain significant market share in this impactful industry (Aging Analytics Institute, 2024). However, ethical concerns, regulatory hurdles, and ensuring equitable access to technologies remain. Stakeholders must engage in ongoing dialogue about the implications of longevity technologies to ensure responsible development (National Academy of Medicine, 2022). The industry's potential to reshape healthcare and extend human healthspan makes it a necessary focus for researchers, investors, and policymakers.

2.4 Management Theory in Healthcare and Strategic Management

The longevity industry presents a unique landscape for applying strategic management theories, particularly Porter's framework of competitive strategies. Porter (1985) identifies three fundamental strategies—cost leadership, differentiation, and focus—that organizations can implement to maintain a competitive edge over time. In the context of the longevity industry,

these strategies take on specific characteristics and applications. Differentiation emerges as a key strategy in the longevity sector. Companies innovating through personalized healthcare solutions, leveraging advancements in genomics, artificial intelligence, and biotechnology, can create unique offerings that distinguish them from traditional healthcare providers (Chen, 2023). This approach allows enterprises to offer customized care for aging-related conditions, leveraging individual genetic profiles or health data, increasingly attracting customers willing to pay a premium for personalized services. The differentiation strategy aligns closely with the development of precision medicine, where AI-powered diagnostics analyze patient data in real-time to offer tailored healthcare interventions. Such innovations have positioned several firms at the forefront of longevity technology, capturing significant market share by providing value that is difficult for competitors to replicate (Fleisch et al., 2021).

Additionally, many longevity firms employ a focus strategy by targeting niche markets. For instance, startups and established firms have specialized in anti-aging therapies or digital health solutions that serve specific demographics, such as the elderly or high-net-worth individuals (Statista, 2023). By prioritizing distinct customer segments with unique health requirements, such as long-term wellness management or preventive care, companies can cultivate a competitive edge through their specialized offerings (Chen, 2023). While the cost leadership strategy is less common in the high-tech, innovation-led longevity domain, it still holds viable opportunities, particularly in digital health services. As wearable technology and AI become more mainstream, companies can scale operations and reduce the cost of services such as telemedicine, remote monitoring, and online consultations. These options increase accessibility to healthcare services and also considerably lessen the demands placed on established healthcare systems (Digital Health Report, 2023).

Beyond Porter's framework, other strategic management theories provide valuable insights into the longevity industry's dynamics. The firm's resource-based view (RBV) (Barney, 1991) is particularly relevant, as companies in this sector often develop unique and valuable resources, such as proprietary technologies, specialized knowledge, and extensive health data sets, to distinguish themselves from their peers. Idiosyncratic resources, which are rare, inimitable, and non-substitutable, can contribute towards creating sustainable competitive advantages in the rapidly evolving healthcare landscape, notwithstanding shortcomings of the RBV about the ability of these factors to predict superior performance and circularity and tautology in the definition. Dynamic capabilities associated with sensing and seizing opportunities (Teece et al., 1997) are also helpful when applied to the fast-paced longevity sector. To make Teece’s

formulation more precise and actionable in his reconceptualization of Dynamic Capabilities as a multidimensional construct with four key dimensions, Barreto states that Dynamic Capabilities consist of a firm's ability to (1) sense opportunities and threats, (2) make timely and market-oriented decisions, (3) adapt the firm's resource base, and (4) reconfigure resources to align with evolving market demands (Barreto, 2010). Successful companies must continuously integrate, build, and reconfigure their competencies to address rapidly changing environments and technologies. This is evident in how longevity firms adapt to new scientific discoveries, regulatory changes, and evolving consumer preferences.

The notion of ambidexterity (O'Reilly & Tushman, 2008) also applies to the longevity industry, as companies must balance exploitation (improving existing products and services) with exploration (developing innovations). For instance, a company might need to refine its current gene therapy treatments while exploring new AI applications in predictive healthcare. Lastly, the Blue Ocean strategy (Kim & Mauborgne, 2004) is also relevant to many longevity companies endeavoring to create uncontested market spaces by offering innovative products and services that do not yet exist, rather than competing in established markets. For example, companies developing personalized anti-aging therapies based on individual genetic profiles create new market segments.

2.5 How Longevity Can Disrupt Traditional Healthcare

The longevity industry's potential to disrupt traditional healthcare extends beyond merely addressing aging mechanisms. It represents a fundamental shift in healthcare paradigms, moving from a reactive, disease-focused model to a proactive, preventive approach. This transformation aligns with disruptive innovation, where new technologies create new markets and value networks, initially used by niche early adopters, eventually displacing established market leaders and alliances as they go mainstream (Christensen, 1997). At the core of this disruption is the integration of biotechnology with digital health technologies. Advancements in gene therapy, regenerative medicine, and stem cell therapies are increasingly being used to repair or reverse aging-related cellular deterioration (Neves, 2017). These innovations can potentially address fundamental aging issues, including cellular senescence and telomere shortening, which are linked to the emergence of chronic diseases such as Alzheimer's and cardiovascular disorders (Florea et al., 2023). By taking proactive measures early in the aging process, longevity-focused companies can potentially prevent or significantly delay the onset

of these conditions, thereby reducing long-term pressures on traditional healthcare systems. This approach exemplifies value innovation, as described in the Blue Ocean Strategy (Kim & Mauborgne, 2005). Longevity companies are creating uncontested market space by simultaneously pursuing differentiation and low cost, offering preventive solutions that traditional healthcare has not prioritized. Digital health technologies facilitate real-time health monitoring, particularly wearable devices and AI-based diagnostic tools. These innovations generate a constant flow of data supporting early identification of health concerns before they become severe illnesses (Fleisch et al., 2021). For instance, wearable biometric devices can track essential physiological parameters and identify irregularities that may indicate the onset of conditions like hypertension, diabetes, or neurodegenerative diseases (Statista, 2023). This shift towards continuous monitoring and early intervention aligns with the dynamic capabilities framework (Teece et al., 1997; Barreto, 2010), as it requires healthcare providers to continuously adapt and reconfigure their competencies to address rapidly changing patient needs and technological capabilities.

The rise of digital health technologies has led to a growing emphasis on preventive healthcare, decreasing reliance on expensive hospital services and long-term care typical of traditional healthcare approaches. This shift represents a form of architectural innovation (Henderson & Clark, 1990), where the reconfiguration of existing components in the healthcare system creates entirely new possibilities for care delivery. The global digital health industry is anticipated to reach $275 billion by 2028, primarily fueled by innovations in wearable devices, telehealth, and AI-driven diagnostics (Digital Health Report, 2023). This expansion reflects a significant change in consumer expectations, as patients increasingly demand healthcare options that provide ongoing monitoring and personalized treatment strategies. Traditional healthcare, which tends to focus on episodic and disease-oriented care, struggles to fulfill this need, thereby establishing the longevity sector as a potential major disruptor. The longevity industry also poses a significant challenge to the pharmaceutical sector, which has historically concentrated on managing chronic illnesses through extended medication protocols. This disruption aligns with the concept of competence-destroying innovation (Tushman & Anderson, 1986), where new technologies render existing competencies obsolete. Longevity research is pushing innovations in anti-aging treatments and biotechnological advancements, offering opportunities for more definitive solutions that could potentially diminish reliance on continuous pharmaceutical interventions. Should gene therapies or regenerative medicine successfully address or prevent chronic conditions linked to aging, pharmaceutical firms may experience a

decline in their traditional revenue sources (Chen, 2023). This shift is particularly pronounced in the realm of neurodegenerative disorders, such as Alzheimer's and Parkinson's, where the longevity sector is currently expanding prevention and treatment possibilities (Michaud & St. Amour, 2023). These advancements represent a form of radical innovation, challenging the core competencies of traditional pharmaceutical companies and requiring them to adapt or risk obsolescence.

The disruptive potential of the longevity industry also presents challenges. Traditional healthcare systems, with their established infrastructure and practices, may resist rapid changes, exemplifying the concept of organizational inertia (Hannan & Freeman, 1984). There are also concerns about equity and access, as longevity technologies may initially be available only to those who can afford them, potentially exacerbating health disparities (Chen, 2023). In conclusion, the longevity industry is poised to disrupt traditional healthcare on multiple fronts, from diagnostics and treatment approaches to care delivery models and financing structures. Shifting the focus from disease management to health optimization and prevention challenges fundamental aspects of how healthcare has been practiced for decades. As this disruption unfolds, addressing challenges related to integration, regulation, and equitable access will be crucial to ensure that the benefits of longevity innovations are widely accessible and contribute to improving health outcomes for all. The success of this transition will depend on the ability of both new entrants and established players to navigate this complex landscape, leveraging theories of innovation and strategic management to create sustainable value in this emerging field.

2.6 Role of Investments in Development

Investment plays a pivotal role in driving the development and innovation of the longevity industry. The influx of capital, mainly through venture capital, institutional funding, and public-private partnerships, is a crucial catalyst for growth in this sector. As global demographics shift towards an aging population, the demand for solutions to extend healthspan increases, making financial backing for longevity technologies increasingly important.

From an RBV perspective (Barney, 1991), companies in the longevity sector often develop unique and valuable resources, such as proprietary technologies, specialized knowledge, and extensive health data sets. These resources, which are to be collected, rare, inimitable, and non-substitutable, can provide sustainable competitive advantages. However, developing such

resources requires significant capital investment, particularly in the early stages of research and development.

Venture capital has been instrumental in the growth of many longevity-focused companies, particularly those operating at the intersection of biotechnology and digital health. These firms often work on high-risk, high-reward projects such as gene therapies, regenerative medicine, and aging biomarkers, which require significant upfront investment but promise substantial returns if successful. In recent years, venture capital investment in health technology has surged, funneling billions of dollars into biotech startups focused on extending healthspan and addressing age-related diseases (Michaud & St. Amour, 2023). VC investments typically have a horizon of 5-7 years, which can be insufficient for the lengthy clinical trials and regulatory approvals required in healthcare (Mekniran & Kowatsch, 2023). This short-term focus contrasts with the need for long-term public funding, which aligns better with the extended timelines necessary for developing and validating new longevity technologies (OECD, 2024).

Public funding is compatible with the longevity industry's needs because it can provide sustained financial support over decades, accommodating the slow and rigorous clinical research and development process. The OECD guidelines show the importance of long-term investment in health innovation to address aging populations and rising healthcare costs. Public investments can bridge the gap left by VC's shorter timelines, ensuring that promising technologies receive the necessary support to reach market maturity.

The digital health market, a significant segment of the longevity industry, has experienced remarkable growth. Between 2020 and 2023, it expanded from $110 billion to $230 billion, driven by several key factors, including the COVID-19 pandemic, which accelerated the adoption of digital healthcare solutions such as telemedicine and AI-powered diagnostics (Statista, 2023). The global digital health market is projected to exceed $1 trillion by 2028 (Deloitte, 2023), indicating the massive potential for growth and investment in this sector.
Despite this growth, the current level of investment in longevity research and development remains insufficient compared to the industry's potential impact and market size. The OECD guidelines on health spending and financial sustainability highlight the need for increased investment in preventive care and innovative health technologies to address the challenges of aging populations and rising healthcare costs (OECD, 2024).

The OECD analysis suggests four policy levers for financing more resilient health systems: 1) increasing government spending, 2) increasing the allocation to health within current budgets, 3) reassessing the boundaries between public and private spending, and 4) maximizing efficiency gains. These levers are particularly relevant to the longevity industry, where public-private partnerships and efficient allocation of resources are crucial for advancing research and bringing innovations to market. Public-private partnerships play a critical role in advancing the longevity industry. These collaborations often facilitate large-scale, long-term clinical trials, the development of regulatory frameworks, and efforts to ensure equitable distribution of new therapies and technologies (Chen, 2023). Such partnerships exemplify open innovation (Chesbrough, 2003), where firms leverage both external and internal ideas and paths to market to advance their technology. Despite the influx of private and public investment, there remains a gap in public funding for longevity-focused research, particularly in early-stage projects that carry higher risks. This gap presents both a challenge and an opportunity for the industry. From a strategic management perspective, firms that can successfully navigate this funding landscape and secure resources for high-risk, high-potential projects may gain significant first-mover advantages (Lieberman & Montgomery, 1988). OECD projections indicate that over the long term, growth in health spending from public sources is projected to be twice the average growth in government revenues (2.6% and 1.3%, respectively, on average across OECD countries). This trend underscores the need for innovative financing models and increased efficiency in healthcare delivery, areas where longevity technologies could play a crucial role.

2.7 Risk Factors for the Longevity Industry (Regional and Global)

While promising significant advancements in healthcare and human lifespan, the longevity industry faces several risk factors that could impede its development and global adoption. These risks encompass regulatory challenges, public trust issues, scalability concerns, and disparities in access to longevity technologies across different regions. Analyzing these risks through the lens of strategic management theories provides valuable insights into the industry's future trajectory.

One of the most salient challenges the industry faces is regulatory uncertainty. The rapid pace of biotechnology and digital health innovation often outstrips existing regulatory frameworks (Chen, 2023). This situation aligns with the concept of institutional voids in emerging markets (Khanna & Palepu, 2010), where the absence of specialized intermediaries, regulatory systems, and contract-enforcing mechanisms creates challenges for industry growth. For instance, gene

therapy and regenerative medicine approaches require new safety and efficacy standards, potentially slowing down the adoption of new treatments and technologies, particularly in countries with stringent approval processes (Michaud & St. Amour, 2023). The disparity in regulatory frameworks across regions creates barriers to scaling innovations globally, exemplifying the challenges of institutional distance in international business (Kostova & Zaheer, 1999). While some countries may quickly adopt new technologies, others may lag due to more conservative or less developed regulatory systems (Fleisch et al., 2021). This regulatory fragmentation can lead to a disjointed global market for longevity technologies, potentially limiting their overall impact and accessibility.

Public trust and ethical concerns represent another significant risk factor. The industry's exploration of technologies such as genetic editing has raised concerns over ethical implications. This situation reflects the importance of legitimacy in organizational theory (Suchman, 1995), where companies must comply with legal requirements and meet societal expectations to gain acceptance. Public skepticism about the safety and ethicality of altering human biology, primarily through methods like CRISPR and stem cell therapies, poses a barrier to widespread acceptance of longevity technologies (Sinclair, 2024). Additionally, the potential exacerbation of healthcare inequalities—where only wealthy individuals can afford life-extending treatments—fuels public distrust and raises concerns about fairness and accessibility (Chen, 2023).To address these concerns, companies must engage in strategic corporate social responsibility (CSR) activities (Porter & Kramer, 2006). This involves ensuring transparency in research and development processes, engaging in ethical debates, and working towards making innovations accessible to a broader range of consumers.

Scalability poses a significant challenge for the longevity industry, particularly in cost and infrastructure. Many treatments and technologies developed within the industry, such as gene therapies or advanced regenerative medicine, are expensive and require specialized knowledge and infrastructure (Neves, 2021). From an economies of scale perspective, these high fixed costs and specialized requirements make it difficult for companies to achieve the scale necessary to reduce per-unit costs and make these treatments widely accessible. While these specialized resources differentiate firms, they limit scalability due to their rarity and inimitability. Moreover, developing and scaling these technologies can be prohibitive, making it difficult for smaller companies or regions with fewer resources to participate in the longevity

revolution (Statista, 2023). This aligns with resource heterogeneity in RBV, where firms with superior resources are better positioned to succeed and scale their operations.

Global inequalities in healthcare access and investment represent a further risk for the longevity industry. This situation reflects the challenges of base-of-the-pyramid (BoP) markets in strategic management (Prahalad & Hart, 2002). While regions like North America, Europe, and parts of Asia are seeing significant investments in biotechnology and digital health, other areas, particularly developing nations, are lagging, hindering equity in healthcare access. This disparity creates a divide between those who can afford and access longevity-enhancing solutions and those who cannot (Petretto & Pili, 2021). Addressing this issue requires innovative business models that can serve BoP markets while maintaining profitability, a challenge that aligns with frugal innovation (Zeschky et al., 2011).

In conclusion, while the longevity industry holds significant promise, it faces numerous risks that must be addressed to ensure its continued development and global adoption. By viewing these challenges through the lens of strategic management theories, industry players can develop more effective strategies to mitigate risks and capitalize on opportunities. The industry's success will depend on its ability to navigate regulatory complexities, build public trust, achieve scalability, and address global inequalities in access to longevity technologies.

3 Methodology

3.1 Research Design

This research adopts a triangulated approach to develop the drivers of longevity technologies and their role in disrupting traditional healthcare models. Triangulation, as defined by Flick (2002), integrates multiple data sources and methodologies to enhance the robustness and validity of findings. Qualitative data were obtained through semi-structured interviews with stakeholders in the longevity industry, including venture capitalists, startup founders, CEOs, and researchers, offering nuanced perspectives on industry dynamics. Quantitative data were gathered through a structured survey of over 130 respondents from various demographic backgrounds. These methods were complemented by secondary data derived from the Pitchbook database, providing an overview of investment trends and activity in longevity-focused startups.

The integration of qualitative interviews, survey data, a secondary dataset analysis, and financial data ensures a holistic exploration of the research question. Qualitative insights were analyzed thematically, enabling the identification of key themes related to investment patterns, technological scalability, and regulatory challenges (Mayring, 2000). Quantitative survey responses were examined using statistical techniques, including descriptive analysis and regression models, to uncover influential factors in consumer attitudes toward longevity technologies. Findings from these methods were reconciled with insights from the literature review to identify strategic opportunities for scaling longevity startups and achieving disruption in healthcare.

3.2 Primary Data - Qualitative Surveys

Semi-structured interviews served as the primary qualitative data collection method, enabling an in-depth exploration of expert perspectives in the longevity industry. This approach allowed for discussions while providing flexibility to adapt to emerging themes during the interview process (Seidman, 2006). The interviews were designed around four key pillars to understanding the field: the societal impact of technologies, barriers to innovation, the dynamics between public and private funding, and identifying the most promising developments within the longevity sector.

