

# INDEPENDENT LIVING FOR THE ELDERLY

TREND REPORT 2020



Independent Living for the Elderly

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**Kindly supported by  
alley - VBMC ValueBasedManagedCare GmbH**

alley is an e-health start-up driving disruptive innovations aiming to enhance the quality of life.

alley is an innovative care model that bridges gaps, which emerge in patient care due to missing links in a patient's journey. It strives to become the leading medical platform for data-driven mapping of patient profiles and the individual companion for patients along their journey. alley aims to implement Value-Based Medicine as a new standard for the highest quality in health care and result-driven treatment.

The collaboration with the CDTM Trend Seminar 2020 is a promising step in understanding future challenges, in focussing on authentic needs and desires as well as in creating disruptive technology that provides solutions for challenges lying ahead of alley.

Visit [www.alley.de](http://www.alley.de) for more information.



**A project of the Center for  
Digital Technology and Management (CDTM)**

The Center for Digital Technology and Management (CDTM) is a joint, interdisciplinary institution for education, research, and entrepreneurship of the Ludwig-Maximilians-Universität (LMU) and the Technische Universität München (TUM).

It offers the add-on study program „Technology Management“ for students from various backgrounds, which provides students with tools and knowledge at the intersection of business and digital technologies.

The entire trend report was written by CDTM students under the close guidance of research assistants.

Visit [www.cdtm.de](http://www.cdtm.de) for more information.

# PREFACE OF THE EDITORS

As Herman Kahn, one of the founding fathers of modern scenario planning, nicely states, it is tremendously important for strategy and policymakers to get a deep understanding of possible future developments in order to be prepared for them.

The Center for Digital Technology and Management (CDTM) aims to empower the innovators of tomorrow. It is our mission to equip our students with the tools and knowledge they will need to become responsible leaders, who actively shape their future environment, rather than only react to changes.

This trend report is the result of the course Trend Seminar, which is part of the interdisciplinary add-on study program "Technology Management" at CDTM. About 25 selected students of various disciplines, such as Business Administration, Psychology, Neuroscience, Computer Science, Electrical Engineering, and others, work together on a relevant topic of our time. Over the course of seven intense weeks of full-time work, the participating students dive deeply into the topic of

Andreas Schrems (Freelance Consultant)  
 Anina Albert (IICM)  
 Bastian Best (Bardehle Pagenberg)  
 Christoph Berger (CDTM)  
 Dennis Wetzig (PIXRAY)  
 Dr. Anant Jani (University of Oxford)  
 Dr. Anne Latz (Alley)  
 Dr. Felix von Held (IICM)  
 Dr. Felix Werle (IICM)  
 Dr. Hartwig Rüll (Freelance Consultant)  
 Dr. Jean Ledger (University College London)  
 Felix Krauth (Alasco)  
 Franz Zünkler (CDTM)  
 Georg Plötz (Verbraucherzentrale Bayern e.V.)  
 Marina Fernández Fernández-Campoamor (CDTM)  
 Maximilian Rogg (IICM)

the Trend Seminar. Working in several interdisciplinary sub-teams, students apply the knowledge of their main studies and learn new perspectives from their team members. They conduct trend research, develop scenarios of the future, generate ideas for innovative products or services, and detail them out into concrete business concepts.

We would like to take the chance to thank everyone who contributed and made this CDTM trend report possible:

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 Remy Goldstein (CDTM)

“ **Everybody can learn from the past. Today it is important to learn from the future.** ”

Herman Kahn ”

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Philipp Hofsummer and Anna-Sophie Liebender-Luc  
 Center for Digital Technology and Management (CDTM)

# PREFACE OF THE PROJECT PARTNER

A baby born in Germany today can expect a life that lasts longer than 90 years. This data was reported by the Statistisches Bundesamt in 2020. An increased life expectancy results in a growing amount of people, aged 65 years or older, and thus a growing amount of elderly people compared to the total population. In 2019, 18 million German men and women were older than 65 years (1991: 12 million). Therefore, the question of dignified aging is becoming increasingly pressing.

Demographic change is one of the major trends that shape our society. However, it is not the only one: digitalization and new technologies are revolutionizing the way we communicate and connect with others and how we manage our daily life. New and innovative technologies are finding their way into our homes and workplaces, into our private spheres as well as into the public sector. Furthermore, innovations such as big data and artificial intelligence are becoming more and more involved in healthcare and consequently open new ways to diagnose, care and treat. With that, new chances to develop new solutions for upcoming problems are arising. Nevertheless, not all challenges faced by our society have already been addressed. We have also observed that society does not benefit equally from the unfolding chances.

We, at alley, are convinced that digitalization is one key element to tackle challenges caused by demographic change. We are convinced that smartly designed technology is one lever to empower elderly people and to promote independence over the course of life. Let's rethink elderly living in the digital age!