Understanding the societal impact of technologies focused on seeing how advancements in longevity affect healthcare systems, demographics, and social structures. Discussions about barriers to innovation addressed challenges such as regulatory hurdles, scalability of technologies, and market readiness. Public versus private funding examined the roles of venture capital, government funding, and alternative funding mechanisms in driving growth and innovation. Finally, exploring the most promising developments sought to identify key technological breakthroughs and trends that could redefine the sector. These themes were informed by a comprehensive literature review, which established their relevance as the grounding for further research (Rowley, 2012). Follow-up questions were used to refine the understanding, ensuring the collected data was contextually rich (Turner, 2014). Likert-scale items were occasionally incorporated to transform qualitative insights into measurable data (Joshi et al., 2015).

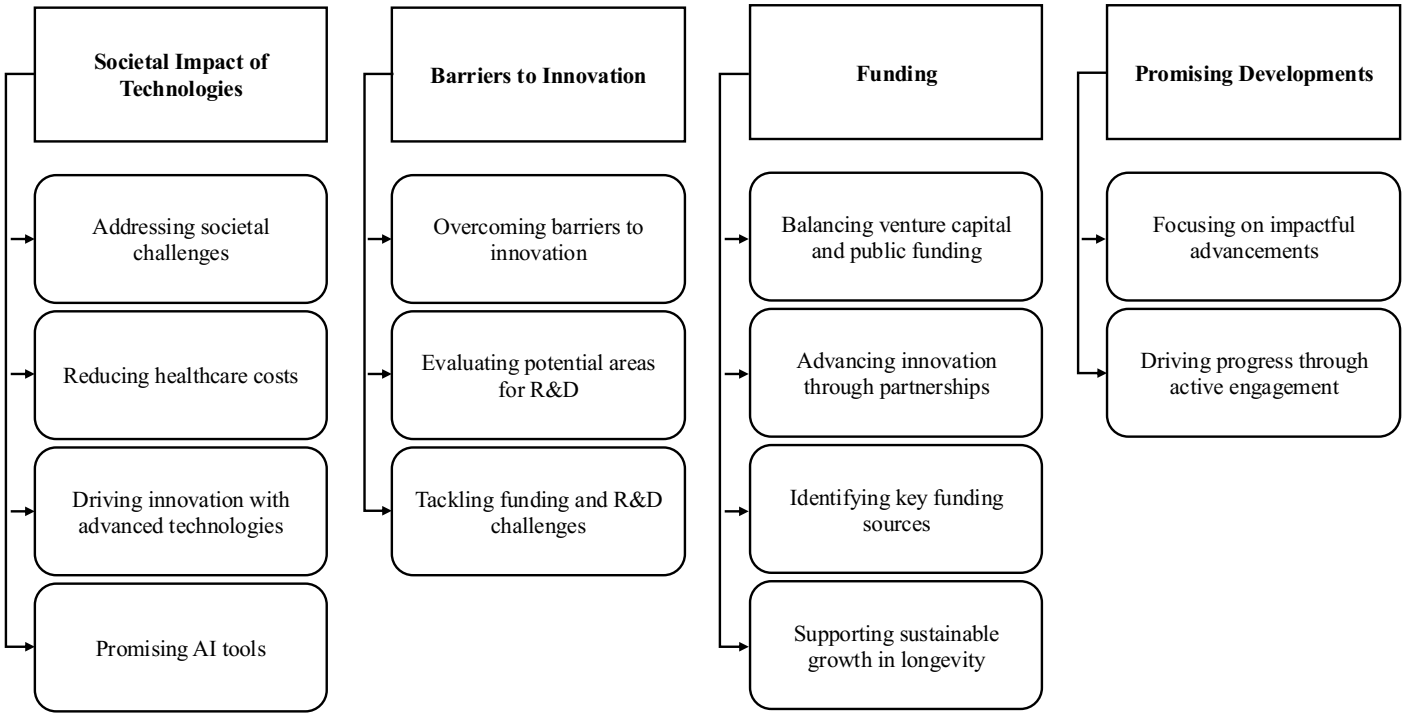

Table 1: Interview Questions Topics

Participants, including C-level executives, startup founders, investors, and researchers, were selected based on their expertise and active involvement in the longevity sector. Prospective interviewees were contacted via LinkedIn and direct email. The interviews, lasting 30 to 45 minutes, were conducted virtually through platforms such as Zoom, Google Meet, and Microsoft Teams to accommodate participants across diverse geographic locations. Each session was recorded with the participants' informed consent and transcribed verbatim to ensure accuracy in subsequent analysis.

The qualitative data collected through these interviews were analyzed using the thematic approach outlined by Mayring (2000), enabling the identification of recurring patterns, unique insights, and contrasts across different perspectives. This method provided a robust foundation for integrating the findings into the broader research framework, ensuring a nuanced understanding of the interplay between technology, funding, and societal change in the longevity sector.

The respondents' current positions, the markets in which they operate, and their estimated company turnover or fund sizes are summarized in the table below.

Interview ID	**Position**	**Country**	**Revenue or Fund Size Estimate**
IV1	Female Founder and CFO at Telehealth Company	GER	≈ 1-2 Billion
IV2	Male Researcher/Scientist at Leading Swiss University	CH	N/A
IV3	Male Investor at VC (VC/Private Equity)	GER	≈ 150 Million
IV4	Male Founder CEO at Health Startup	AUT	≈ 1 Million
IV5	Male Founder CEO at Health Startup	GER	N/A
IV6	Male Investor at Family Office (VC/Private Equity)	GER	≈ 3 Billion
IV7	Male Founder CTO at Health Startup	GER	≈ 1 Million
IV8	Male Healthcare Executive at Albert Einstein College of Medicine	USA/ISR	N/A
IV9	Female Investor Longevity VC (VC/Private Equity)	GER	≈ 150 Million
IV10	Male Founder/CEO/CTO/CFO/COO	GER	≈ 1 Million
IV11	Male Founder of the biggest Longevity platform	UK	≈ 5 Million
IV12	Male Healthcare Professional at NYU	USA	N/A
IV13	Male Investor at Multinational Corporate VC (VC/Private Equity)	GER	≈ 5-10 Billion
IV14	Female Investor and Healthcare Professional (VC/Private Equity)	USA	N/A
IV15	Female VP at one of the largest wearable start-ups	USA	≈ 250 Million
IV 16	Female VP leading healthcare at Tech Company	ITA/BEL	211 Billion

Table 2: Interview Partners of Semi-Structured Interviews

After reviewing and correcting the auto-transcripts, the interviews were re-examined, and thematic codes were assigned using the Atlas.ti software. This code system (see Table 2) was initially developed deductively based on existing literature relevant to the research questions. However, an inductive approach was also employed to incorporate emerging topics identified

during the interviews, adding additional codes after the interviews were conducted (Mayring, 2000). The resulting coded interview segments served as the foundation for the results section of this study.

3.3 Primary Data Collection – Quantitative Survey data

A survey was conducted to gain insights into consumer perspectives on longevity-related innovations and their potential to disrupt traditional healthcare systems. The survey focused on five key areas, including Adoption and Future Use, exploring current use and willingness-to-adopt longevity innovations, Barriers, and Incentives, identifying key obstacles, spending capacity and the role of government funding. Analyzing the influence of healthcare professionals, data-sharing attitudes, and the disruptive potential of innovations; Technology Impact and finally assessing views on impactful digital health technologies and *Demographics*, capturing respondent characteristics.

The survey was distributed in a self-administered format online via Qualtrics, ensuring cost efficiency and rapid response collection (Evans & Mathur, 2005). It utilized a combination of Likert scales, multiple-choice questions and ranking options to quantify attitudes and behaviors. The survey was designed to minimize respondent fatigue and maximize clarity while ensuring anonymity for unbiased responses.

3.4 Secondary Data Collection – Financial and Funding Data from Pitchbook

This study utilized secondary data from Pitchbook to analyze financing activities in the longevity sector from 2014 to 2023 and the first two quarters of 2024. The dataset, retrieved in September 2024, included insights from 1,276 companies, providing an overview of funding trends and deal types. These included Accelerator/Incubator funding, Angel investments, Corporate funding, Early and Late-Stage Venture Capital, Equity Crowdfunding, IPOs, Private Equity Growth/Expansion rounds, PIPEs, Public Secondary Offerings and Seed rounds (Kaplan, 2016).

The analysis focused on historical trends and funding volumes to assess alignment with or deviations from past patterns. This approach addressed challenges such as reporting delays and inconsistencies in private market datasets (Kaplan, 2016). Cross-referencing with external insights highlighted the role of targeted investments in advancing technologies within the longevity sector (Predin, 2023). The study also examined whether shifts in deal counts

correlated with changes in average ticket sizes, offering a perspective on the industry's maturity and ability to attract larger-scale investments.

4 Analysis of Interviews

4.1 Qualitative Analysis of Interviews

4.1.1 Reducing the Economic Burden of Chronic Diseases Through Longevity Technologies

Innovations can significantly reduce the economic burden of chronic diseases by implementing early detection and prevention. Advanced diagnostic tools, wearable devices and AI-driven analytics enable proactive health monitoring, allowing risks to be identified and managed before they escalate into chronic conditions. This shift reduces hospitalizations, minimizes frequent doctor visits, and enables a more resource-efficient healthcare system. By transitioning from a reactive "sick-care" model to a proactive, preventive approach, these innovations support the creation of a more sustainable healthcare framework (IV13, IV6, IV11, IV10, IV5, IV14, IV9, IV16). Increased workforce productivity is another benefit. Chronic diseases often lead to absenteeism and reduced workplace efficiency, but early interventions can help individuals stay healthier longer, decreasing sick days and enhancing economic output. Reducing the prevalence of chronic illnesses also alleviates financial and operational pressures on healthcare systems and businesses, highlighting the broader societal benefits of longevity advancements. Medical Drugs like metformin further demonstrate the potential for significant global economic savings by delaying the onset of chronic conditions (IV2, IV3, IV13, IV8, IV12, IV5, IV4, IV1).

Experts underlined the role of proactive interventions in compressing comorbidities and tailoring treatment plans to individual needs. Tools that empower self-management, such as personalized monitoring systems and accessible medical information platforms, are essential for promoting equity in aging and reducing illness prevalence. Coupled with sleep, nutrition and exercise education, these technologies offer scalable solutions for improving public health outcomes, particularly in underprivileged communities (IV13, IV6, IV12, IV11, IV7, IV14). A governance shift is also necessary to prioritize prevention and early detection in healthcare systems. Systemic reforms that integrate longevity technologies into policies and funding frameworks can transform healthcare into a proactive, cost-effective model. Scalable interventions, including personalized medicine and AI-driven diagnostics, address the root causes of chronic diseases, reducing treatment costs and optimizing resource allocation (IV1,

IV11, IV2, IV8, IV6, IV14, IV16). These innovations not only tackle significant health challenges like diabetes, heart disease and dementia but also create a foundation for long-term public health improvement.

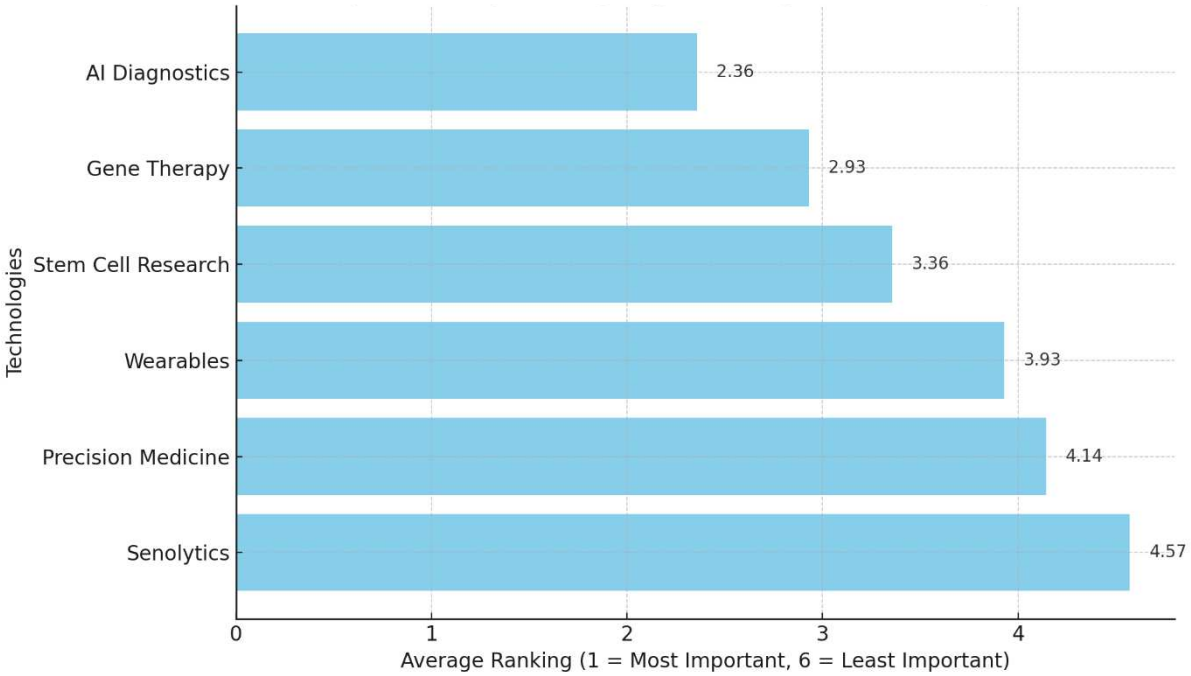

Figure 1: Expert Rankings of Longevity Technologies based on Importance

The diagram above visualizes the expert rankings of longevity technologies based on their importance for driving innovation in the industry. The x-axis represents the average ranking (on a scale from 1 to 6), where 1 denotes the highest importance, and the y-axis lists the technologies being evaluated.

4.1.2 Revolutionizing or Integrating - The Role of Diagnostic and Prevention Tools in Healthcare

Experts were divided on whether Longevity will revolutionize the industry or integrate into existing systems. Most believed these tools will complement current healthcare frameworks, enhancing workflows and preventive care without replacing hospital-centered structures. Integration is seen as scalable and accessible, though the rigidity of public healthcare systems could hinder adoption. Experts stressed the need for purposeful integration to deliver meaningful outcomes for patients and providers (IV3, IV12, IV7, IV5, IV13, IV8, IV6, IV14). A gradual adaptation process is anticipated, as hospitals and healthcare providers adjust operational frameworks to accommodate new technologies. This step-by-step approach is

essential to ensure seamless adoption by professionals, patients and industries (IV2, IV4, IV16). However, some experts argued these tools could fundamentally transform healthcare, shifting focus from treatment to prevention and personalization. Advancements in AI and wearable technology are cited as catalysts for decentralizing care and empowering individuals to manage their health independently (IV11, IV10, IV9, IV1).

Challenges remain, particularly resistance from stakeholders like the pharmaceutical industry, which may prefer to maintain traditional revenue streams. Governance frameworks and industry partnerships will determine whether these technologies achieve widespread integration or remain confined to niche markets (IV16). The ultimate success of these tools depends on balancing innovation with accessibility. Equitable integration into healthcare systems is essential to ensure their benefits extend beyond self-paying individuals, requiring collaboration among governments, providers, and technology developers build on long-term scalability and inclusivity (IV3, IV5, IV12).

4.1.3 Barriers to Innovation in the Longevity Sector

Despite its transformative potential to revolutionize healthcare and improve quality of life, the sector faces several significant barriers that hinder innovation and growth. These challenges arise from regulatory, financial, societal, and technical complexities, collectively slowing the development and adoption of new technologies. Regulatory hurdles are consistently identified as obstacles, as the complexity and variability of frameworks across regions delay the approval and implementation of therapies and technologies. The fragmented nature of global regulations further complicates compliance, making it difficult for innovators to navigate efficiently. Experts stressed the need for streamlined processes and international collaboration to create a more supportive environment for innovation in longevity (IV3, IV4, IV5, IV7, IV9, IV10, IV13, IV14, IV16).

A lack of long-term funding options also poses a significant challenge. The substantial upfront investments and lengthy development timelines required for longevity technologies are often misaligned with the shorter-term focus of traditional investment cycles, such as venture capital ones. Without sufficient long-term funding, many promising projects remain stuck in early stages of development. Increased government involvement and dedicated funding programs are necessary to address this gap fueling sustained innovation (IV8, IV9, IV11, IV13). Public

skepticism about new technologies adds another layer of difficulty. This skepticism fuels concerns about safety, efficacy, and long-term implications, often stemming from misinformation, lack of understanding, or distrust in the organizations promoting these innovations. Experts underscore the importance of transparency and public education to build trust, mitigate misconceptions, and encourage widespread acceptance of longevity solutions (IV2, IV4, IV6, IV13).

High research and development costs further compound the challenges facing the sector. Technologies such as gene therapy, stem cell research, and senotherapeutics require intensive scientific exploration and technical expertise, leading to substantial financial demands. These costs are heightened by the uncertainty of achieving successful outcomes, making it difficult for companies to sustain R&D efforts over time. Collaborative funding models and partnerships are essential to distributing risks and reducing financial burdens across stakeholders (IV9, IV13, IV14). Technology-specific challenges also slow progress in the sector. AI diagnostics and wearables, for example, have made advancements in preventive healthcare but face limitations in integration due to regulatory and infrastructural constraints. Similarly, gene therapy and stem cell research are impeded by high costs and complex regulations, despite their revolutionary potential in regeneration and cellular reprogramming. Experts highlight the need for targeted policy support and investments tailored to address these unique barriers, ensuring that emerging innovations can realize their full potential (IV3, IV6, IV7, IV9, IV13, IV14).

4.1.4 Challenges in Securing Venture Capital and State-Backed Funding for Longevity Startups

Securing adequate funding is challenging for founders in the longevity sector due to its unique characteristics, including long development cycles, high costs, and the need to balance short-term financial goals with long-term societal benefits. Venture capital (VC) funding, while offering agility and access to resources, poses significant challenges for longevity startups. Many VC investors prioritize quick returns, creating difficulties for projects with extended research and development timelines. The high costs of clinical trials and regulatory approvals, which often exceed the typical investment scope of VC firms, exacerbate these challenges (IV2, IV7, IV12). Additionally, the novelty of the longevity sector creates a steep learning curve for investors, leaving only a small subset of funds specializing in this field. This misalignment between the technical complexity of longevity projects and investor understanding further

complicates funding efforts (IV8, IV13). A particular challenge arises with prevention-focused products, which often struggle to present an attractive business model to VC investors. This misalignment between societal value and financial return has forced some startups to pivot toward more immediately profitable but less impactful products, such as supplements (IV2, IV11, IV13). These dynamics highlight the difficulties of balancing profitability with the sector's broader goals, particularly without patient investors who understand the unique demands of longevity innovation. State-backed funding, in contrast, offers long-term stability and essential support for foundational research. Founders frequently rely on government support during the pre-seed stage, as it provides non-dilutive funding crucial for early-stage research and development (IV4, IV10, IV11, IV14). However, the bureaucratic processes, extensive documentation requirements, and slow pace of state-backed funding often delay the allocation of resources and hinder responsiveness to the fast-paced demands of the longevity sector (IV1, IV7, IV10, IV14, IV16). Despite these challenges, state-backed funding remains indispensable for high-risk, niche markets where private investors may hesitate to engage. The sector’s unique funding needs include significant costs associated with evidence generation, high scientific and technical risks, and early-stage market nature. Founders pointed out that the sector's long development cycles and niche focus deter traditional investors. The lack of precise customer needs and uncertain time horizons further complicate funding efforts (IV4, IV6, IV9, IV13). Experts proposed fostering collaboration between public and private funding sources to address these challenges, balancing the short-term focus of VC with the long-term stability of state-backed funding. Pharma companies also play a crucial role in bridging this gap, as demonstrated by initiatives from firms like Eli Lilly and GSK, which have contributed significant resources to age-related research (IV11).

To navigate the complex funding landscape, many participants advocated for a balanced funding model, suggesting an equal split between venture capital and public funding to sustain an innovation ecosystem. Venture capital provides the agility and risk tolerance necessary for scaling experimental projects, while public financing ensures foundational research and societal benefits (IV1, IV2, IV3, IV4, IV5, IV7, IV8, IV10, IV11, IV12, IV14, IV15, IV16). Other variations were suggested based on project stage and nature. A 60/40 split favoring public funding was recommended for foundational research requiring long-term stability. In comparison, a 70/30 split favoring private funding was seen as ideal for experimental projects needing rapid iteration and scalability (IV6, IV9, IV13).

The role of public funding extends beyond financial support to address broader societal challenges. It prioritizes accessibility and equity, ensuring that innovations benefit diverse demographics and address systemic healthcare issues. Nevertheless, the rigidity and slow pace of public funding processes often limit their effectiveness, underscoring the need for reforms to make these mechanisms more adaptable to the fast-evolving demands of the sector (IV1, IV7, IV10, IV14, IV16).

Venture capital, on the other hand, excels at driving rapid experimentation and growth. Its flexibility and speed allow startups to quickly scale and adapt to market demands, with additional benefits such as strategic guidance and mentorship. These aspects are particularly valuable for later-stage development and experimental projects (IV4, IV5, IV13, IV14, IV16). However, many VC investors' short-term focus (5 - 7 years) can create misalignments with the longevity sector's extended timelines and high costs. The sector's novelty further compounds these challenges, requiring patience and expertise from investors (IV2, IV7, IV12).
The unique requirements of the longevity sector necessitate funding models that support foundational research and market scalability. Non-dilutive funding options, such as grants and partnerships with pharmaceutical companies, were recommended to complement VC and public funding. Advisors and sector-specific investors who understand the technical and market complexities of longevity innovation are crucial for guiding startups through regulatory challenges, managing risks, and aligning goals with market needs (IV4, IV10, IV11, IV14). This collaborative approach, combining public funding stability with VC agility and private sector partnerships, offers a potential pathway to address the sector's funding challenges while helping to achieve sustainable growth and innovation.

4.1.5 The Role of Public-Private Partnerships

Public-private partnerships (PPPs) are emerging as a promising solution to these challenges. By combining the strengths of venture capital and public funding, PPPs offer a more balanced approach to advancing longevity technologies. Public financing provides the stability and support needed for high-risk, long-term research, ensuring that projects with significant societal value are not overlooked. Private funding, on the other hand, drives innovation and scalability, helping startups bring products to market more efficiently. Together, these complementary funding sources create a synergistic system that maximizes the impact of investments in longevity research and development (IV3, IV5, IV6, IV9).

Misaligned priorities between public entities and private investors often lead to tensions, as public stakeholders focus more on societal benefits while private investors prioritize financial returns. Additionally, bureaucratic delays and the complexities of coordinating multiple stakeholders can hinder the effectiveness of founders steering their startups toward success (IV3, IV5, IV10, IV15).

4.1.6 Expert Perspectives on Growth Areas in the Longevity Industry

Experts highlighted specific technologies and approaches poised for significant growth in the coming years. Personalized supplements have emerged as commercially appealing and practical, often more readily embraced by consumers than foundational health improvements like sleep or exercise. Although their direct impact on longevity may be limited, these supplements serve as a gateway for broader health engagement. Blood biomarker tracking is emphasized as a key tool to measure and validate their effects. However, experts critiqued the lack of robust evidence supporting many supplements and stressed the need for better education and objective health tracking through regular blood tests (IV1, IV9, IV12, IV13, IV14, IV16).

AI-powered diagnostics have also been identified as a crucial area for growth, particularly in enhancing preventive healthcare. Experts noted that the necessary data already exists, but its full potential requires advanced machine learning models to analyze data points effectively. These tools promise innovation by enabling real-time risk assessment, disease prediction, and tailored health plans, making preventive healthcare more scalable and impactful across diverse populations (IV1, IV6, IV15, IV16). Similarly, non-invasive diagnostic tools and AI-powered wearables are gaining traction as transformative technologies. These innovations enable painless, real-time health tracking through devices like advanced blood monitors and wearables, significantly improving accessibility and reducing barriers to regular health assessments. By empowering individuals with user-friendly platforms, these tools align with the broader trend of decentralizing healthcare and promoting proactive health management. When combined with AI-driven systems, wearables deliver personalized, real-time health feedback, enhance early detection of health issues, and reduce strain on traditional healthcare systems. Integrating health data analytics into these devices further allows users to make informed decisions about their well-being. It contributes to doctor databases to comprehensively understand patient lifestyles, fitness, and other health metrics. These advancements represent a societal shift toward moving

healthcare closer to the individual and reducing reliance on centralized systems (IV1, IV6, IV11, IV12, IV14, IV16).

Biomarker-based health monitoring is another growth area, with tools like epigenetic clocks playing a pivotal role in measuring biological aging and validating interventions. These biomarkers are essential for assessing the efficacy of longevity-focused interventions, including pharmaceuticals such as GLP-1 agonists. Experts expressed the importance of reaching a consensus on biomarker validation to attract investment and accelerate clinical adoption. GLP-1 agonists, traditionally used to treat type 2 diabetes and obesity, are being explored for their potential in regulating metabolism, reduce inflammation, and influencing aging pathways. Experts anticipated these therapies becoming a cornerstone of longevity-focused healthcare, with applications extending to metabolic disorders and broader healthspan improvement (IV9, IV11).

Personalized diet plans, informed by genetic and lifestyle factors, are frequently highlighted as an underexplored area with significant potential. Tailored nutrition offers opportunities to prevent chronic diseases and optimize individual health outcomes. Leveraging AI and real-world evidence to design and implement these solutions can further enhance their effectiveness and reach (IV1, IV9, IV14, IV 16). Additionally, health literacy and consumer education remain essential for adopting longevity technologies. Experts also underlined that individuals must be better informed about using advanced devices and effectively interpreting health data. Platforms focused on user engagement and health education are expected to grow significantly, complementing the adoption of new diagnostics and therapeutics (IV10). These advancements signal a shift toward a more personalized, data-driven, and proactive approach to healthcare and longevity.

4.1.7 AI Tools Driving Longevity and Healthcare Progress

AI tools are transforming the longevity and healthcare sectors, with platforms like Freenome, PathAI, and Gero spearheading advancements in oncology diagnostics, drug discovery, and aging research. Gero, for example, models biological aging to explore interventions that could slow or reverse aging processes (IV1, IV6, IV8). Tools like Mito Health and WHOOP specialize in monitoring metabolic and physical performance, with WHOOP providing personalized insights into fitness and recovery, aligning with the broader goal of optimizing

healthspan (IV6, IV7). AI-powered platforms such as Zebra Medical and BioAge Labs advance drug discovery by identifying novel molecules and targeting aging-specific pathways, marking a pivotal intersection between biotech and pharmaceutical innovation (IV4, IV8, IV9, IV12). Genome analysis tools like 23andMe use AI to uncover genetic predispositions and design preventive strategies, showcasing the increasing importance of personalized medicine in longevity (IV7, IV11, IV14). Analytical AI, preferred for its maturity and practical applications, enhances diagnostic accuracy, patient outcomes, and operational processes. Treatment protocols are refined by integrating physician expertise with AI analytics, and actionable health insights are generated (IV4, IV7, IV12). Despite its potential, gaps remain in AI applications for early disease detection and biomarker-informed supplements, which require broader validation and adoption. These areas present opportunities for development and investment. Additionally, AI insights are accelerating drug development pipelines and advancing targeted therapies, particularly in oncology, enabling early identification of effective treatments and improving patient outcomes (IV7, IV9, IV12, IV14).

4.2 Quantitative Survey data

4.2.1 Demographics

The demographic characteristics of the survey respondents provide a foundation for understanding consumer acceptance of longevity-focused innovations.

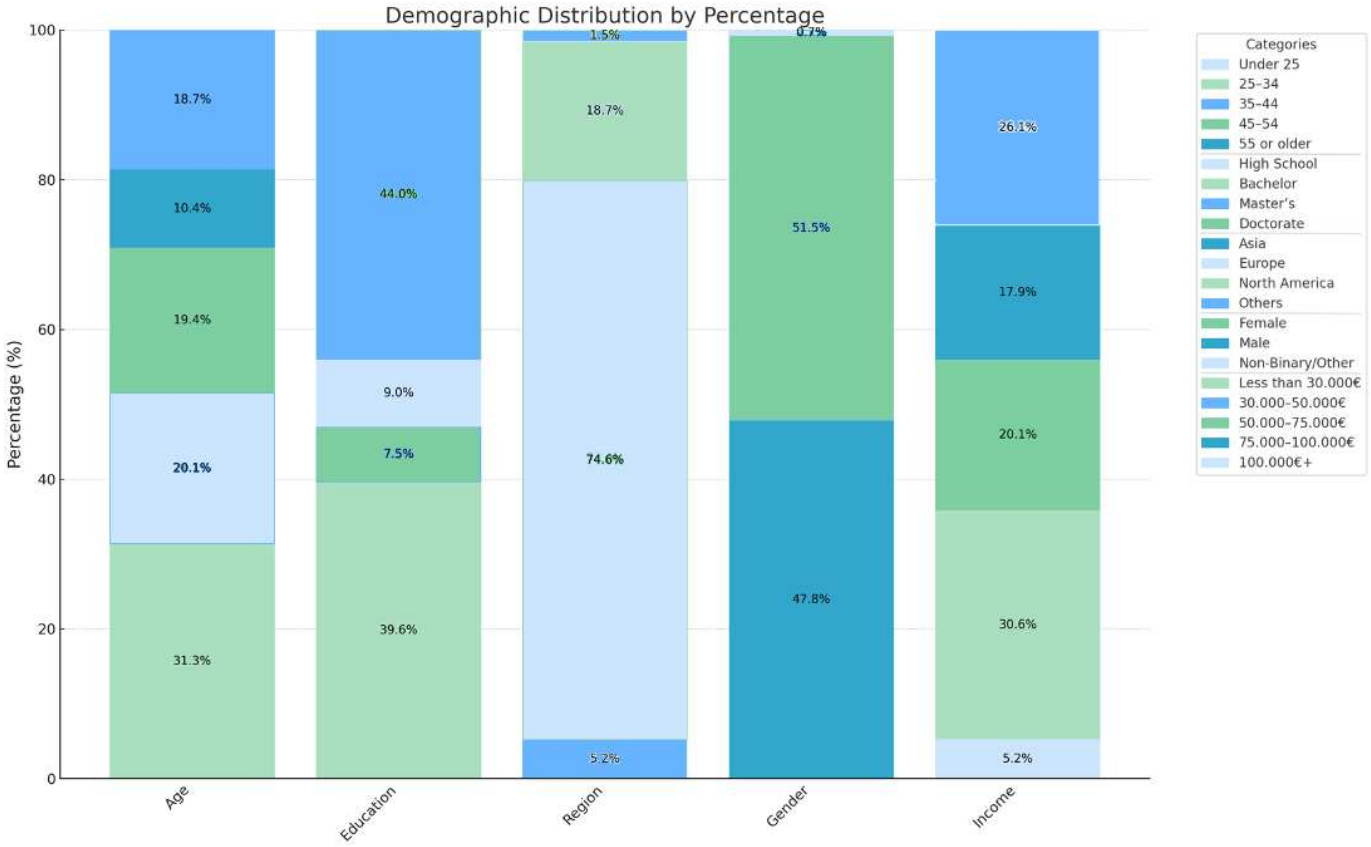

Figure 2: Demographic Data from Survey (n=134)

Age Distribution:

The age distribution skewed toward younger and middle-aged groups, with a large proportion of respondents aged 25–34 (42%, n = 56) and 35–44 (27%, n = 36). Respondents aged 45–54 accounted for 26% (n = 35), while fewer respondents fell into the Under 25 group (3%, n = 4). The smallest proportion of respondents were 55 years or older (2%, n = 3).

Education Level Distribution:

Respondents exhibited a high level of educational attainment. The largest proportion reported holding a Master's degree (44%, n = 59), followed by a Bachelor's degree (40%, n = 53). A smaller proportion reported having completed high school or equivalent (9%, n = 12), while Doctorate or higher degrees were reported by 7% (n = 10).

Regional Distribution:

Most respondents reported residing in Europe (75%, n = 100), followed by North America

(19%, n = 25). Fewer respondents lived in Asia (5%, n = 7), with few reporting Other regions (1%, n = 2).

Gender Distribution:

Most respondents identified as male (52%, n = 69), while a slightly smaller proportion identified as female (48%, n = 64). A minor part of the cohort identified as non-binary/other (<1%, n = 1).

Income Distribution:

The largest proportion of respondents reported an annual household income of less than €30,000 (29%, n = 34). This was followed by those earning €30,000–€50,000 (18%, n = 21). A larger proportion earned €50,000–€75,000 (21%, n = 25), and even more earned €75,000–€100,000 (25%, n = 29). The fewest respondents reported an income of €100,000 or more (7%, n = 8).

4.2.2 Willingness-to-adopt Longevity Innovations

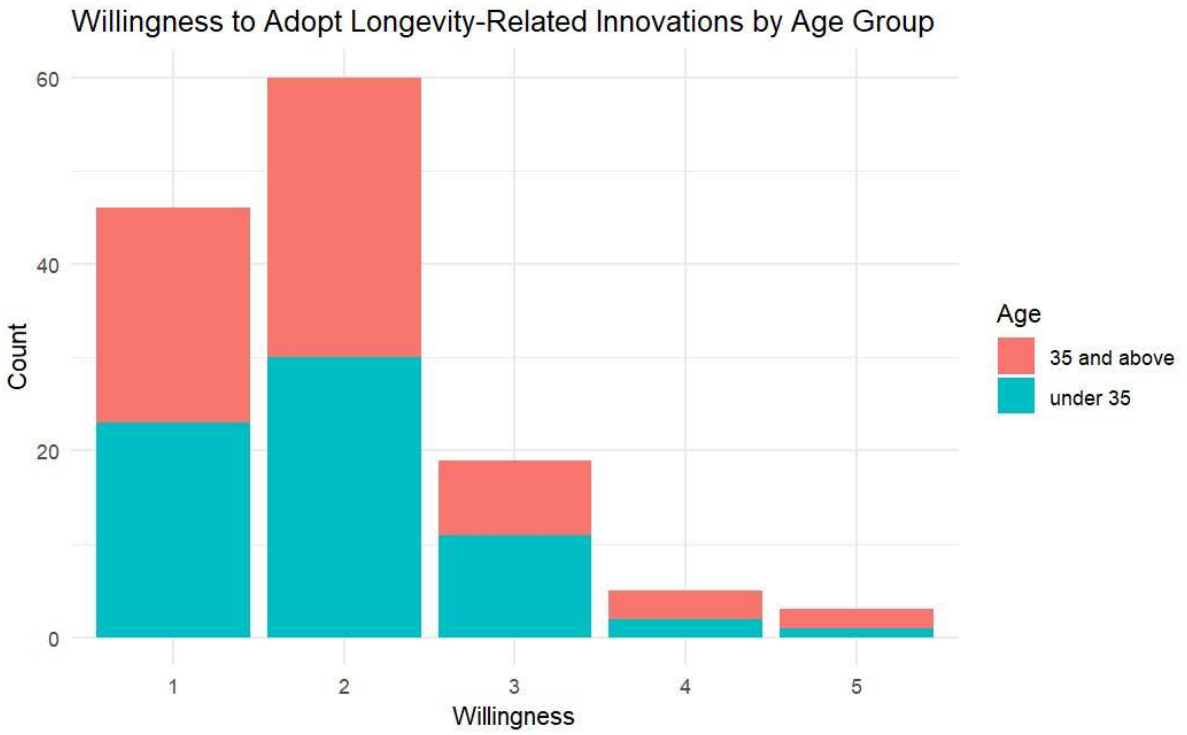

Figure 3: Willingness-to-adopt Longevity Innovations (n=134), Table with Statistics for Willingness-to-adopt Long.Act.