To develop innovations that contribute to healthy and content living among the elderly, we must first understand what the life of the elderly is like now, and what it will be like in 5 years, in 20 years. Therefore, we came up with these leading questions: What leads to happiness and fulfillment in old age? What are the social determinants

of health and how do these affect elderly living? How can supporting environments be designed to protect the elderly from health issues, and what preventative measures can be implemented to shift the focus towards independent, healthy living?

The enclosed research findings from alley's collaboration with the CDTM provide good news: They show that innovative technology is a powerful tool to tackle the challenges the elderly will face. We can empower older people, enable independent living, foster connectedness, and contribute to happiness as well as fulfillment in old age. We at alley are looking forward to developing great ideas during the CDTM partnership in order to focus on our users' needs and desires. alley being an agile start-up is growing constantly, and we are more than delighted to stay in touch with CDTM and the students of the fall 2020.

To all the CDTM students of the class of fall 2020 – thank you so much for your drive and enthusiasm, complementary skills, and visionary ideas. You truly took us on an inspiring journey to the future of the elderly and yes, of our very own future. You revealed chances how the future can be shaped and how smart technologies can contribute to a dignified future for all of us.

Our special thanks go to Anna-Sophie Liebender-Luc and Philipp Hofsommer, CDTM Trend Seminar Supervisors,

“ **Digitalization and digital medicine are powerful factors for enhancing quality of life, now and in the future. Let's rethink elderly living!** ”

for your continuous support, good organization, and for keeping up the spirit in a challenging time.

Manuel Mandler, Dr. Anne Latz, Klara Honsl, Benjamin Kroh, Marie Hohensee & Christina Auffenberg  
alley – VBMC ValueBasedManagedCare GmbH, Cologne

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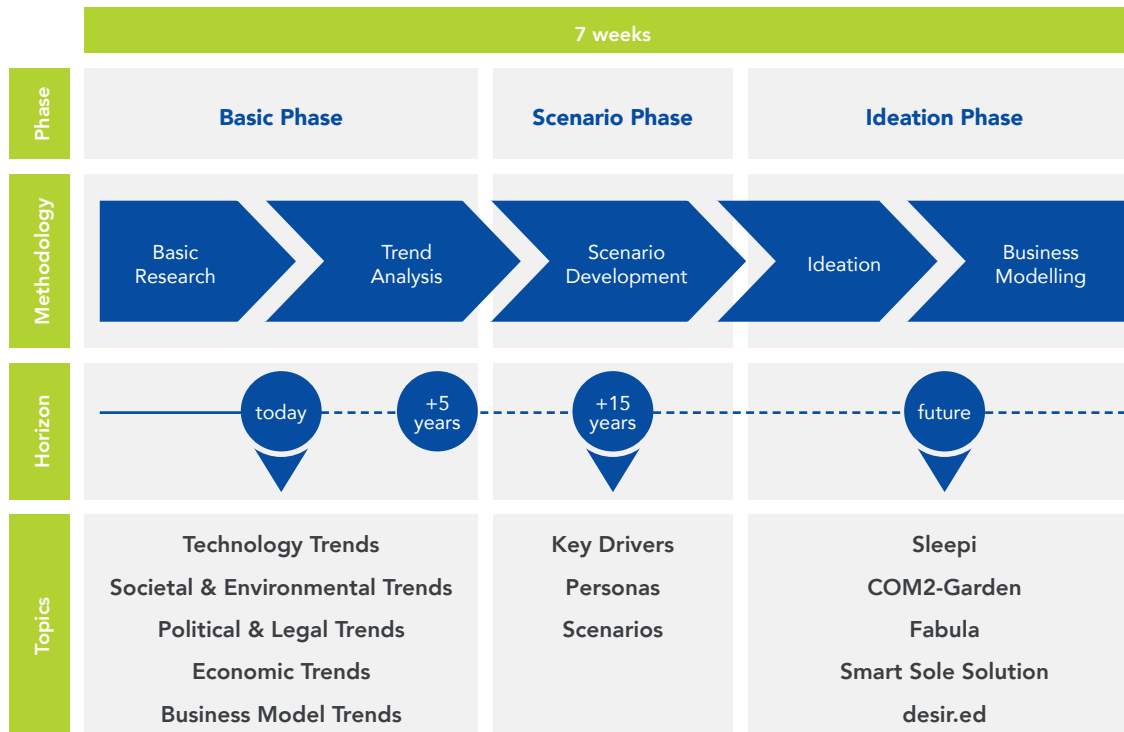
# METHODOLOGY

For a given topic that is highly impacted by digital technologies, the Trend Seminar pursues three main goals:

- To analyze the status quo and recent developments in order to identify important trends
- To develop extreme scenarios of the future in order to be prepared for upcoming challenges
- To develop future-proof product and service ideas and to detail them out into business concepts.

These goals are represented by the three phases of the trend seminar: the Basic Phase, the Scenario Phase, and the Ideation Phase.

Twenty-six students, supervised by two doctoral candidates, pursue the Trend Seminar in seven weeks of intensive full-time work alongside with their project partner. In each phase, interdisciplinary subteams are formed including students from technology, business, and various other backgrounds to combine versatile ways of thinking.