Respondents were divided into two age groups to analyze willingness to adopt longevity-focused innovations: Under 35 and 35 and Above. Willingness was measured on a scale from 1 (Very Willing) to 5 (Not Willing). The mean scores were 1.93 for respondents Under 35 and 1.95 for those 35 and Above, indicating both groups are similarly very willing to adopt these innovations. The bar chart shows that most respondents rated their willingness at 1 or 2, with

very few choosing higher, less willing scores. A Welch Two Sample t-test was performed to assess mean differences, yielding a p-value of 0.8557 and a 95% confidence interval of -0.3459 to 0.2876, confirming no statistically significant difference between the groups.

In conclusion, with no notable differences, both age groups are highly willing to adopt longevity innovations. This consistency indicates strong interest across demographics.

4.2.3 Barriers to Adoption of Longevity Innovations

To identify key barriers to adopting longevity-focused innovations, respondees (n = 208) were asked to select up to three barriers they perceived as most significant. While participants could choose a maximum of three, they were not required to do so. The results, ranked by Adjusted Normalized Mean, revealed each barrier's relative importance based on the selection frequency.

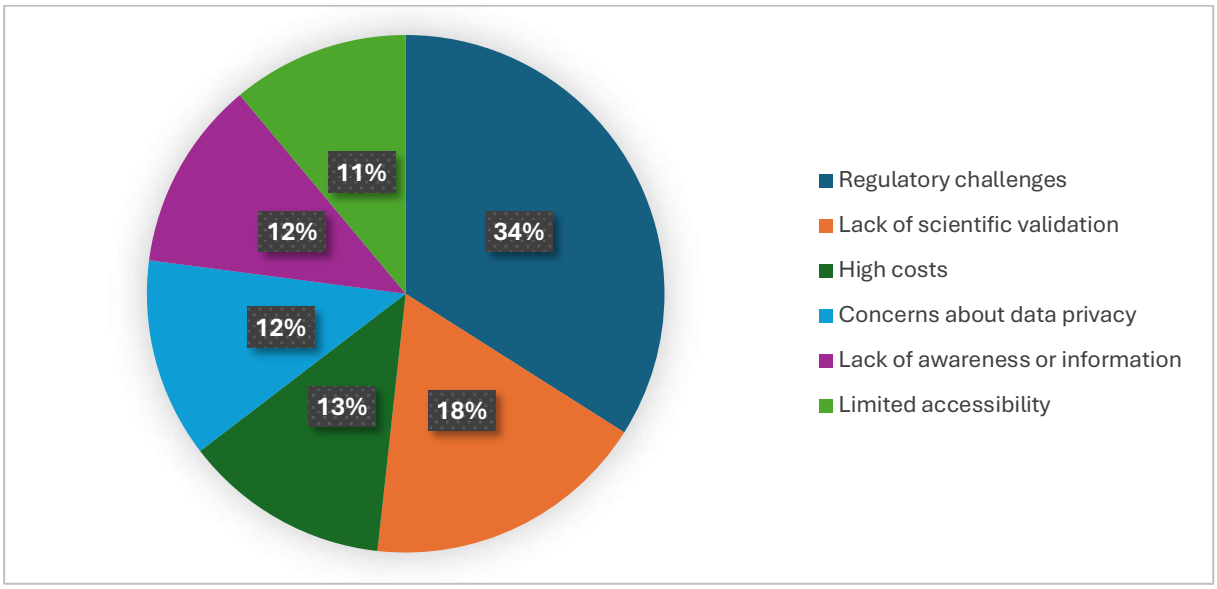

Figure 4: Barriers to Longevity Innovations

The most significant barrier identified was regulatory challenges, selected by 71 respondents (34%), with an Adjusted Normalized Mean of 0.3413. This highlights concerns about unclear frameworks, approval processes, and regulatory bottlenecks that impede progress and adoption. Following this, 37 respondents (18%) chose a lack of scientific validation, with a normalized mean of 0.1779, reflecting skepticism about the robustness of research and the credibility of longevity-focused innovations.

Financial considerations also emerged as an essential barrier, with high costs being selected by 27 respondents (13%) and an Adjusted Normalized Mean of 0.1298. Similarly, 26 respondents

(13%) noted concerns about data privacy, yielding a normalized mean of 0.1250. This points to hesitations regarding the security and confidentiality of personal data tied to longevity-related technologies.

Additionally, a lack of awareness or information was identified by 24 respondents (12%), with an Adjusted Normalized Mean of 0.1154, underscoring the need for better communication and education to bridge knowledge gaps. Finally, limited accessibility, chosen by 23 respondents (11%) and with an Adjusted Normalized Mean of 0.1106, highlights the still given disparities in the availability and distribution of longevity products and services.

4.2.4 Willingness to Share Personal Data vs Willingness to Adopt Longevity Innovations

	Willingness to Adopt
Very willing	0.529*
	(0.272)
Neutral	0.647**
	(0.309)
Slightly unwilling	0.772**
	(0.302)
Extremely unwilling	1.192***
	(0.321)
Constant	1.308***
	(0.245)
Observations	133
R^2	0.107
Adjusted R^2	0.079
Residual Std. Error	0.882 (df = 128)
F Statistic	3.833*** (df = 4; 128)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 1 – Regression Table Data Sharing Willingness vs Willingness to Adopt

The analysis explored the willingness to share personal data about adopting longevity-focused innovations. The baseline group, represented by the constant, reflected individuals who were extremely willing to share data (coefficient = 1.308, $p<0.01$). Compared to this group, those who were willing to share data also showed a positive, though modest, likelihood of adoption

(coefficient = 0.529, $p<0.1$). Neutral respondents demonstrated a slightly higher likelihood (coefficient = 0.647, $p<0.05$), and those who were slightly unwilling showed an even stronger association (coefficient = 0.772, $p<0.05$). Interestingly, individuals who were extremely unwilling to share data had shown the highest likelihood of adoption (coefficient = 1.192, $p<0.01$), suggesting that privacy concerns might not have acted as a strict barrier.

With an R^2 of 0.107 and an F-statistic of 3.833 ($p<0.01$), the model was significant but explained only a small proportion of adoption behavior, indicating that other factors had played a role. These results highlighted that while data privacy concerns mattered, they had not necessarily deterred individuals from adopting innovations, showing the need to address trust and transparency to encourage wider acceptance.

4.2.5 Impact of Government Subsidies on Likelihood to Adopt Longevity Innovations

A one-sample t-test was conducted to determine whether government subsidies or funding initiatives had significantly influenced respondents' willingness to adopt longevity-focused innovations. The test evaluated whether the mean likelihood of adoption, measured on a scale from 1 to 5, had been significantly greater than zero (with 3, neutral, set as the standard for 0) after the introduction of government initiatives. This indicated that over 53% of the respondents had reported that subsidies had positively influenced their likelihood of adoption, with 17% expressing a significant increase in likelihood and 36% indicating a moderate increase. However, 37% had remained neutral, suggesting subsidies had not affected their decision, while only 10% had reported a negative influence.

The mean willingness score of 3.57 was significantly greater than the hypothesized threshold of 0. The t-statistic of 18.72 and the extremely small p-value (2.15×10^{-39}) provided evidence to reject the null hypothesis in favor of the alternative hypothesis: the mean willingness score had been significantly greater than 0 (likely to adopt).

4.2.6 Age vs. Data Sharing Willingness

	Data Sharing Willingness
25-34	-0.838***
	(0.292)
35-44	-1.267***
	(0.321)
45-54	-1.120***
	(0.327)
55+	-0.171
	(0.386)
Constant	3.600***
	(0.231)
Observations	133
R^2	0.148
Adjusted R^2	0.121
Residual Std. Error	1.157 (df = 128)
F Statistic	5.549*** (df = 4; 128)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 2: Regression Table - Age on Data Sharing Willingness

The analysis reveals significant variations in willingness to share personal data across age groups. Younger respondents under 25, represented by the constant with a coefficient of 3.600 (p<0.01), exhibit the highest willingness, serving as the baseline. Willingness declines significantly with age, most notably among those aged 35–44, with a coefficient of -1.267 (p<0.01). Respondents aged 25–34 (-0.838, p<0.01) and 45–54 (-1.120, p<0.01) also show significant reductions. However, for those aged 55 and above, the coefficient of -0.171 is not significant, indicating a return to levels closer to younger respondents. This rebound may reflect a stronger focus on health-related benefits and reliance on healthcare technologies, where data sharing is viewed as essential for personalized care.

The model explains 12–15% of the variation in willingness (R^2 = 0.148, adjusted R^2 = 0.121), with an F-statistic of 5.549 (p<0.01), confirming statistical significance. The decline in willingness among middle-aged groups likely stems from heightened privacy concerns and skepticism about data security, influenced by greater exposure to data misuse risks. Addressing

these concerns through transparent communication and robust security measures is crucial. For older adults, the tangible health benefits of data sharing can enhance engagement.

4.2.7 Willingness to Adopt vs Willingness to Spend and Income

	Willingness to Adopt
Willingness to spend: 25-49€	-0.750***
	(0.246)
Willingness to spend: 50-99€	-1.106***
	(0.254)
Willingness to spend: 100-200€	-1.235***
	(0.277)
Willingness to spend: 200€+	-1.320***
	(0.335)
Income: 30.000-49.999€	0.561**
	(0.216)
Income: 50.000-74.999€	0.046
	(0.222)
Income: 75.000-99.999€	0.283
	(0.205)
Income: 100.000€+	-0.016
	(0.362)
Constant	2.633***
	(0.235)
Observations	133
R^2	0.205
Adjusted R^2	0.153
Residual Std. Error	0.846 (df = 124)
F Statistic	3.990*** (df = 8; 124)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 3: Regression Table - Willingness to Adopt vs Willingness to Spend and Income

This analysis presented a combined evaluation of the relationship between willingness to spend, income levels, and their respective influences on the likelihood of adopting longevity innovations. The first part examined how willingness to spend on longevity innovations influenced adoption likelihood. The constant, with a coefficient of 2.645 ($p<0.01$), represented respondents spending less than 25€, who demonstrated the highest baseline likelihood of adoption. As spending willingness increased, adoption likelihood decreased significantly. For those willing to spend 25–49€, the coefficient was -0.753 ($p<0.01$), becoming increasingly negative for 50–99€ (-1.103, $p<0.01$), 100–200€ (-1.206, $p<0.01$), and 200€+ (-1.318, $p<0.01$).

This counterintuitive trend suggested that higher willingness to spend correlated with lower adoption, possibly due to skepticism about value or effectiveness at higher price points. Consumers with greater spending capacity may have had higher expectations, which current innovations failed to meet. The model explained a modest portion of variation ($R^2 = 0.202$, adjusted $R^2 = 0.151$), and the F-statistic (3.948, $p<0.01$) confirmed its overall significance. Addressing perceived value and trust was crucial to converting spending willingness into adoption.

For the analysis of income in relation to the likelihood of adopting longevity innovations, the constant (2.645, $p<0.01$) represented respondents earning less than 30,000€, who showed the most substantial baseline likelihood of adoption. Individuals earning 30,000–49,999€ were significantly more likely to adopt (coefficient = 0.543, $p<0.05$), indicating that this group aligned financial ability with perceived necessity. Higher-income groups showed weaker or insignificant relationships with adoption. Those earning 50,000–74,999€ (0.027) and 75,000–99,999€ (0.262) exhibited slight but statistically insignificant increases, while respondents earning 100,000€+ (-0.029) showed no meaningful difference. This suggested that financial capacity alone did not drive adoption, particularly for higher-income groups who may have had alternatives or perceived less urgency.

The model highlighted the need for tailored approaches, as income and spending interacted with perceptions of necessity and value. These findings emphasized the importance of targeting mid-income earners while addressing skepticism among higher-income groups to enhance adoption rates. However, it was necessary to note that both of these results did not assert meaningful causalities and may also have reflected biases or limitations in the sampled cohort.

4.3 Financing of Longevity Ventures

The longevity sector has shown considerable volatility in financing, marked by cycles of significant peaks and corrections. With an unprecedented $9.99 billion raised, 2021 remains a standout year still to beat. Comparatively, 2023 experienced a sharp decline to $3.01 billion, highlighting the sector's sensitivity to macroeconomic pressures and investor caution. However, 2024 has already begun to outperform 2023, signaling renewed momentum and leveraging the untapped potential in emerging fields such as longevity discovery platforms and neuropharma. Experts stressed that PPPs can bridge the gap between short-term private capital and the long-term stability provided by state-backed initiatives, ensuring that foundational research receives

the necessary support for scalable innovations (IV1, IV4, IV11). This collaborative funding model addresses the sector's unique requirements, balancing agility with the demand for sustained investment in transformative longevity technologies.

4.3.1 Financing Trends Over the Past Decade (2014-2023)

The longevity sector has experienced a dynamic evolution in financing activity, characterized by periods of growth, correction, and exceptional spikes.

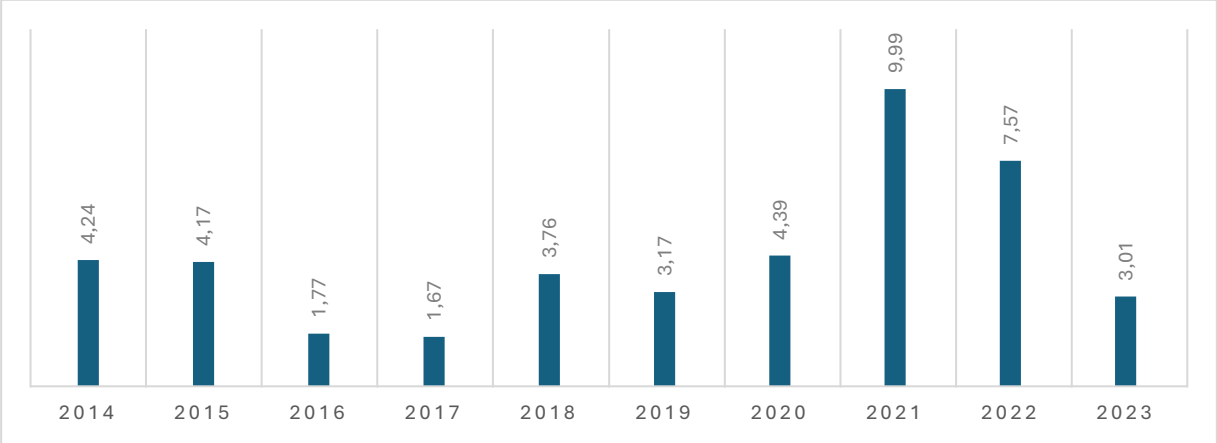

Table 4: Financing by Year

The past decade has been characterized by dynamic shifts in financing activity within the longevity sector. After strong initial momentum in 2014 and 2015, the market faced a notable slowdown in 2016–2017, reflecting early commercial traction and scientific validation challenges. Interviews with experts revealed that these challenges were compounded by investor skepticism regarding the long development timelines required for longevity innovations (IV2, IV7, IV10).

Recovery began in 2018 as technological advancements in diagnostics, biomarkers and AI-powered health tools gained traction, restoring investor confidence. The significant spike in 2021 was driven by a global focus on health during the pandemic, highlighting the sector's strategic importance. However, the subsequent correction in 2022–2023 demonstrates the sector's reliance on macroeconomic stability and investor sentiment, with funding levels stabilizing as investors adopt a more cautious approach.

4.3.2 Shifts in Average Deal Volume (Q1 2023 – Q2 2024)

The movement in average deal volumes reveals a notable shift in investor strategy. In 2023, deal volumes remained modest and relatively stable, pointing to cautious yet consistent funding activity. The steady deal sizes suggest that investors were focused on spreading capital across a broader base of early to mid-stage opportunities during a period of economic uncertainty. A significant change emerged in Q1 2024, where average deal sizes surged dramatically. This movement indicates a clear shift toward prioritizing larger, higher-value investments, likely in more mature companies or promising technologies with proven potential. The correction in Q2 2024, with deal volumes moderating, suggests the market is finding balance after an initial influx of concentrated capital.

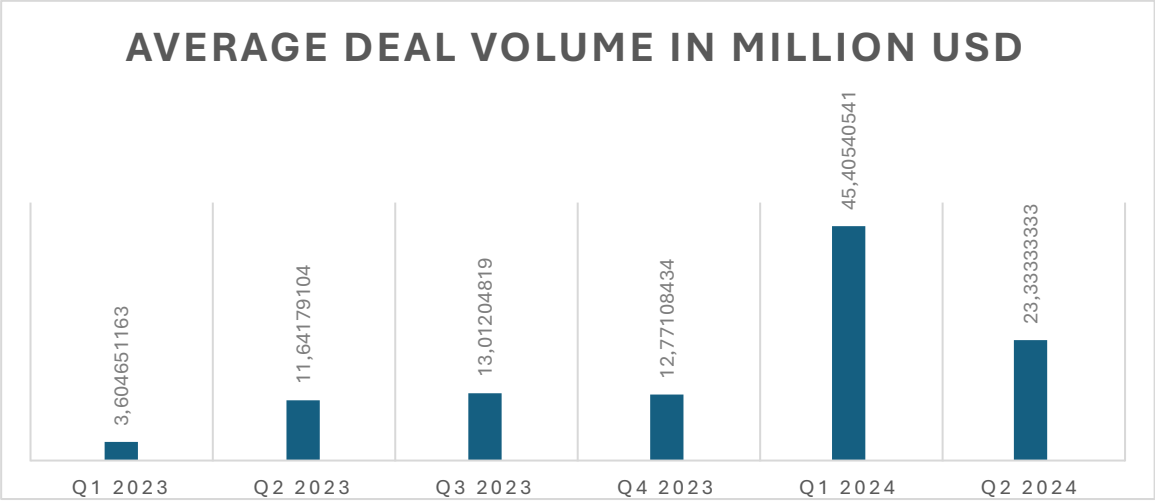

Table 5: Average deal volume in Million USD

The rise in average deal sizes reinforces the notion of increasing selectivity, as investors focus on fewer but more significant opportunities. Experts emphasized that this trend reflects a maturing sector where investor confidence is concentrated in solutions that address considerable health and economic challenges, such as chronic disease prevention and personalized health management (IV4, IV6, IV11). As investor behavior evolves, the focus on high-value, evidence-backed innovations drives funding activity, aligning with expert perspectives on the sector's growth potential and strategic importance.