The **Basic Phase** yields a holistic overview on recent developments and trends in the environment of the overall topic. Based on the commonly used STEEP approach (Social-Technological-Economic-Ecological-Political), the status quo and trends in the fields society & environment, technology, economics, politics & legal, as well as emerging business models are analyzed. Knowledge is gathered by literature research, preceded by a series of input presentations by experts on the topic. The class is split into five teams, each working on one of the thematic scopes. At the end of the Basic Phase, the teams present their key findings to each other in order for everyone to get a holistic view on the topic to build upon in the following phases.

The **Scenario Phase** builds upon the analyzed trends in order to create four scenarios of different futures in twenty years ahead. Driving forces behind developments are identified and specified as drivers with bipolar outcomes. Once specified, all drivers are ranked according to their respective impact on the overall topic and the perceived degree of uncertainty regarding their outcome. Two key drivers that are independent from one another and have both a high impact and a high degree of uncertainty are chosen and, with their bipolar outcomes, used to create a scenario matrix of four scenarios. A timeline for each of the scenarios is created and the scenarios are sketched out using persona descriptions and visualizations. The Scenario Phase starts with a two-day workshop followed by group work in four teams. Teams are newly formed in order to include experts from each subtopic of the Basic Phase in each new Scenario Team.

In the third phase, the **Ideation Phase**, the goal is to develop innovative business concepts, which are then tested against the previously developed scenarios. Within a two-day workshop on structured ideation following the SIT approach (systematic inventive thinking), a large number of business ideas are developed. Out of these, the most promising five ideas are selected and further developed into detailed business concepts. The business model canvas by Alexander Osterwalder and Yves Pigneur serves as the base structure. At the end of the seminar, the business model concepts are presented to the project partner and guests.

# LIST OF ABBREVIATIONS

## **ADL**

Activities of Daily Living

## **AgeTech**

Age Technology

## **AI**

Artificial Intelligence

## **API**

Application Programming Interface

## **AR**

Augmented Reality

## **B2B**

Business-to-Business

## **B2C**

Business-to-Consumer

## **BaFin**

Bundesanstalt für Finanzdienstleistungsaufsicht

## **CDTM**

Center for Digital Technology and Management

## **DiGA**

Digitale Gesundheitsanwendungen

## **DVG**

Digital Healthcare Act

## **EPR**

Electronic Patient Record

## **ETF**

Exchange Traded Fund

## **GDP**

Gross Domestic Product

## **GDPR**

General Data Protection Regulation

## **GNAFCC**

Global Network for Age-friendly Cities and Communities

## **HR**

Human Resources

## **HWA**

Home-Workout-Assistant

## **ICT**

Information and Communications Technology

## **IoT**

Internet of Things

## **LTC**

Long-Term Care

## **NCD**

Non-Communicable Disease

## **NLP**

Natural Language Processing

## **PDSG**

Patient Data Protection Act

## **SDoH**

Social Determinants of Health

## **TI**

Tactile Internet

## **UI**

User Interface

## **URLLC**

Ultra-Reliable Low-Latency Communication

## **UX**

User Experience

## **VBMC**

Value Based Managed Care

## **VC**

Venture Capitalist

## **VR**

Virtual Reality

## **WHO**

World Health Organization



# TRENDS

The following chapter lists current trends that have a strong impact on the future of aging and elderly living in the digital age. In accordance with the Basic Phase methodology, trends and related driving forces are structured into five areas: technological trends, societal and environmental trends, legal and political trends, economic trends, and business model trends.

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# TECHNOLOGY TRENDS

## INFLUENCING INDEPENDENT LIVING OF THE ELDERLY

Ambient Assisted Living  
Assistive Robotics  
Wearables and Self-Quantification  
Virtual Reality for Increased Well-being  
Preservation of Mobility  
Enhanced Accessibility Through Novel UI  
Emergence of the Tactile Internet

# TECHNOLOGY TRENDS

## Influencing Independent Living of the Elderly

Modern technologies hold great potential to facilitate and extend the independence of the elderly, particularly of those who wish to age in their own homes. Such technologies can improve the lives of the elderly in many areas: Preventive health, access to health care, entertainment, communication infrastructure, access to information and services, social integration, digital security, and safety within their own homes. One trend with a considerable influence on the elderly is the increased availability of Ambient Assisted Living (AAL) systems. Products such as smart home empower the elderly to maintain independence, well-being, functionality, and quality of life. Another is the field of assistive robotics. While global and particularly European workforces see an increasing shortage of health care workers, advances in robotics may hold the potential to fill the resulting coverage gap [1, p.833], [2, p.27].