4.3.3 Deal Count Dynamics (Q1 2023 – Q2 2024)

The deal count trends highlight changing levels of market activity. While 2023 exhibited fluctuations, with notable peaks and dips, the overall volume remained consistent, reflecting an ongoing interest in exploring opportunities within the longevity space. However, the gradual decline observed in 2024, particularly in Q2, signals a shift in investor behavior. The decrease in deal counts, alongside rising average deal volumes, suggests that investors focus on a more consolidated market where they prefer fewer but more significant opportunities. This pattern may reflect a maturing sector where investments are increasingly concentrated in companies with established market potential or breakthrough innovations.

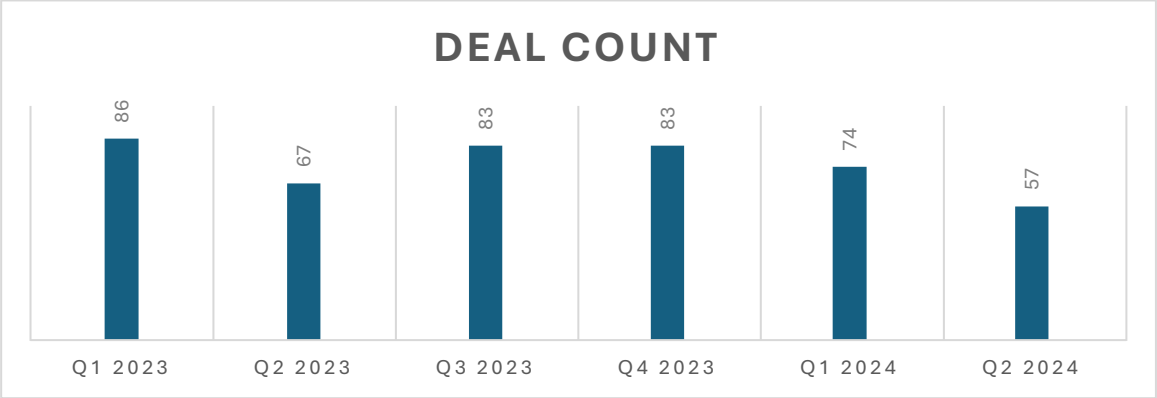

Table 6: Deal Count 2023/2024

5 Discussion

5.1 Main findings

Findings in the previous chapter inform our assessment of Longevity's disruptive potential.

5.2 Current Levels and Integration

The longevity industry has the potential to disrupt traditional healthcare models, but this disruption is likely to be incremental and integrative**,** shaped by technological readiness, regulatory dynamics, and investment behavior. The shift from reactive, hospital-centered care to proactive, preventive care is the most significant opportunity for longevity technologies. These technologies reflect an architectural innovation model (Henderson & Clark, 1990), where existing healthcare structures are reconfigured to incorporate new capabilities without being rendered obsolete. Technologies enhancing prevention and self-management align well with consumer and institutional priorities, while survey data revealed strong consumer willingness to adopt solutions that demonstrate tangible health benefits.

5.3 Barriers to Disruption

Despite advancements, longevity technologies face systemic challenges that limit their disruptive impact in the short term**.** Regulatory fragmentation was identified as a primary barrier, with inconsistent approval processes and governance frameworks across regions creating uncertainty for investors and slowing technology adoption (IV3, IV7, IV13). Experts emphasized the importance of building credibility through validated outcomes and transparent education campaigns to address skepticism, particularly for emerging therapies such as gene therapy and senolytics (IV6, IV9). Adoption will remain niche without such efforts, appealing primarily to high-income early adopters. The role of financing emerged as another critical determinant of the industry's trajectory. Over the past decade, investment trends have been marked by volatility, with significant peaks driven by health crises and subsequent corrections reflecting investor caution. The sector's sensitivity to macroeconomic conditions and the mismatch between short-term VC timelines and the longevity sector's long development cycles are another challenge the industry faces. Experts highlighted that venture capital, while agile, struggles to support technologies requiring years of foundational research, particularly those involving expensive clinical trials and regulatory approvals (IV8, IV13). Public-private partnerships (PPPs) were repeatedly cited as essential for bridging this funding gap, including pharma and government funding. This led to equity in society and those using and receiving preventative and analytical care. However, bureaucratic inefficiencies and misaligned priorities within public funding mechanisms were noted as challenges that could delay progress.

Dimensions	First-Order Variables	Second-Order Variables	Mediators/Moderators
Firm-Related Factors	- Technological readiness (AI tools, biomarkers) - Foundational innovations (gene therapy, senolytics).	- Scalability and production economics - Business model innovations (B2B, DTC)	- Early adopters driving demand. - Regulatory compliance costs (IV13, IV14).
Exogenous Drivers	- Macroeconomic stability and investor sentiment - Regulatory frameworks (fragmentation, transparency)	- Public-private partnerships (PPPs). - Government subsidies and incentives (IV4, IV11)	- Investor selectivity (VC vs. public funding). - Sociopolitical acceptance (IV5, IV16).

Table 7: Multivariate Framework of Longevity Disruption Potential

The data revealed a shift in strategy, with Q1 2024 marked by rising average deal sizes and a decline in total deal counts, suggests growing investor selectivity, where funding is concentrated in later-stage companies or technologies with proven scalability and market

potential. Regions with supportive policies and streamlined regulatory processes, such as Singapore, are already accelerating adoption, whereas fragmented markets face stagnation due to policy uncertainty and funding challenges (Barzilai, 2024). The study suggests that longevity technologies will integrate into existing healthcare systems in the short to medium term, enhancing care delivery and driving efficiencies, particularly in preventive care and chronic disease management. Over time, as costs decrease and public acceptance grows, these technologies may achieve broader adoption, positioning the industry to play a transformative role in global healthcare systems and societal well-being.

5.4 Implications for Stakeholders Including Possible Scenarios

The following table was created to systematically outline the priorities and corresponding metrics for success for each stakeholder group. The structure provides a framework for evaluating how the efforts of different stakeholders align with the industry's overarching goal of transforming healthcare from a reactive to a proactive, preventive model. The table draws on insights from recent literature, emphasizing the interconnected nature of innovation, investment, regulation, and adoption (Chen, 2023; Sinclair, 2024; OECD, 2024). The essence of the industry is to bridge the gap between theoretical advancements in longevity and their practical implementation.

Stakeholder	Priorities	Metrics for Success
Startups	- Adapt funding type to innovation needs: - High-risk, experimental innovations → non-dilutive funding or professional investors - Recognized, scalable models → venture capital - Focus on validated, high-impact solutions (e.g., AI diagnostics, biomarkers) - Align strategies with preventive care models to ensure market fit	- Funding type adapted to the innovation stage (e.g., non-dilutive vs. VC) - Number of successful early-stage innovations reaching scale - Funding secured and product adoption rates
Investors	- Balance short-term ROI with long-term potential - Develop patient investment strategies for high-cost, breakthrough innovations - Prioritize measurable outcomes in investments - Support innovations that address chronic disease prevention and aging	- Investment horizon (short-term vs. long-term) - ROI for high-risk innovations over time - Adoption and impact of funded technologies

Stakeholder	Priorities	Metrics for Success
Policymakers	- Streamline regulatory approval processes for faster adoption - Integrate longevity technologies into healthcare funding (subsidies, reimbursements) - Increase public funding for foundational research to bridge innovation gaps	- Time-to-market for approved technologies - Public funding allocations for foundational research - Policy reforms supporting preventive care reimbursement
Healthcare Providers	- Use AI diagnostics and wearables to enable early detection and personalized treatment - Transition to preventive care models to reduce costs and improve patient outcomes - Integrate longevity technologies into existing healthcare workflows	- Reduction in chronic disease cases - Cost savings from early detection and prevention - Improvements in quality-adjusted life years (QALY)
Consumers	- Improve trust through transparent communication and evidence-based education - Increase accessibility via health monitoring platforms (e.g., wearables, AI tools) - Address privacy and trust concerns to drive adoption	- Consumer trust and education levels - Adoption rates of health monitoring platforms - Surveyed satisfaction and perceived benefits

Table 8: Bridging Gaps between Stakeholders

The trajectory remains uncertain due to regulatory challenges, investment behaviors, and adoption rates. Scenario planning (Roxburgh, 2009) offers a structured approach to address these uncertainties by exploring plausible futures and identifying opportunities for innovation and growth. Similarly, McKinsey & Company (2015) pointed out that effective scenario planning helps stakeholders challenge assumptions, overcome cognitive biases, and prepare for various outcomes—critical for industries navigating complex, evolving landscapes like longevity.

Scenario	Driver	Metrics for Success/Failure	Outcomes
Green Horizon	- Streamlined regulations by policymakers - Patient investment strategies by investors - Startups focus on validated solutions (AI tools, precision medicine) - Consumer adoption of wearables and AI - Healthcare integrates longevity tools	- Funding for scalable models - Reduction in chronic disease cases - Widespread wearable adoption - Measurable ROI on high-risk innovations	- Healthcare shifts to proactive prevention - Reduced healthcare costs and improved QALY - Increased productivity and broader societal benefits
Investment Winter	- Short-term ROI focus from investors - Regulatory bottlenecks remain unresolved - Startups pivot to low-impact, commercially viable solutions - Consumer skepticism due to privacy concerns - Insufficient public funding	- Decline in funding for high-risk innovations - Limited technology adoption - Longer time-to-market - Reduced patient investment strategies	- Startups stagnate due to funding gaps - Chronic disease burden continues - Minimal preventive interventions - Healthcare costs remain high
Elite Longevity	- Premium solutions targeting wealthy consumers - Limited public funding - Private healthcare integrates technologies - Restricted access for low-income demographics	- High adoption in private healthcare - ROI on premium, high-cost solutions - Targeted funding for niche products	- Longevity benefits are limited to wealthy consumers - Health inequalities widen - Public trust declines - Limited societal impact
Tech Break-through	- Breakthroughs in gene therapies, AI tools, senolytics - Increased funding for scalable, high-impact innovations - Streamlined regulations enabling rapid adoption - Consumers embrace preventive health platforms - Healthcare reconfigures workflows	- Funding secured for disruptive innovations - Early detection reduces chronic diseases - High wearable adoption - Reduced healthcare costs and improved healthspan	- Longevity industry disrupts healthcare globally - Preventive care replaces reactive models - Health outcomes improve broadly - Reduced costs and increased productivity

Table 9: Scenario planning

This presents four distinct scenarios (Roxburgh, 2009; McKinsey & Company, 2015). Green Horizon**,** Investment Winter**,** Elite Longevity**,** and Tech Breakthrough are based on critical drivers such as streamlined regulations, investment strategies, and technological breakthroughs. These scenarios are evaluated using measurable outcomes, including secured funding, reduced chronic disease, healthcare cost savings, and adoption rates**.** Survey data reinforce the importance of such planning, with findings revealing a high willingness to adopt longevity technologies (mean score: 4.07/5), particularly for AI diagnostics and wearables. Expert interviews further emphasized the transformative potential of early detection and scalable innovations in shifting healthcare toward a proactive, preventive model.

However, the industry's ability to disrupt traditional healthcare is currently constrained by systemic challenges. Regulatory hurdles, including fragmented approval processes and varying standards across regions, slow the adoption of new technologies. Additionally, the high cost of

advanced therapies and limited scalability make many innovations inaccessible to the broader population. Investment trends in the longevity sector reveal gaps in funding, particularly for early-stage research, as many venture capital firms prioritize short-term returns over the longer timelines required for developing foundational technologies. Public-private partnerships offer a promising solution, providing both the stability needed for research and the agility necessary for commercialization.

6 Conclusion

6.1 Limitations

While this study provides critical insights into the dynamics of the longevity industry, certain limitations must be acknowledged and reevaluated based on the survey data and analysis. The survey primarily included younger and middle-aged respondents, with 64% aged between 25–44. This creates a potential sampling bias, as older populations are likely to be key adopters of longevity technologies and are underrepresented. The modest R-squared values observed in multiple analyses further highlight the complexity of predicting adoption behavior. Additionally, the modest relationships between variables, reflected in the low R^2 values (e.g., $R^2 = 0.0003$ for willingness-to-adopt by age), may initially appear problematic. However, low R^2 values are not inherently bad in social science research. This is because the primary goal is often to assess the significance of relationships between variables rather than achieving high predictive power. The dynamic nature of human behavior and the wide range of influencing factors make it challenging for models to capture all relevant predictors, leading to lower R^2 values (Ozili, 2023). In this study, while the R^2 values were low, the statistical significance of some predictors indicates meaningful relationships, aligning with the objectives of social science modeling. This study's relatively short time frame limited its ability to explore long-term impacts, such as how these innovations might reshape healthcare systems. Nonetheless, the findings suggest that broader adoption hinges on improving transparency, regulatory clarity, and communication about the tangible benefits of these technologies, especially for older and higher-income groups with heightened expectations or concerns.

6.2 Future Research

Future research should address current limitations by including a diverse participant pool, especially older adults, high-income groups, and varied geographic regions, to better reflect a broad range of perspectives. Longitudinal studies are needed to track how adoption patterns

evolve as longevity technologies mature. Prioritizing socioeconomic equity is essential to ensure innovations are accessible across all demographics, avoiding exacerbating existing healthcare inequalities. Efforts to harmonize international regulatory standards, trust, transparency, and education will be important for widespread adoption. Additionally, case studies on healthcare systems successfully integrating longevity technologies could provide actionable insights. Ethical considerations and public perceptions of transformative advancements, like gene therapy and AI diagnostics, should also be key research priorities to promote responsible innovation.

6.3 Answer to the Research Question

In answering the research question, this thesis concludes that the longevity industry has begun to affect traditional healthcare but has not reached its full transformative potential. Its impact remains focused on enhancing existing systems rather than completely replacing them. By enabling proactive and personalized care, longevity technologies challenge the traditional model but require significant progress in regulatory alignment, investment strategies, and public trust to achieve broader adoption and integration.

6.4 Final Statement

The longevity industry represents a critical evolution in healthcare, offering the possibility to extend healthspan and redefine how we age and live. While its current disruptions are incremental, the industry holds the potential to reshape healthcare in the coming decades fundamentally, provided it navigates the challenges outlined in this study. With continued collaboration among stakeholders, the longevity sector can create a healthier, and longer-lived society.

7. Bibliography

Abecassis-Moedas, C. (2024) Aging and Longevity: Challenges and Opportunities in the Context of Social Innovation. CATÓLICA-LISBON [online]. Available from: https://clsbe.lisboa.ucp.pt/news/aging-and-longevity-challenges-and-opportunities-context-social-innovation (Accessed 29 December 2024).

Agency, A. A. (2019) *Longevity Industry Landscape*.

Aging Analytics Agency (2019) *Longevity Industry Landscape*.

Anon (n.d.) *Statista*.

Barney, J. (1991) Firm Resources and Sustained Competitive Advantage. *Journal of Management*. [Online] 17 (1), 99–120.

Bonnes, S. L. R. et al. (2024a) Establishing healthy longevity clinics in publicly funded hospitals. *GeroScience*. [Online] 46 (5), 4217–4223.

Chen, D. (2023a) *The Era of Longevity: Transformation of Aging, Health and Wealth*. [Online]. Singapore: Springer Nature Singapore. [online]. Available from: https://link.springer.com/10.1007/978-981-19-6784-9 (Accessed 4 October 2024).

Chesbrough, H. (20) *Open innovation: the new imperative for creating and profiting from technology*. Nachdr. Boston, Mass: Harvard Business School Press.

Christensen, C. M. & Raynor, M. E. (2003) *The innovator's solution: creating and sustaining successful growth*. Boston, Mass: Harvard Business School Press.

Deloitte (n.d.) *Living a 140-year long and healthy life*.

Digital Health Report, C., HealthEnabled (n.d.) *Digital Health Report*.

Falshaw, N. et al. (2024) The Longevity Med Summit: insights on healthspan from cell to society. *Frontiers in Aging*. [Online] 51417455.

Fleisch, E. et al. (2021) 'Digital Health Data and Infrastructure: Data Donation is the New Blood Drive', in *The Digital Pill: What Everyone Should Know about the Future of Our Healthcare System*. [Online]. Emerald Publishing Limited. pp. 159–162. [online]. Available from: https://doi.org/10.1108/978-1-78756-675-020211011 (Accessed 16 October 2024).

Fleisch, E. et al. (2021) *The Digital Pill: What Everyone Should Know about the Future of Our Healthcare System*. Bingley, UNITED KINGDOM: Emerald Publishing Limited. [online]. Available from: http://ebookcentral.proquest.com/lib/unimannheim-ebooks/detail.action?docID=6518950 (Accessed 4 October 2024).

Flick, U. (1992) Triangulation Revisited: Strategy of Validation or Alternative? *Journal for the Theory of Social Behaviour*. [Online] 22 (2), 175–197.