Notwithstanding substantial remaining ethical questions [3, p.29], these must be adequately addressed in parallel to the technology development. Furthermore, the increase in adoption of wearables and self-quantifying technologies among the elderly allows this group to benefit from the data econ-

omy [4, p.2]. Potential applications include sharing this more complete data with medical professionals, receiving personalized preventative recommendations, and benefitting from tracking and alarm systems in case of falls or other emergencies [5, p.1]. Moreover, as Virtual Reality (VR) headsets become more affordable and companies move towards products targeting the elderly, they may soon be increasingly able to undertake actions previously inaccessible to them due to health, movement, or even financial constraints. Products such as virtual traveling, 3D gaming and sports, remote physiotherapy, and virtual social visits are the first examples that already address these issues (though so far on a small scale). Likewise, technology preserves and enhances in- and out-of-home mobility of the elderly and holds the potential to increase their quality of life. Assisted mobility and technologies such as exoskeletons enable older people to continue participating in society [6, p.939] and to remain in the workforce longer [7]. Smartphone adoption rates among the elderly are anticipated to grow, as there is increased smartphone exposure during their working life [8]. Novel User Interfaces (UI) will further enhance accessibility. Novel technologies such as speech recognition and Natural Language Processing (NLP)

hold great potential in providing the elderly with alternative ways of interacting with technology, especially in case of impairment. Another major trend holding great potential for the independence of the elderly is the emergence of the Tactile Internet (TI) that tackles problems such as social integration, access to healthcare, or remote monitoring. Though these trends must counter challenges, such as the current high levels of technological illiteracy among the elderly, their long-term impact can significantly improve the elderly's health and quality of life, thus fostering their independence.



# AMBIENT ASSISTED LIVING

Smart home empowers the elderly to maintain independence and quality of life

The elderly are confronted with inevitable frailties such as reduced vision or increased risk of falls. In this context, AAL systems must be designed to appeal to the needs of the elderly and enhance their living [5, p.357]. AAL systems are mainly Wireless Sensor Networks that support the Activities of Daily Living (ADL) (that can be divided into: safety, healthcare, physical activities, personal care, and social engagement [9, p.1]. The identified hazards that arise with the network-based system's usage can be communicated to family members or caregivers to prevent potential impairment of the elderly [10, p.1096].

Additionally, AAL systems can provide caregivers with health information outside of medical facilities. Consistent monitoring allows early detection of the development of diseases or the deterioration of the state of health [11, p.4]. AAL systems can improve fitness and functional health by supporting all events related to the elderly's movements with exercise applications or behavior recognition systems. As the elderly share a significant risk of social isolation and loneliness, ambient communication services can help the elderly to stay connected with friends and family and obtain a higher quality of life [12, p.91].

## Facts:

- The global market for AAL is expected to grow from 2.9bn USD in 2016 to 5.6bn USD by 2021, at a CAGR of 58% [13, p.5].
- Health workforce imbalances and the increasing needs of aging populations are major concerns in the EU [14, p.44].
- Smart home technology adoption rates among adults over 50 more than doubled in the last two years [15, p.32].
- The ALL program, funded by the EU's Horizon 2020 initiative, is at the forefront of applied research for information and communications (ICT)-based services for aging well, supporting 150 projects since 2008 [16].

## Key Drivers:

- Safety, health, and home care, as critical areas of independent living of the elderly, account for the largest share of 71% in the research of AAL products [17].
- The integration of Internet of Things (IoT) in AAL systems and the increasing number of IoT connected devices worldwide (up to 43bn by 2023) can provide essential solutions for the care needs of the elderly [18, p.805], [19].
- The increasing connectivity, with an expected CAGR of 34.1% from 2019 to 2023, builds the fundament for the development of the smart home market [20, p.19].
- Wireless connectivity standards with high energy-efficiency, such as ZigBee or Z-wave, are the fastest-growing segments in the smart home market [20, p.15], [21].

## Challenges:

- Expensive products and additional economic barriers slow down the adoption rate of the elderly [22, p.14].
- Issues of privacy and trust challenge the usage of smart home services for the elderly [23, p.526].
- Poorly designed UIs are responsible for the hesitant use of smart home technology by adults over 50 [24, p.1].
- Incompatible network standards limit the communication and usage of smart home devices from different providers [20, p.13].

## Impact on Independent Living of the Elderly:

With an increasing number of older people worldwide and the resulting demand for care, AAL technologies present a promising solution to cope with several challenges. Emerging technologies such as IoT, Artificial Intelligence (AI), advanced sensors, or wireless communication technologies have further advanced the development of AAL approaches in recent years. Today, AAL technologies are already making important contributions in specific application fields, such as safety or home care. Nevertheless, research and development of new business models in the AAL field are still needed to ensure that the elderly can enjoy a high quality of life and age independently in their familiar environment.

# ASSISTIVE ROBOTICS

## Robots to support independent living and quality of life for the elderly

With robotics on the verge of drastic improvements and the potential shortage of care personnel, there is an opportunity for assistive robotics applications that provide effective support for ADL of the elderly [1, p.833], [2, p.27]. Robot research in eldercare mainly focuses on assistive robots, which can be divided into rehabilitation and social assistive robots [25, p.95]. With regard to rehabilitation, robots provide physical assistive technology, such as artificial limbs or smart wheelchairs [26, p.3]. Social assistive robots can be considered as social entities which rely on communication with the user. It can be further distinguished between companion-type and service-type robots. Service-type robots support independent living by helping with household tasks and mobility and by monitoring health and safety. They use their sensors to obtain information from their environment and independently perform a goal-oriented task, such as vacuum cleaning or delivering goods [27, p.45]. Companion-type robots aim to improve the health and psychological well-being of the elderly by providing social interaction. A use case is the baby seal PARO, a therapeutic robot which not only reduces stress levels, but also stimulates interaction between patient and care provider [28, p.1787]. Overall, this emerging area of robotics is used across environments and contributes significantly to the improvement of human-machine interaction [27, p.87].