Florea, M. et al. (2023) *Longevity Bottlenecks*.

Forbes (2023) *Venture Capital Giants In The Billion-Dollar Quest For Longevity Breakthroughs*.

Forum, W. E. & Bloom, D. E. (n.d.) *Population Aging and Economic Growth: From Demographic Dividend to Demographic Drag?*

Hannan, M. T. & Freeman, J. (1984) Structural Inertia and Organizational Change. *American Sociological Review*. [Online] 49 (2), 149.

Kaplan, S. N. & Lerner, J. (2016) *Venture Capital Data: Opportunities and Challenges*.

Khanna, T. & Palepu, K. G. (2010) Winning in Emerging Markets: A Road Map for Strategy and Execution. *NHRD Network Journal*. [Online] 3 (3), 75–75.

Kim, W. C. & Mauborgne, R. (2005a) Blue Ocean Strategy: From Theory to Practice. *California Management Review*. [Online] 47 (3), 105–121.

Kostova, T. & Zaheer, S. (1999) Organizational Legitimacy under Conditions of Complexity: The Case of the Multinational Enterprise. *The Academy of Management Review*. [Online] 24 (1), 64.

Kraaijenbrink, J. et al. (2010) The Resource-Based View: A Review and Assessment of Its Critiques. *Journal of Management*. [Online] 36 (1), 349–372.

Lieberman, M. B. & Montgomery, D. B. (1988a) First-mover advantages. *Strategic Management Journal*. [Online] 9 (S1), 41–58.

Marblestone, A. et al. (2022) Unblock research bottlenecks with non-profit start-ups. *Nature*. [Online] 601 (7892), 188–190.

Marchetti, C. (1997) Longevity and life expectancy. *Technological Forecasting and Social Change*. [Online] 55 (3), 281–299.

Marino, N. et al. (2023) Towards AI-driven longevity research: An overview. *Frontiers in Aging*. [Online] 41057204.

Mayring, P. (2000) Qualitative Content Analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*. [Online] Vol 1No 2 (2000): Qualitative Methods in Various Disciplines I: Psychology.

McKinsey / Roxburgh, C. (2015) *The use and abuse of scenarios*.

Mekniran, W. & Kowatsch, T. (2023) 'Scalable Business Models in Digital Healthy Longevity: Lessons from Top-Funded Digital Health Companies in 2022:', in *Proceedings of the 16th International Joint Conference on Biomedical Engineering Systems and Technologies*. [Online]. 2023 Lisbon, Portugal: SCITEPRESS - Science and Technology Publications. pp. 609–615. [online]. Available from:

https://www.scitepress.org/DigitalLibrary/Link.aspx?doi=10.5220/0011778400003414 (Accessed 4 October 2024).

Michaud, P.-C. & St-Amour, P. (2023) Longevity, Health and Housing Risks Management in Retirement. *SSRN Electronic Journal*. [Online] [online]. Available from: https://www.ssrn.com/abstract=4388459 (Accessed 29 December 2024).

Mikhailova, O. (2018a) Adoption and implementation of new hospital technologies: a network perspective. *IMP Journal*. [Online] 12 (2), 368–391.

National Academy of Medicine (2022) *Global Roadmap for Healthy Longevity*. [Online]. Washington, D.C.: National Academies Press. [online]. Available from: https://www.nap.edu/catalog/26144 (Accessed 4 October 2024).

Nemitz, J. (2022) Increasing longevity and life satisfaction: is there a catch to living longer? *Journal of Population Economics*. [Online] 35 (2), 557–589.

Neves, J., Sousa-Victor, P. and Jasper, H. (2017) 'Rejuvenating Strategies for Stem Cell-Based Therapies ,' Aging', *Cell Stem Cell*, 20(2), pp. 161–175. doi: 10.1016/j.stem.2017.01.008.

OECD (2021) *Quantitative indicators for high-risk/high-reward research*. [online]. Available from: https://www.oecd-ilibrary.org/science-and-technology/quantitative-indicators-for-high-risk-high-reward-research_675cbef6-en (Accessed 16 October 2024).

Olshansky, S. J. & Kirkland, J. L. (2024) Geroscience and Its Promise. *Cold Spring Harbor Perspectives in Medicine*. [Online] 14 (8), a041725.

O'Reilly, C. A. & Tushman, M. L. (2008b) Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in Organizational Behavior*. [Online] 28185–206.

Ozili, P. K. (2022) The Acceptable R-Square in Empirical Modelling for Social Science Research. *SSRN Electronic Journal*. [Online] [online]. Available from: https://www.ssrn.com/abstract=4128165 (Accessed 29 November 2024).

Petretto, D. & Pili, R. (2021) *Longevity, lifestyles and eating: The importance of education*. [online]. Available from: https://unicapress.unica.it/index.php/unicapress/catalog/book/978-88-3312-039-3 (Accessed 29 December 2024).

Porter, M. E. (1991) Towards a dynamic theory of strategy. *Strategic Management Journal*. [Online] 12 (S2), 95–117.

Porter, M. E. & Kramer, M. R. (n.d.) *The Link Between Competitive Advantage and Corporate Social Responsibility*.

Prahalad, C. K. & Hart, S. L. (2010a) The fortune at the bottom of the pyramid. *Revista Eletrônica de Estratégia & Negócios*. [Online] 1 (2), 1.

Rowley, J. (2012b) Conducting research interviews. *Management Research Review*. [Online] 35 (3/4), 260–271.

Roxburgh, S. (2009) Untangling Inequalities: Gender, Race, and Socioeconomic Differences in Depression[1]. *Sociological Forum*. [Online] 24 (2), 357–381.

Seidman, I. (2006) *Interviewing as qualitative research: a guide for researchers in education and the social sciences*. 3. ed. New York: Teachers College Press.

Sinclair, D. A. & LaPlante, M. D. (2019) *Lifespan: why we age--and why we don't have to*. First Atria Books hardcover edition. New York: Atria Books.

Singh, A. (2010) Modern Medicine: Towards Prevention, Cure, Well-being and Longevity. *Mens Sana Monographs*. [Online] 8 (1), 17.

Teece, D. J. et al. (1997) Dynamic capabilities and strategic management. *Strategic Management Journal*. [Online] 18 (7), 509–533.

Turner, D. (2014) Qualitative Interview Design: A Practical Guide for Novice Investigators. *The Qualitative Report*. [Online] [online]. Available from: https://nsuworks.nova.edu/tqr/vol15/iss3/19/ (Accessed 29 November 2024).

World Economic Forum & Bloom, D. E. (n.d.) *Population Aging and Economic Growth: From Demographic Dividend to Demographic Drag?*

Zeschky, M. et al. (2011) Frugal Innovation in Emerging Markets. *Research-Technology Management*. [Online] 54 (4), 38–45.

8 Appendices

8.1 Interview Questions:

Category	**Questions**
Societal Impact of Technologies	Which specific societal challenges do you feel longevity medicine is best positioned to address in the next decade, and why?
Societal Impact of Technologies	How do you think longevity technologies could reduce the economic burden of chronic diseases on healthcare systems?
Societal Impact of Technologies	Do you believe 'Smart' diagnostic and prevention tools and health monitoring systems will revolutionize healthcare, away from hospitals, or be integrated into existing healthcare models?
Societal Impact of Technologies	How important are the following factors in driving innovation within the longevity industry? (e.g., Gene Therapy, Stem Cell Research, AI Diagnostics, Wearable Devices, Precision Medicine, Senolytics)
Societal Impact of Technologies	What are promising AI Tools for Longevity?
Barriers to Innovation	What are the primary barriers to innovation in the longevity sector?
Barriers to Innovation	What challenges do founders face when seeking venture capital or state-backed funding for longevity startups?
Barriers to Innovation	How likely are you to invest or continue investing in companies focused on the following areas: Gene Therapy, Stem Cell Research, AI Diagnostics, Wearable Devices, Precision Medicine, Senolytics?
Barriers to Innovation	What are the biggest challenges your company faces when securing funding for longevity-related research and development? For investors - what is the most challenging part to evaluate?
Funding	How do you perceive the role of venture capital vs. state-backed funding in driving innovation within the longevity industry?
Funding	What type of funding does your company primarily rely on? / What funding do you typically provide?
Funding	What balance between public funding and venture capital do you believe would best support sustainable innovation in longevity technologies, and why?
Funding	How do you perceive the role of public-private partnerships in advancing longevity research? Do you believe they are more effective than private funding alone?
Promising Developments	Which specific areas within the longevity industry do you believe have the most potential for growth over the next five years, and why?

Promising Developments	How focused are you personally on longevity?
Promising Developments	Are you engaged in any longevity actions? If yes, what?

Interview 1: Female Founder/CFO from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Chronic diseases; higher productivity, reduced healthcare costs.
2	How can longevity tech reduce healthcare costs? Response: Public healthcare too rigid/short-term; tools mainly for self-paying individuals.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 1 (Revolutionize); system rigidity limits integration.
4	Innovation drivers ranked (best to worst): Wearables (1), AI Diagnostics (2), Stem Cell Research (3), Gene Therapy (4), Precision Medicine (5), Senolytics (6).
5	Barriers to innovation? Response: Lack of long-term funding (VC/state-backed).
6	Role of VC vs. state funding? Response: VC: flexible but short-term; State: traditional, slow to support longevity startups.
7	Challenges in securing funding? Response: Prevention-focused products hard to monetize; state funding outdated; VC prefers supplements for profitability.
8	Investment likelihood in longevity areas? Rank: Precision Medicine (5), Gene Therapy (4), Stem Cell Research (3), AI Diagnostics (2), Wearables (1), Senolytics (6).
9	Company funding type? Response: Bootstrapped.
10	Optimal public/VC funding balance? Response: 50:50 for sustainable innovation: public ensures long-term focus, VC ensures efficiency.
11	Challenges in funding R&D? Response: Misaligned VC ROI expectations with long-term longevity goals.
12	Public-private partnerships effectiveness? (1-5) Selected: 2 (Somewhat unlikely); public funding too slow and traditional.
13	Longevity industry growth areas? Response: Personalized supplements (easy adoption) and foundational health (sleep, nutrition) with measurable impacts.
14	Personal focus on longevity? (1-5) Selected: 5 (Very focused); regular monitoring and optimization.
15	Longevity actions taken? Response: Routine: sleep, exercise, nutrition, regular blood work, occasional tech experiments.
16	Promising AI tools for longevity? Response: None identified.
17-22	Demographics: Female, Germany, Master's degree, 25-34 years, $200K+ income, somewhat liberal.

Interview 2: Male Researcher/Scientist from Switzerland

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Improving quality of life by compressing comorbidities and increasing productivity.
2	How can longevity tech reduce healthcare costs? Response: By compressing comorbidities, reducing economic burden, and increasing productivity.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 3; tools likely integrated due to system constraints before full revolution.
4	Innovation drivers ranked (best to worst): Wearables (1), AI Diagnostics (2), Precision Medicine (3), Senolytics (4), Stem Cell Research (5), Gene Therapy (6).
5	Barriers to innovation? Response: Public skepticism from misinformation, distrust, and safety concerns.
6	Role of VC vs. state funding? Response: VC supports startups with speed and risk tolerance; state funding ensures long-term R&D.
7	Challenges in securing funding? Response: High costs for evidence generation through trials and regulatory approvals.
8	Investment likelihood in longevity areas? Rank: Gene Therapy (5), AI Diagnostics (5), Wearables (5), Precision Medicine (4), Stem Cell Research (3), Senolytics (3).
9	Company funding type? Response: University grants.
10	Optimal public/VC funding balance? Response: Public prioritizes care integration for accessibility; VC ensures innovation speed.
11	Challenges in funding R&D? Response: Mismatch between VC ROI expectations and longevity research timelines.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; important but not always more effective than private funding alone.
13	Longevity industry growth areas? Response: Real-world evidence (RWE) to drive adoption via data-driven validation.
14	Personal focus on longevity? (1-5) Selected: 5 (Very focused); direct research involvement and innovation commitment.
15	Longevity actions taken? Response: Talent Incubator in Zurich and EDEN Project for longevity innovation.
16	Promising AI tools for longevity? Response: None identified.
17-22	Demographics: Male, Switzerland, Master's degree, 25-34 years, income $50K-$99K, neutral political orientation.

Interview 3: Male Investor (VC/Private Equity) from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Reducing chronic diseases, doctor visits, hospitalizations, and healthcare costs.
2	How can longevity tech reduce healthcare costs? Response: By reducing doctor visits and hospitalizations, improving resource efficiency.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 4; likely integrated within current healthcare frameworks.
4	Innovation drivers ranked (best to worst): Gene Therapy (1), Stem Cell Research (2), Senolytics (3), AI Diagnostics (4), Wearables (4), Precision Medicine (6).
5	Barriers to innovation? Response: Regulatory hurdles across regions delaying approvals and adoption.
6	Role of VC vs. state funding? Response: VC provides agility; state funding ensures long-term societal R&D benefits.
7	Challenges in securing funding? Response: VC vehicles focus on quick ROI, not long-term R&D.
8	Investment likelihood in longevity areas? Rank: Gene Therapy (4), Wearables (4), Stem Cell Research (2), AI Diagnostics (1), Senolytics (3), Precision Medicine (6).
9	Company funding type? Response: Seed & Series A.
10	Optimal public/VC funding balance? Response: Close to 50/50; VC ensures agility; public funding ensures long-term support.
11	Challenges in funding R&D? Response: High R&D costs are a major challenge.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; somewhat effective but not necessarily more efficient than private funding.
13	Longevity industry growth areas? Response: AI-based preventive healthcare for personalized, data-driven solutions.
14	Personal focus on longevity? (1-5) Selected: 2 (Somewhat unlikely); limited due to primary investment activities.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: AI-based preventive healthcare as a promising innovation area.
17-22	Demographics: Male, Germany, Master's degree, 25-34 years, income $100K-$199K, somewhat conservative political orientation.

Interview 4: Male Founder/CEO/CTO/CFO/COO from Austria

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Reducing healthcare costs through tailored, efficient preventive actions.
2	How can longevity tech reduce healthcare costs? Response: Addressing individual needs efficiently with tailored preventive measures.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 3; revolutionize gradually after integration into existing workflows.
4	Innovation drivers ranked (best to worst): AI Diagnostics (1), Precision Medicine (2), Wearables (3), Senolytics (4), Gene Therapy (5), Stem Cell Research (6).
5	Barriers to innovation? Response: Regulatory hurdles delaying approval and adoption.
6	Role of VC vs. state funding? Response: VC ensures growth agility; state funding supports stability and long-term R&D.
7	Challenges in securing funding? Response: Time-consuming process with setbacks and difficulties securing consistency.
8	Investment likelihood in longevity areas? Rank: AI Diagnostics (5), Precision Medicine (2), Wearables (4), Stem Cell Research (3), Senolytics (4), Gene Therapy (1).
9	Company funding type? Response: Public funding supports innovation with long-term societal benefits.
10	Optimal public/VC funding balance? Response: Early public funding, followed by 50:50 balance at the seed stage.
11	Challenges in funding R&D? Response: VC short-term ROI expectations misalign with longevity R&D timelines.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; valuable but limited in agility compared to private funding.
13	Longevity industry growth areas? Response: Machine learning for advanced data analysis, predictive modeling, and personalization.
14	Personal focus on longevity? (1-5) Selected: 5 (Very focused); involved in personalized health and predictive technologies.
15	Longevity actions taken? Response: Personalized Risk Tool identifies individuals at risk early for proactive interventions.
16	Promising AI tools for longevity? Response: Machine learning for predictive modeling and personalization.
17-22	Demographics: Male, Austria, Doctoral degree, 35-44 years, income $50K-$99K, neutral political orientation.

Interview 5: Male Founder/CEO/CTO/CFO/COO from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Early detection and prevention reduce aging-related disease costs and enhance quality of life.
2	How can longevity tech reduce healthcare costs? Response: Proactive measures address health issues early, reducing interventions and costs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 5; integration ensures scalability, accessibility, and long-term impact.
4	Innovation drivers ranked (best to worst): Gene Therapy (1), AI Diagnostics (2), Stem Cell Research (3), Precision Medicine (4), Senolytics (5), Wearables (6).
5	Barriers to innovation? Response: Regulatory hurdles delay approval and adoption of new technologies.
6	Role of VC vs. state funding? Response: Public funding supports research; VC scales and translates to market.
7	Challenges in securing funding? Response: High R&D costs, long timelines, and niche market challenges.
8	Investment likelihood in longevity areas? Rank: Stem Cell Research (1), AI Diagnostics (2), Gene Therapy (3), Precision Medicine (4), Senolytics (5), Wearables (6).
9	Company funding type? Response: Early Stage (Seed, Series A).
10	Optimal public/VC funding balance? Response: Public funds support long-term research; VC drives market scalability.
11	Challenges in funding R&D? Response: High costs and long timelines lead to uncertain payoffs and undefined customer needs.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; bridge research and market but face regulatory and market challenges.
13	Longevity industry growth areas? Response: AI Diagnostics for model development and precise data interpretation.
14	Personal focus on longevity? (1-5) Selected: 2 (Somewhat unlikely); moderate focus with other professional priorities.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: Freenome, Mito Health, PathAI, Gero, WHOOP.
17-22	Demographics: Male, Germany, Bachelor's degree, 25-34 years, income $25K-$49K, neutral political orientation.

Interview 6: Male Investor (VC/Private Equity) from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Enabling early diagnosis and treatment of chronic diseases to manage them at an early stage and reduce economic costs.
2	How can longevity tech reduce healthcare costs? Response: Early diagnosis and treatment prevent conditions from developing fully or becoming severe.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 4; will complement existing models rather than replace them entirely.
4	Innovation drivers ranked (best to worst): Stem Cell Research (1), Gene Therapy (2), Senolytics (3), AI Diagnostics (4), Precision Medicine (5), Wearables (6).
5	Barriers to innovation? Response: High R&D costs, unclear customer needs, uncertain payoffs, and the need for substantial technical knowledge.
6	Role of VC vs. state funding? Response: VC supports short-term growth, while state funding is crucial for fundamental research.
7	Challenges in securing funding? Response: High R&D costs and undefined time horizons pose challenges for securing funding.
8	Investment likelihood in longevity areas? Rank: Stem Cell Research (1), Gene Therapy (3), AI Diagnostics (4), Senolytics (2), Precision Medicine (5), Wearables (6).
9	Company funding type? Response: Equity investments of €200,000 to €1 million in Seed Series rounds.
10	Optimal public/VC funding balance? Response: Current 60/40 split; public funding supports fundamental research, while VC drives market scalability.
11	Challenges in funding R&D? Response: Regulatory delays, uncertain payoffs, and time horizons make funding difficult.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; valuable but constrained by regulatory challenges.
13	Longevity industry growth areas? Response: Wearables and AI to revolutionize healthcare via real-time monitoring and personalized recommendations.
14	Personal focus on longevity? (1-5) Selected: 2; not strongly focused, with other professional priorities.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: AI-based diagnostics for faster and more accurate identification of diseases.
17-22	Demographics: Male, Germany, Doctoral degree, 25-34 years, income $100K-$199K, neutral political orientation.

Interview 7: Male Founder/CEO/CTO/CFO/COO from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Enables self-management and preventive care through user-friendly, accessible medical knowledge.
2	How can longevity tech reduce healthcare costs? Response: Encourages early responses to health issues, reducing the need for costly interventions.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 4; integration should be meaningful and outcome-driven.
4	Innovation drivers ranked (best to worst): AI Diagnostics (1), Wearables (2), Stem Cell Research (3), Gene Therapy (4), Senolytics (5), Precision Medicine (6).
5	Barriers to innovation? Response: Regulatory hurdles delay the adoption and approval of new technologies.
6	Role of VC vs. state funding? Response: VC drives growth agility; state-backed funding provides stability for long-term development.
7	Challenges in securing funding? Response: State funding requires detailed financial plans; healthcare incumbents resist new models.
8	Investment likelihood in longevity areas? Rank: Wearables (4), Stem Cell Research (3), AI Diagnostics (1), Gene Therapy (2), Senolytics (5), Precision Medicine (6).
9	Company funding type? Response: State and private funding combined; public funds capped at €500k, requiring private co-funding.
10	Optimal public/VC funding balance? Response: Balanced 50/50 funding structure; good advisors often more valuable than funding for scaling.
11	Challenges in funding R&D? Response: VC short-term ROI expectations conflict with long-term longevity R&D needs.
12	Public-private partnerships effectiveness? (1-5) Selected: 4; valuable for stability and growth but may lack agility compared to private funding.
13	Longevity industry growth areas? Response: Non-invasive blood measurement methods for accessible monitoring.
14	Personal focus on longevity? (1-5) Selected: 2; focused but not deeply immersed.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: Analytical AI for improved diagnostics and operational efficiency; generative AI not yet mature for hospitals.
17-22	Male, Germany, Master's degree, 25-34 years, income $50K-$99K, somewhat conservative political orientation.

Interview 8: Male Healthcare Professional from US/Israel

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Increase healthspan by 2 years, reduce chronic disease onset, and lower healthcare costs.
2	How can longevity tech reduce healthcare costs? Response: Delaying chronic diseases improves productivity and reduces ongoing treatment needs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 4; smart tools must be integrated into existing models for scale.
4	Innovation drivers ranked (best to worst): Stem Cell Research (1), Gene Therapy (2), Senolytics (3), Wearables (4), AI Diagnostics (5), Precision Medicine (6).
5	Barriers to innovation? Response: High R&D costs and lengthy timelines present challenges.
6	Role of VC vs. state funding? Response: State awareness and pharmaceutical engagement are critical; examples include Eli Lilly and GSK's investments.
7	Challenges in securing funding? Response: Investor misunderstanding of long-term potential and undefined customer needs.
8	Investment likelihood in longevity areas? Rank: Stem Cell Research (5), Senolytics (1), Gene Therapy (3), Wearables (4), AI Diagnostics (2), Precision Medicine (6).
9	Company funding type? Response: Funding for trials comes from pharmaceutical companies or the government.
10	Optimal public/VC funding balance? Response: 50/50 split ensures foundational research and market translation.
11	Challenges in funding R&D? Response: Investor misunderstanding and long timeframes for impactful outcomes.
12	Public-private partnerships effectiveness? (1-5) Selected: 5; bridges foundational research and commercial scalability.
13	Longevity industry growth areas? Response: Approved drugs, like metformin, could make longevity medicine integral to daily life.
14	Personal focus on longevity? (1-5) Selected: 5; highly engaged through supplements and related research.
15	Longevity actions taken? Response: Movement, sleep tracking, blood analysis, and metformin use for health optimization.
16	Promising AI tools for longevity? Response: Monitoring vital data and advancements in new drugs entering the market.
17-22	Demographics: Male, US/Israel, Doctoral degree, 65+, income >$200K, neutral political orientation.

Interview 9: Female Investor (VC/Private Equity) from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Early disease detection, enhanced prevention, and more personalized treatments.
2	How can longevity tech reduce healthcare costs? Response: Improving early detection and effective treatments reduces long-term care costs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 2; tools integrate with existing models, driven by wearables.
4	Innovation drivers ranked (best to worst): Gene Therapy (2), Wearables (2), AI Diagnostics (3), Precision Medicine (4), Senolytics (5), Stem Cell Research (6).
5	Barriers to innovation? Response: High R&D costs and complexity deter VC investment due to risk.
6	Role of VC vs. state funding? Response: VC drives rapid growth; public funding supports long-term foundational research.
7	Challenges in securing funding? Response: Long research timelines misalign with VC goals; state funding is slow but essential for societal goals.
8	Investment likelihood in longevity areas? Rank: Gene Therapy (1), Wearable Devices (2), AI Diagnostics (3), Precision Medicine (4), Senolytics (5), Stem Cell Research (6).
9	Company funding type? Response: Venture capital, particularly for long-term investments.
10	Optimal public/VC funding balance? Response: Suggested 60/40 split to prioritize public funding in early development stages.
11	Challenges in funding R&D? Response: High R&D costs and misalignment of VC and public funding goals.
12	Public-private partnerships effectiveness? (1-5) Selected: 5; critical for bridging pre-product, pre-revenue stage funding gaps.
13	Longevity industry growth areas? Response: Genome analysis, personalized medicine, health monitoring, and drug discovery platforms.
14	Personal focus on longevity? (1-5) Selected: 3; moderately focused.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: AI/ML tools in drug discovery and genome analysis.
17-22	Demographics: Female, Germany, Master's degree, 25-34 years, income $50K-$99K, somewhat liberal political orientation.

Interview 10: Male Founder/CEO/CTO/CFO/COO from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Early disease detection, prevention, efficient treatment, and personalized options improve life quality for aging populations.
2	How can longevity tech reduce healthcare costs? Response: Early detection, preventive measures, and personalized treatment reduce chronic disease burdens.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 2; tools will integrate due to regulatory and adoption challenges.
4	Innovation drivers ranked (best to worst): AI Diagnostics (1), Gene Therapy (2), Stem Cell Research (2), Wearables (3), Precision Medicine (4), Senolytics (5).
5	Barriers to innovation? Response: Regulatory hurdles and market misunderstandings by investors slow scaling and adoption.
6	Role of VC vs. state funding? Response: VC is agile but takes significant stakes; state-backed funding supports long-term research but is slower to access.
7	Challenges in securing funding? Response: Investors often lack a deep understanding of the longevity sector's potential.
8	Investment likelihood in longevity areas? Rank: Wearables (3), AI Diagnostics (1), Gene Therapy (2), Stem Cell Research (2), Precision Medicine (4), Senolytics (5).
9	Company funding type? Response: Grants and angel investment rounds planned for this year.
10	Optimal public/VC funding balance? Response: Minimal state funding preferred due to slow decision-making; VC provides agility but takes stakes.
11	Challenges in funding R&D? Response: Regulatory delays and market uncertainty make investment challenging.
12	Public-private partnerships effectiveness? (1-5) Selected: 4; partnerships provide long-term support but not necessarily more effective than private funding alone.
13	Longevity industry growth areas? Education is critical; informed users are essential for adopting technical devices.
14	Personal focus on longevity? (1-5) Selected: 4; focused but balanced with other priorities.
15	Longevity actions taken? Response: Health-conscious lifestyle including sleep tracking, food monitoring, and exercise (4+ times per week).
16	Promising AI tools for longevity? Response: AI tracking and analysis of health metrics for personalized care.
17-22	Demographics: Male, Germany, Master's degree, 18-24 years, income $50K-$99K, neutral political orientation.

Interview 11: Male Founder of the Biggest Longevity Platform from UK

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Shifting from sick-care to proactive care to prevent chronic diseases and reduce healthcare burdens.
2	How can longevity tech reduce healthcare costs? Response: A proactive care model reduces chronic disease onset and healthcare costs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 2; lifecare therapies mitigate diseases at early stages but integrate into private markets.
4	Innovation drivers ranked (best to worst): Stem Cell Research (1), Gene Therapy (2), Precision Medicine (3), AI Diagnostics (4), Wearables (5), Senolytics (6).
5	Barriers to innovation? Response: Lack of long-term funding, regulatory hurdles, and investor understanding.
6	Role of VC vs. state funding? Response: Public funding provides long-term stability; VC offers agility and scalability.
7	Challenges in securing funding? Response: Few funds are dedicated solely to longevity, requiring focus on healthspan over longevity.
8	Investment likelihood in longevity areas? Rank: Stem Cell Research (2), Gene Therapy (4), Wearables (5), Precision Medicine (3), AI Diagnostics (1), Senolytics (6).
9	Company funding type? Response: Grants and VC.
10	Optimal public/VC funding balance? Response: 50/50 split; public funds support research; VC scales innovation.
11	Challenges in funding R&D? Response: Regulatory delays, high R&D costs, and investor misunderstanding of potential.
12	Public-private partnerships effectiveness? (1-5) Selected: 4; grant funding and informed VCs critical for sector success.
13	Longevity industry growth areas? Response: GLP-1 agonists (e.g., semaglutide) and aging biomarkers for real-time intervention evaluation.
14	Personal focus on longevity? (1-5) Selected: 4; engaged in health research, supplementation, and optimization.
15	Longevity actions taken? Response: Sleep, balanced exercise, no alcohol, stress management, and personalized supplements.
16	Promising AI tools for longevity? Response: Tools like "10 Levels of Longevity" and Whoop to enhance health metrics for platforms.
17-22	Demographics: Male, UK, Master's degree, 55-64 years, income >$200K, somewhat liberal political orientation.

Interview 12: Male Healthcare Professional from United States

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Improve quality of life, reduce illness at end of life, and promote equity in aging through sleep, exercise, and nutrition.
2	How can longevity tech reduce healthcare costs? Response: Preventative measures like sleep, exercise, and nutrition reduce the healthcare burden and contribute to a stronger workforce.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 5; integrated into existing models with hospitals adapting to new technologies.
4	Innovation drivers ranked (best to worst): Stem Cell Research (1), Gene Therapy (2), Precision Medicine (3), AI Diagnostics (4), Wearables (5), Senolytics (6).
5	Barriers to innovation? Response: Regulatory hurdles and lack of understanding of technology potential limit scaling.
6	Role of VC vs. state funding? Response: Both are equally important for driving innovation.
7	Challenges in securing funding? Response: VC and pharma engagement needed for solving long-term challenges in longevity.
8	Investment likelihood in longevity areas? Rank: Gene Therapy (4), Stem Cell Research (2), AI Diagnostics (5), Precision Medicine (3), Wearables (6), Senolytics (2).
9	Company funding type? Response: Trials funded by pharmaceutical companies or the government.
10	Optimal public/VC funding balance? Response: 50/50 split ensures foundational research and market scalability.
11	Challenges in funding R&D? Response: Lack of proof of concept, risk management, and VC funding challenges.
12	Public-private partnerships effectiveness? (1-5) Selected: 3; partnerships have potential but are not always superior to private funding alone.
13	Longevity industry growth areas? Response: Precision medicine with biomarkers and probiotics; Altos Labs as an example of future innovation.
14	Personal focus on longevity? (1-5) Selected: 5; highly focused through professional engagement and personal habits.
15	Longevity actions taken? Response: Tracking health data, glucose levels, and testing therapeutics collaboratively.
16	Promising AI tools for longevity? Response: AI-driven drug discovery tools like Zebra Medical for molecule identification in trials.
17-22	Demographics: Male, United States, Doctoral degree, 25-34 years, income $100K-$199K, somewhat liberal political orientation.

Interview 13: Male Investor (VC/Private Equity) from Germany

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Prevention and education on lifestyle choices improve long-term health outcomes.
2	How can longevity tech reduce healthcare costs? Response: Fewer doctor visits and hospitalizations reduce costs and improve resource efficiency.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 4; tools are likely to integrate into existing healthcare models.
4	Innovation drivers ranked (best to worst): Wearables (1), AI Diagnostics (2), Gene Therapy (3), Stem Cell Research (4), Precision Medicine (5), Senolytics (6).
5	Barriers to innovation? Response: Public skepticism, long research cycles, and regulatory hurdles.
6	Role of VC vs. state funding? Response: VC enables flexibility and speed; public funding supports long-term R&D.
7	Challenges in securing funding? Response: Novelty of longevity sector requires patience and sustained investment.
8	Investment likelihood in longevity areas? Rank: Stem Cell Research (1), AI Diagnostics (3), Gene Therapy (2), Wearables (4), Precision Medicine (6), Senolytics (5).
9	Company funding type? Response: Venture Capital, Series A and B funding.
10	Optimal public/VC funding balance? Response: 70/30 split; government supports long-term R&D, VC focuses on experimental projects.
11	Challenges in funding R&D? Response: Regulatory delays, high R&D costs, and uncertain project timelines.
12	Public-private partnerships effectiveness? (1-5) Selected: 5; partnerships effectively advance longevity research.
13	Longevity industry growth areas? Response: Personalized diets tailored to genetic profiles and specific health needs.
14	Personal focus on longevity? (1-5) Selected: 2; not very focused.
15	Longevity actions taken? Response: None.
16	Promising AI tools for longevity? Response: Oncology diagnostics and AI-powered pharma R&D tools.
17-22	Demographics: Male, Germany, Master's degree, 25-34 years, income $100K-$199K, somewhat liberal political orientation.

Interview 14: Female Investor (VC/Private Equity) from United States

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Prevention and early intervention for diseases like diabetes, heart disease, and dementia.
2	How can longevity tech reduce healthcare costs? Response: Addressing root causes of chronic diseases before they fully develop reduces costs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 5; tools will integrate into existing models, driven by wearables and personalized medicine.
4	Innovation drivers ranked (best to worst): Gene Therapy (1), Wearables (2), AI Diagnostics (3), Precision Medicine (4), Senolytics (5), Stem Cell Research (6).
5	Barriers to innovation? Response: Regulatory hurdles and lack of investor understanding of technology's potential.
6	Role of VC vs. state funding? Response: VC fuels growth and experimentation; public funding provides long-term foundational support.
7	Challenges in securing funding? Response: Public funding is slow; private capital is more flexible and suitable for innovation.
8	Investment likelihood in longevity areas? Rank: Gene Therapy (1), Wearables (2), AI Diagnostics (3), Precision Medicine (4), Senolytics (5), Stem Cell Research (6).
9	Company funding type? Response: Venture Capital, focused on long-term funding.
10	Optimal public/VC funding balance? Response: Private capital should dominate, as public funding is too slow for fast-paced innovation.
11	Challenges in funding R&D? Response: Regulatory complexity, treatment uncertainty, and lack of investor understanding.
12	Public-private partnerships effectiveness? (1-5) Selected: 4; partnerships are valuable but public funding is often too slow.
13	Longevity industry growth areas? Response: Hormonal replacement therapies to address aging challenges and systemic health regulation.
14	Personal focus on longevity? (1-5) Selected: 5; deeply engaged through supplementation and optimization practices.
15	Longevity actions taken? Response: Use of supplements like Creatine, NHD, and NAD to support cellular health and energy production.
16	Promising AI tools for longevity? Response: Tools include 23andme, Biome, Genomic Analysis, Google DeepMind, Grail, and Bioage Labs.
17-22	Demographics: Female, United States, Master's degree, 45-54 years, income >$200K, somewhat liberal political orientation.