### Facts:

- The global market for care robots and manufacturers of assistive technology is expected to grow from 408m USD in 2018 to 2.5bn USD by 2029 [29].
- Roughly 41% of US citizens would be interested in a robot caregiver to improve quality of care and reduce the burden on the family [30, p.42].
- Project RADIO, funded by the EU's Horizon 2020 initiatives, strives for the integration of robotic and home automation technologies to provide independent living for the elderly [31]. Furthermore, there are specific rule-based

processes e.g. applying for a resident parking permit in Frankfurt or payment of family allowance in Austria, which are entirely automated and digitalized [18], [19], [20].

### Key Drivers:

- A shortage of health workers in Europe demands social care technologies to fill the gap [32, p.166].
- Government initiatives foster the development and research of robotic assistive technologies [33].
- Advancements in AI can help assistive robots to understand their environment and interact with humans in a flexible and human-compliant way [34, p.2].
- Cloud computing features offer scalable computing and storage, which allow to design smaller and cheaper robots with improved contextual awareness due to shared information [35, p.397].

### Challenges:

- Digital alienation, particularly for the elderly, slows down the adoption of social care technologies [36, p.8].
- Data protection and privacy can be threatened, and the vulnerability of older people can be exploited [37, p.2].
- Scope of action of assistive robotics is currently defined by guidelines and thus causes a high degree of legal uncertainty [38, p.20].
- Ethical concerns and human values need to be taken into account when developing social assistive [3, p.29].

### Impact on Independent Living of the Elderly:

In recent years, assistive robots have become more prominent in human-machine-interaction research. Given the potential shortage of caregivers, robotic care can provide important compensation. Companionship robots can offer social interaction and entertainment and improve the mental well-being of the elderly. Service-type robots, on the other hand, support older people in their daily activities and play an important role in their independent living. Assistive robots are drivers of the digital healthcare revolution and will provide more support and advice in various areas of our daily lives, especially in eldercare in the future.





# WEARABLES AND SELF-QUANTIFICATION

## Wearable technologies integrate the elderly into the data economy

Wearable technologies come in all shapes and sizes: watches, bracelets, glasses, and even clothes and implants can help solve pressing challenges associated with healthy aging, patient monitoring, and emergency management. With the ability to track biomarkers, movements, or the ambient environment, wearables can augment the lives of the elderly. In combination with advancements in the fields of IoT, VR/AR, and AI, wearables are likely to become the new interface between humans and the digital world. With increasing adoption, wearable technologies are introducing the elderly to a new dimension of human connectedness, unlocking the benefits of the data economy [4, p.1]. Today, wearable technologies are particularly widespread in the management of emergencies (every year, one in three seniors falls [39, p.1]) or the support of long-term therapies (80% of elderly have at least one chronic condition [40]) but will increasingly contribute to data-driven prevention [41, p.1].

### Facts:

- The global market size for wearables is forecasted to reach 150bn USD by 2026 (from 30bn USD in 2016) [4, p.2]. In the US, adults over 50 already have a wearable adoption rate of 17%, which is similar to those aged 18–49 (20%) [15, p.22].
- Of the elderly wearable users, more than 80% wear it on a daily basis [15, p.22].
- 60% of the elderly are interested in the future use of wearable technologies [42, p.1].
- The most frequently used wearable device functions are “calls and messages,” “health management”, and “tracking trip and distance”; around 12.5% use it for “tracking

location and safety of children and elderly” [29].

### Key Drivers:

- Insurance companies partially promote and subsidize the use of fitness trackers [43].
- Increasing self-awareness fuels the desire for a “quantified-self” [44, p.119]. 66% of users share their information with their healthcare providers [45].
- Studies suggest that a design focus on user-friendliness, higher performance, and lower costs increases interest from the elderly [46, p.16].
- IoT-related technologies advance rapidly. ZigBee communication, characterized for example by low power consumption, low cost, low data rate, and high message throughput, is also fueled by standardization across industries and along value chains [4, p.18], [47, p.2].

### Challenges:

- The intention of the elderly to use smart wearables depends on the confidentiality of collected data, the durability of the integrated sensors, and the cost-benefit ratio [48, p.6].
- Poor and less-educated elderly show a significantly lower likelihood to adopt wearable technologies [49, p.1].
- Political initiatives criticize the potential negative impact of wearable technologies based on the solidarity principle of the German health insurance system [50, p.3].
- The aesthetic appeal of wearables is important for the purchase intention, but is often not compliant with existing standards in societies [51, p.7].