Interview 15: Female Wearable VP from the United States

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Improving quality of life for aging populations through specialized technology like the Oura Ring, which supports small, sustainable steps toward health improvements.
2	How can longevity tech reduce healthcare costs? Response: The Oura Ring helps address sports, relaxation, and overall well-being by integrating gradual lifestyle changes.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 5; wearable tech has potential but faces challenges such as bad data reputation, lack of EHR compatibility, and privacy concerns.
4	Innovation drivers ranked (best to worst): Wearables (1), AI Diagnostics (2), Precision Medicine (3), Gene Therapy (4), Stem Cell Research (5), Senolytics (6).
5	Barriers to innovation? Response: Regulatory hurdles, which delay integration and market acceptance of wearable technology.
6	Role of VC vs. state funding? Response: VC provides speed, expertise, and commercialization opportunities, while state-backed funding is slower but supports long-term foundational research.
7	Challenges in securing funding? Response: High ROI expectations and short timeframes create pressure for healthcare startups to balance risk and reward.
8	Investment likelihood in longevity areas? Rank: Wearables (1), AI Diagnostics (2), Precision Medicine (3), Gene Therapy (4), Stem Cell Research (5), Senolytics (6).
9	Company funding type? Response: Bootstrapped; quick private funding combined with government grants (75/25 split).
10	Optimal public/VC funding balance? Response: Private funding is faster and more flexible, while public funding is essential but often delayed by regulatory requirements.
11	Challenges in funding R&D? Response: Regulatory delays hinder wearable tech integration into clinical environments.
12	Public-private partnerships effectiveness? (1-5) Selected: 4; integrating wearable data into clinical environments is a promising path forward.
13	Longevity industry growth areas? Response: Genetic testing, personalized recommendations, and nutrition supplementation such as collagen, retinol, and hyaluronic acid.
14	Personal focus on longevity? (1-5) Selected: 4; actively engaged in using wearable devices like Oura Ring.
15	Longevity actions taken? Response: Regularly tracking health metrics using the Oura Ring and incorporating nutrition and skincare supplements.
16	Promising AI tools for longevity? Response: Tools include 23andme, Biome, Google DeepMind, Grail, and Bioage Labs.
17-22	Demographics: Female, United States, Master's degree, 35-44 years, income $100K-$199K, somewhat conservative

Interview 16: Female VP at Tech Company

QID	Question and Response
1	Societal challenges longevity medicine can address? Response: Preventive activities and education to improve quality of life for aging populations.
2	How can longevity tech reduce healthcare costs? Response: Prevention and proactive actions reduce chronic diseases and long-term costs.
3	Revolutionize or integrate into healthcare models? (1-5) Selected: 3; integration is realistic given pharma industry influence.
4	Innovation drivers ranked (best to worst): Wearables (1), AI Diagnostics (2), Precision Medicine (3), Gene Therapy (4), Stem Ce Research (5), Senolytics (6).
5	Barriers to innovation? Response: Regulatory hurdles slow innovation and market introduction of solutions.
6	Role of VC vs. state funding? Response: VC supports rapid growth; public funding provides long-term foundationa research.
7	Challenges in securing funding? Response: Higher risks make investors hesitant; balancing risk and reward is critical.
8	Investment likelihood in longevity areas? Rank: Wearables (1), AI Diagnostics (2), Precision Medicine (3), Gene Therapy (4), St Cell Research (5), Senolytics (6).
9	Company funding type? Response: Primarily private funding.
10	Optimal public/VC funding balance? Response: More public funding needed for long-term success, balanced with VC for short-term innovation.
11	Challenges in funding R&D? Response: Short-term ROI expectations from VCs conflict with longevity sector's long term focus.
12	Public-private partnerships effectiveness? (1-5) Selected: 5; critical for long-term success and healthcare revolution.
13	Longevity industry growth areas? Response: AI-driven home tools like systems analyzing urine and providing dietary advice.
14	Personal focus on longevity? (1-5) Selected: 5; deeply integrated into personal and professional practices.
15	Longevity actions taken? Response: Consulting, coaching, education, and use of AI-based tools for health tracki and planning.
16	Promising AI tools for longevity? Response: Tools for health data analysis, nutrition tracking, and workout planning.
17-22	Demographics: Female, Italy, Master's degree, 55+ years, income N/A ,

8.2 Survey Guide

- **Do you currently use any longevity-focused products or services (e.g., wearable devices, gene therapy, AI-powered diagnostics)?**

  - Yes
  - No

- **How likely are you to consider adopting longevity-related innovations to monitor or improve your health in the future?**

  - Extremely likely (definitely)
  - Very likely (probably)
  - Neutral (undecided)
  - Slightly unlikely (probably not)
  - Extremely unlikely (definitely not)

- **How would you describe your current approach to managing your health?**

  - Extremely proactive (e.g., regular check-ups, preventive care, health monitoring)
  - Somewhat proactive (e.g., occasional check-ups, some focus on prevention)
  - Neutral (e.g., reactive only when needed, no specific focus on prevention)
  - Somewhat reactive (e.g., only seek care when experiencing symptoms)
  - Extremely reactive (e.g., avoid healthcare unless absolutely necessary)

- **To what extent would a recommendation from your doctor or healthcare provider increase your likelihood of using longevity-related products?**

  - Extremely likely (would significantly increase my likelihood)
  - Very likely (would slightly increase my likelihood)
  - Neutral (would make no difference)
  - Slightly unlikely (would decrease my likelihood slightly)
  - Extremely unlikely (would significantly decrease my likelihood)

- **What do you see as the biggest barriers to adopting longevity-focused innovations? (Select up to three)**

  - High costs
  - Lack of scientific validation
  - Limited accessibility
  - Concerns about data privacy
  - Lack of awareness or information
  - Regulatory challenges

- **How much would you be willing to spend out of pocket per month on longevity-focused products or services?**

  - 0–25€
  - 25–50€
  - 50–100€
  - 100–200€
  - More than 200€

- **How willing are you to share your personal health data with companies developing longevity-related technologies if it meant receiving more personalized care?**

  - Extremely willing (would share data under any circumstances)
  - Very willing (would share data with some privacy controls)
  - Neutral (indifferent to sharing data)
  - Slightly unwilling (would prefer not to share data)
  - Extremely unwilling (would not share data under any circumstances)

- **Which digital health technologies do you see as most impactful for improving health outcomes? (Select up to two)**

  - AI-powered diagnostics
  - Wearable devices
  - Telemedicine platforms
  - Remote patient monitoring
  - Other

- **To what extent do you think longevity-focused innovations will disrupt traditional healthcare practices within the next decade?**

  - Extremely disruptive (will completely replace traditional healthcare practices)
  - Very disruptive (will significantly alter healthcare practices)
  - Moderately disruptive (will cause noticeable changes)
  - Slightly disruptive (will cause minor changes)
  - Not disruptive at all (no significant impact on traditional practices)

- **To what extent would government subsidies or funding initiatives influence your likelihood of adopting longevity-related products?**

  - Extremely likely (would significantly increase my likelihood)
  - Very likely (would slightly increase my likelihood)
  - Neutral (would make no difference)
  - Slightly unlikely (would decrease my likelihood slightly)
  - Extremely unlikely (would significantly decrease my likelihood)

- **To what extent would a recommendation from a healthcare provider influence your likelihood of using longevity-related products?**

  - Extremely likely (would significantly increase my likelihood)

- Very likely (would slightly increase my likelihood)
- Neutral (would make no difference)
- Slightly unlikely (would decrease my likelihood slightly)
- Extremely unlikely (would significantly decrease my likelihood)

- **What is your age group?**

  - Under 25
  - 25–34
  - 35–44
  - 45–54
  - 55 or older

- **What is your highest level of education?**

  - High school or equivalent
  - Bachelor's degree
  - Master's degree
  - Doctorate or higher

- **Where do you currently live?**

  - Europe
  - North America
  - Asia
  - Other

- **What gender do you identify with?**

  - Female
  - Male
  - Non-binary/Other

- **What is your annual household income?**

  - Less than €30,000
  - €30,000–€50,000
  - €50,000–€75,000
  - €75,000–€100,000
  - €100,000+

8.3 Data Analysis and Statistics

```
library(tidyverse)
## Warning: Paket 'purrr' wurde unter R Version 4.3.3 erstellt
## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
## ✓ dplyr     1.1.4     ✓ readr     2.1.4
## ✓ forcats   1.0.0     ✓ stringr   1.5.1
## ✓ ggplot2   3.4.4     ✓ tibble    3.2.1
## ✓ lubridate 1.9.3     ✓ tidyr     1.3.0
## ✓ purrr     1.0.2
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all confl
icts to become errors
library(stargazer)
##
## Please cite as:
##
##  Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statisti
cs Tables.
##  R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
library(dplyr)
# read excel file
data <- readxl::read_excel("feasible_data.xlsx")
glimpse(data)
## Rows: 135
## Columns: 15
## $ Q1  <chr> "Do you currently use any longevity-focused products or services (…
## $ Q2  <chr> "How likely are you to consider adopting longevity-related innovat…
## $ Q3  <chr> "How would you describe your current approach to managing your hea…
## $ Q4  <chr> "To what extent would a recommendation from your doctor or healthc…
## $ Q5  <chr> "What do you see as the biggest barriers to adopting longevity-foc…
## $ Q6  <chr> "How much would you be willing to spend out of pocket per month on…
## $ Q7  <chr> "How willing are you to share your personal health data with compa…
## $ Q8  <chr> "Which digital health technologies do you see as most impactful fo…
## $ Q9  <chr> "To what extent do you think longevity-focused innovations will di…
## $ Q10 <chr> "To what extent would government subsidies or funding initiatives …
## $ Q11 <chr> "What is your age?", "4", "3", "1", "1", "1", "1", "2", "1", "1", …
## $ Q12 <chr> "What is your highest level of education?", "3", "3", "1", "1", "2…
```

```
## $ Q13 <chr> "Where do you currently live? - Selected Choice", "1", "1", "1", "…
## $ Q14 <chr> "What gender do you identify with?", "2", "1", "2", "2", "2", "2",…
## $ Q15 <chr> "What is your annual household income?", "1", "3", "2", "1", "1", …
# remove first row
data <- data[-1,]
glimpse(data)
## Rows: 134
## Columns: 15
## $ Q1  <chr> "2", "1", "2", "2", "2", "1", "2", "2", "2", "2", "2", "1", "2", "…
## $ Q2  <chr> "2", "1", "3", "3", "2", "1", "2", "2", "3", "2", "1", "1", "3", "…
## $ Q3  <chr> "5", "2", "3", "2", "3", "2", "2", "3", "2", "2", "1", "1", "2", "…
## $ Q4  <chr> "1", "2", "1", "1", "2", "2", "1", "3", "3", "2", "2", "1", "2", "…
## $ Q5  <chr> "3,4,6", "1,2,5", "4", "2,3,4", "1,2", "2,3", "1,3,5", "2,4,5", "2…
## $ Q6  <chr> "4", "4", "2", "2", "1", "2", "2", "1", "1", "4", "3", "5", "3", "…
## $ Q7  <chr> "4", "1", "3", "4", "2", "3", "2", "5", "3", "2", "2", "3", "2", "…
## $ Q8  <chr> "4", "1,4", "2,4", "1,4", "1,2", "1,2", "1", "3,4", "1,2", "1,3", …
## $ Q9  <chr> "3", "3", "3", "4", "3", "2", "3", "4", "3", "4", "2", "5", "4", "…
## $ Q10 <chr> "3", "1", "2", "3", "3", "2", "3", "2", "3", "4", "2", "3", "2", "…
## $ Q11 <chr> "4", "3", "1", "1", "1", "1", "2", "1", "1", "5", "4", "3", "2", "…
## $ Q12 <chr> "3", "3", "1", "1", "2", "2", "2", "3", "2", "4", "1", "3", "2", "…
## $ Q13 <chr> "1", "1", "1", "1", "1", "1", "1", "1", "1", "3", "1", "1", "1", "…
## $ Q14 <chr> "2", "1", "2", "2", "2", "2", "2", "2", "2", "2", "2", "1", "1", "…
## $ Q15 <chr> "1", "3", "2", "1", "1", "1", "1", "1", "3", "2", "1", "3", "2", "…
adoption_recommend <- lm(Q2 ~ factor(Q7), data = data)
summary(adoption_recommend)
##
## Call:
## lm(formula = Q2 ~ factor(Q7), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.50000 -0.83636  0.04545  0.16364  2.92308
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.3077     0.2437   5.366 3.61e-07 ***
## factor(Q7)2   0.5287     0.2710   1.951 0.053226 .
## factor(Q7)3   0.6469     0.3074   2.104 0.037285 *
## factor(Q7)4   0.7692     0.2985   2.577 0.011084 *
```

```
## factor(Q7)5   1.1923     0.3198   3.728 0.000288 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8787 on 129 degrees of freedom
## Multiple R-squared:  0.1069, Adjusted R-squared:  0.07924
## F-statistic: 3.861 on 4 and 129 DF,  p-value: 0.005365
step(adoption_recommend)
## Start:  AIC=-29.76
## Q2 ~ factor(Q7)
##
##              Df Sum of Sq     RSS     AIC
## <none>                     99.597 -29.759
## - factor(Q7)  4    11.925 111.522 -22.604
##
## Call:
## lm(formula = Q2 ~ factor(Q7), data = data)
##
## Coefficients:
## (Intercept)  factor(Q7)2  factor(Q7)3  factor(Q7)4  factor(Q7)5
##      1.3077       0.5287       0.6469       0.7692       1.1923
spend <- lm(Q2 ~ Q6 + Q15, data = data)
summary(spend)
##
## Call:
## lm(formula = Q2 ~ Q6 + Q15, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.67228 -0.64500  0.08041  0.43110  2.84584
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.64500    0.23347  11.329  < 2e-16 ***
## Q62         -0.75269    0.24502  -3.072 0.002611 **
## Q63         -1.10338    0.25336  -4.355 2.74e-05 ***
## Q64         -1.20622    0.27279  -4.422 2.10e-05 ***
## Q65         -1.31790    0.33467  -3.938 0.000136 ***
## Q152         0.54289    0.21434   2.533 0.012551 *
```

```
## Q153         0.02728    0.22041   0.124 0.901688
## Q154         0.26185    0.20242   1.294 0.198181
## Q155        -0.02855    0.36070  -0.079 0.937044
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8439 on 125 degrees of freedom
## Multiple R-squared:  0.2017, Adjusted R-squared:  0.1506
## F-statistic: 3.948 on 8 and 125 DF,  p-value: 0.0003408
step(spend)
## Start:  AIC=-36.79
## Q2 ~ Q6 + Q15
##
##        Df Sum of Sq     RSS     AIC
## <none>               89.026 -36.795
## - Q15   4    5.6141  94.640 -36.600
## - Q6    4   19.0535 108.079 -18.807
##
## Call:
## lm(formula = Q2 ~ Q6 + Q15, data = data)
##
## Coefficients:
## (Intercept)          Q62          Q63          Q64          Q65         Q152
##     2.64500     -0.75269     -1.10338     -1.20622     -1.31790      0.54289
##        Q153         Q154         Q155
##     0.02728      0.26185     -0.02855
age_vs_data <- lm(Q7 ~ Q11, data = data)
summary(age_vs_data)
##
## Call:
## lm(formula = Q7 ~ Q11, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.6000 -0.7619 -0.3333  1.0952  2.6667
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.6000     0.2320  15.521  < 2e-16 ***
```

```
## Q112          -0.8381     0.2930  -2.861 0.004931 **
## Q113          -1.2667     0.3219  -3.935 0.000135 ***
## Q114          -1.0615     0.3249  -3.268 0.001390 **
## Q115          -0.1714     0.3871  -0.443 0.658644
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.16 on 129 degrees of freedom
## Multiple R-squared:  0.1423, Adjusted R-squared:  0.1157
## F-statistic: 5.352 on 4 and 129 DF,  p-value: 0.0005088
# andere Kontrollvariablen haben keinen Einfluss auf data sharing willingness
stargazer(adoption_recommend,
          type = "html",
          title = "Data Sharing Willingness vs. Willingness to Adopt",
          dep.var.labels = "Willingness to Adopt",
          dep.var.caption = "",
          covariate.labels = c("Very willing", "Neutral", "Slightly unwilling", "Ex
tremely unwilling"),
          model.names = FALSE)
```

Data Sharing Willingness vs. Willingness to Adopt

	Willingness to Adopt
Very willing	0.529*
	(0.271)
Neutral	0.647**
	(0.307)
Slightly unwilling	0.769**
	(0.298)
Extremely unwilling	1.192***
	(0.320)
Constant	1.308***
	(0.244)
Observations	134
R^2	0.107
Adjusted R^2	0.079
Residual Std. Error	0.879 (df = 129)
F Statistic	3.861*** (df = 4; 129)
Note:	*p<0.1;* ***p<0.05;*** p<0.01

```
stargazer(spend, type = "html",
          title = "Spend",
          dep.var.caption = "",
          dep.var.labels = "Willingness to Adopt",
          covariate.labels = c("Willingness to spend: 25-49€", "Willingness to spen
d: 50-99€", "Willingness to spend: 100-200€", "Willingness to spend: 200€+", "Incom
e: 30.000-49.999€", "Income: 50.000-74.999€", "Income: 75.000-99.999€", "Income: 10
0.000€+"),
```

```
          model.names = FALSE)
```

Spend

	Willingness to Adopt
Willingness to spend: 25-49€	-0.753***
	(0.245)
Willingness to spend: 50-99€	-1.103***
	(0.253)
Willingness to spend: 100-200€	-1.206***
	(0.273)
Willingness to spend: 200€+	-1.318***
	(0.335)
Income: 30.000-49.999€	0.543**
	(0.214)
Income: 50.000-74.999€	0.027
	(0.220)
Income: 75.000-99.999€	0.262
	(0.202)
Income: 100.000€+	-0.029
	(0.361)
Constant	2.645***
	(0.233)
Observations	134
R^2	0.202
Adjusted R^2	0.151
Residual Std. Error	0.844 (df = 125)
F Statistic	3.948*** (df = 8; 125)
Note:	*p<0.1;* ***p<0.05;*** p<0.01

```
stargazer(age_vs_data,
          type = "html",
          title = "Age on Data Sharing Willingness",
          dep.var.labels = "Data Sharing Willingness",
          dep.var.caption = "",
          covariate.labels = c("25-34", "35-44", "45-54", "55+"),
          model.names = FALSE)
```

Age on Data Sharing Willingness

	Data Sharing Willingness
25-34	-0.838***
	(0.293)
35-44	-1.267***
	(0.322)
45-54	-1.062***
	(0.325)
55+	-0.171
	(0.387)
Constant	3.600***
	(0.232)
Observations	134
R^2	0.142
Adjusted R^2	0.116
Residual Std. Error	1.160 (df = 129)

F Statistic	5.352*** (df = 4; 129)
Note:	*p<0.1;* ***p<0.05;*** p<0.01