### Impact on Independent Living of the Elderly:

Effective monitoring, tracking, and alarm systems can help prevent unpredictable events including sudden illnesses, falls, and other emergencies [5, p.1]. On the other hand, users with chronic diseases can utilize forms of remote monitoring, which can decrease the number of check-ins required from relatives, caregivers, or medical experts. Numerous studies highlight that such devices can reduce hospitalization and mortality rates of the elderly, improve their mental and physical fitness, and promote healthier lifestyles [42, p.1], [52, p.154], [53, p.1]. Hence, wearable technologies will allow the elderly to simplify their patient journeys and lead a more self-aware, self-determined, and independent life.

# VIRTUAL REALITY FOR WELL-BEING

## Using VR to improve health and quality of life for the elderly

VR solutions hold the potential to address many issues the elderly face, such as loneliness, lack of exercise opportunities, shortages in rural health service coverage, and decline in motor and cognitive abilities. Particularly the fields of therapeutic recreation, remote care, remote exercise, therapy of neurodegenerative disorders, and training of medical and care staff have seen significant advancements. Many studies find positive effects of new VR solutions for usage in the home, and several companies already offer products tailored to the elderly. These seniors are no longer fit enough to experience travel in person, and through the project, become engaged and can restore their joy and motivation through the fascination of travel [54]. Similarly, studies showed that the elderly were more motivated to use exercise equipment in their care homes when using a VR headset, which simulated exercise in changing outdoor locations [55].

### Facts:

- Over 650,000 VR experiences were completed across 200 senior living institutions in the US in the last four years [56].
- Over 150 large organizations ran employee training workshops using VR tools to teach professional and family caregivers to better empathize with and provide care for the elderly [57].
- VR remote exercise therapy trains motor control in the elderly [58, p.239]. It effectively improves balance and functional mobility in seniors still living in their community [58, p.229].
- Therapeutic recreation using VR can train cognitive skills: After training only one month, 60-85-year-olds matched the performance of untrained 20 year-olds in a multitasking game [59, p.1].
- VR therapies reduce anxiety, depression, and hostility among dementia patients [60, p.12].

### Key Drivers:

- VR headsets are becoming more affordable [61]: Low-End models cost 22 EUR [62].
- VR applications include improved graphics due to enhanced computing power in mobile devices [63].
- The VR market is expected to grow with a CAGR of 21.5% for 2019-2025 (from 5bn USD in 2018) [63].
- Treatment of neurodegenerative disorders using VR is significantly advancing [60, p.12].
- Social isolation due to Covid-19 is exacerbating the existing isolation of the elderly, causing detrimental health effects [64, p.1].
- Physical inactivity can have severe negative health effects. Yet, 35% of adults over 75 report performing no physical activity outside of work [65].
- The shortages of healthcare professionals in rural areas is increasing [66, p.1].

### Challenges:

- Technology rejection hinders the adoption of VR technology. Initially, 79% of elderly participants thought VR held no practical benefit for them. After trying the technology, 42% saw a potential for using it [67, p.133].
- Elderly users may experience 3D fear (discomfort resulting from differences in virtual and real 3D environments) [67, p.134].
- The complex button design on High-End devices complicates usability for the elderly [67, p.135].
- Technical illiteracy and insufficient knowledge on how to set up the VR headset complicate first touchpoints. However, technical literacy among the elderly still living at home is rising [27, p.16].

### Impact on Independent Living of the Elderly:

New VR products enable the elderly to partake in activities they can otherwise not experience due to restrictions. From the comfort of their home, they can forget their physical pains through immersion in the VR experience and progress toward rebuilding their physical and cognitive abilities. 12% of Europeans over 65 years of age experience substantial loneliness [68, p.1]. Chronic loneliness negatively impacts older adult's memory, physical well-being, mental health, and life expectancy. VR products make an important contribution to enabling the elderly to live independently.





# PRESERVATION OF MOBILITY

## Enhancing in- and out-of-home mobility of the elderly

Venture Capitalists (VCs) spent 11.8bn USD on mobility companies worldwide during Q1 2020, representing a year-on-year increase of 62% [69, p.4]. Rising enterprises seek to provide mobility-as-a-service as well as technologies fostering autonomy. Especially for the elderly, the preservation of mobility is a very important need contributing significantly to independence, autonomy, and participation [27, p.11]. Mobility is a severe concern for the aging population that slowly expands from the everyday quality of life issues into major health problems [70].

Optimal mobility, defined as relative ease and freedom of movement, is central to healthy aging. Hereby, mobility refers to movements in all forms, including basic ambulation, in-, and out-of-home mobility [71, p.1508]. In the scope of basic ambulation and in-home mobility, assistive robotic devices and care systems support people with motor impairments carrying out task-specific and general-purpose activities such as object manipulation or getting out of bed [72, p.973].

Out-of-home mobility gets significantly enhanced with mobility assistive technologies such as smart wheelchairs, walkers, and scooters [73, pp.3–7]. The development of autonomous vehicles and driving assistants, with a projected global market size of 60bn USD by 2030 [74], can enable journeys for the elderly [75, p.2].

### Facts:

- 31.7% of adults aged 65 years and older report difficulty walking three city blocks [71, p.1508].
- Older adults with mobility difficulties are less likely to have regular social contacts [76, pp.298–303].
- Adults aged 60 years and older are as capable as young adults to regain control of semi-autonomous vehicles [77, pp.468–469].
- US seniors are outliving their ability to drive safely by an average of 7 to 10 years [78].
- The global robotic wheelchair market size is projected to

grow at a compound annual growth rate (CAGR) of 9.4% from 2019 to 2025 [79].

### Key Drivers:

- Companies invest increasingly in autonomous driving. Alphabet's Waymo, GM's Cruise, and Uber have spent 8bn USD on developing fully self-driving cars in the last years [80].
- The development of autonomous vehicles is state-subsidized. The EU funding program for research and innovation "Horizon 2020" intends to develop autonomous vehicles in Europe's urban centers within the project "Avenue" [81].
- Regulation authorities worldwide are beginning to pave the way for autonomous vehicles by developing the appropriate regulatory framework for testing and operating [82, p.5].

### Challenges:

- Some elderly prioritize their out-of-home journeys based on affordability, emphasizing the importance of the price and the need for financing of mobility solutions [83, p.17].
- Technologies for elderly care, including robotic assistive devices and care systems enhancing mobility, have generated a vast research interest, but few solutions are in everyday use. For universal adoption, costs must be reduced, and legal and security issues must be resolved [72, p.975].
- Autonomous driving raises ethical and moral questions. Autonomous vehicles introduce moral dilemmas in situations of unavoidable crashes [84, p.19].

### Impact on Independent Living of the Elderly:

Assisted mobility can enable older people to continue participating in their lives as they used to [6, p.939]. With technologies as exoskeletons that help meet their jobs' physical demands, the elderly can remain in the workforce longer [7]. Older people perceive out-of-home mobility as the fundamentals of living [6, p.939]. Technologies supporting out-of-home mobility provide possibilities to enjoy with other people and enjoy the outside world [83, p.2]. In this scope, automated vehicles represent a way to increase the senior population's mobility [85, pp.16–17].



# ENHANCED ACCESSIBILITY THROUGH NOVEL UI

## Allowing the elderly to access the technology through inclusive UI

Smartphone adaption rates among the elderly are anticipated to grow as they are increasingly exposed to these devices during their working lives [8]. User-centered design is supposed to focus on solving the end user's problems; however, it does not yet meet the needs of the elderly struggling with motor or sensory impairments. Instead, technological "ageism", the discrimination of the elderly, is still frequently encountered, and individual needs are neglected. In this context, UIs are often a barrier for the elderly to benefit from technology. While larger buttons and screens, higher volume options, and simpler menus are comparatively easy to implement, more advanced voice recognition features are on the agenda of UI and User Experience (UX) designers in gerontechnology. Moving away from stigmatizing, from a deficit-oriented perception of the elderly towards a collaborative perception, is required for the development of new applications. This so-called "co-design" detects issues early on in the developing cycle [86, p.95]. As a result, novel UIs, which are inclusive by design and compensate for physiological and cognitive changes, arise. Both tech-savvy and tech-illiterate elderly can benefit from a more intuitive way of interacting with technology alike.

### Facts:

- Recent pilot studies are starting to integrate voice technology in nursing homes. 71.4% of the residents felt more connected to their family, friends, and the community, thanks to these technologies [87, p.4].
- 27% of online internet users perform queries by voice on their mobile devices [88]. Additionally, users aged 35 or older are 17 percentage points more likely than younger

users to use voice search [89].

- The global voice recognition market is forecasted to reach 25bn USD by 2025 at a CAGR of 16.8% [88].

### Key Drivers:

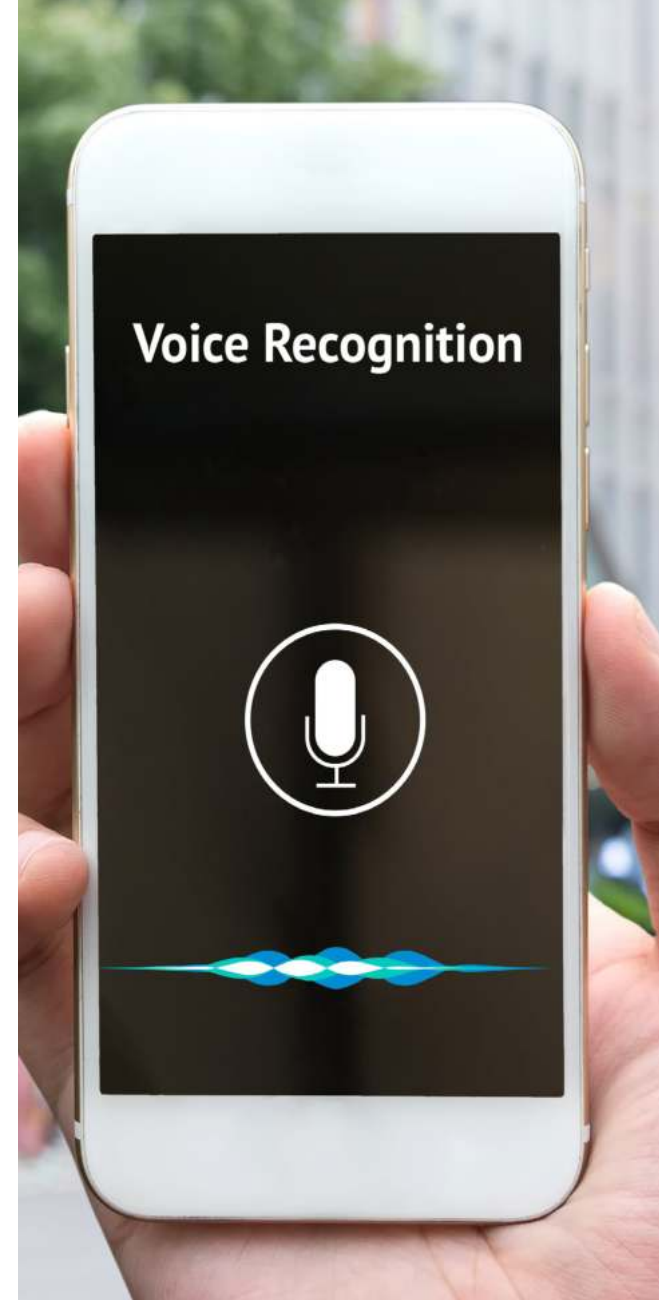
- Devices tailored specific to elderly needs are becoming increasingly available in the market [90].
- 48% of the elderly say that they need help when using a new device compared to 18% of people aged 18-29 years, which shows the need to develop more intuitive UIs [91].
- Cloud computing allows for the deployment of assistive technologies through the web without additional hardware [92, p.4].
- Voice recognition technologies found in current smartphones are almost three times more accurate than human typing [93, p.1].
- Between 12.5% and 14.6% of adults aged 65 or older have some kind of vision impairment [94].

### Challenges:

- There is a limited availability in voice recognition technology of minority languages, rare accents, and dialects. Moreover, minority accents within majority languages such as English show a decreased performance when using voice recognition devices [95], [96, p.235].
- Speech recognition accuracy shows itself to be dependent on the race and gender of the end-user. This is a critical bias to be addressed before global adoption can be achieved [97, p.56], [98, p.5].
- Discovering and remembering new commands in voice interfaces is more challenging than working with traditional interfaces [99, p.73].

### Impact on Independent Living of the Elderly:

Novel technologies such as speech recognition hold great potential in providing the elderly with alternative ways of interacting with technology, especially in case of impairment. In the past years, AI developments have helped voice recognition to reach human-level accuracy [100], [101]. In the future, UIs will evolve from providing a few features such as internet search to total hands-free UIs. UIs guided by voice will contribute to technology adoption among the elderly. These interfaces will allow for a simple way to adopt the always-evolving technologies without facing a steep learning curve.





# EMERGENCE OF THE TACTILE INTERNET

Using 5G to provide a holistic connection experience to the elderly

Disruptive technologies such as telemedicine, robotics, or AI will impact how humans age and live independently under current communication protocols. However, the TI is an innovative prism through which we can see existing technologies from an entirely different perspective. It is defined as an internet network characterized by its extremely low-latency, high reliability, and security [102, p.1]. TI is a long-sought solution made possible by introducing 5G's Ultra-Reliable Low-Latency Communication (URLLC). These types of networks will allow a new dimension of human-machine interaction. As its name indicates, tactile data (haptic feedback) can be transmitted the same way as visual or audio information is transmitted through conventional networks [103, p.460]. This allows for realistic virtual interactions that will more closely resemble face-to-face interactions. The TI is often called the "Internet of Skill" because of its ability to transmit social experiences over large distances. From digital healthcare to robotics, technologies affecting the elderly will evolve in different paths due to the opportunities made available through the TI.

## Facts:

- 5G URLLC allows for a 50-fold reduction in network latency (data transfer time from one point to the next) [104].
- Through haptic feedback gloves, the TI can transmit haptic, tactile, audio, and visual signals to clinicians, fostering telemedicine and helping the elderly to access healthcare in remote rural areas [105], [106].
- 5G networks enable more robust encrypting which helps securely transmit healthcare data collected by elderly care devices [107, p.203].
- The TI enables ultra-low latency (<1ms) required to transmit the haptic feedback, which is necessary for challenging telesurgery operations [108, p.29].

## Key Drivers:

- 5G technologies can be brought to rural and low-income areas for merely 11 EUR per month per household in Europe [109, p.50].
- Telecom companies spent 6bn EUR in 2019 in government auctions to install the 5G network across Germany [110].
- By 2025, 99% of the German population will have access to 5G broadband and 90% of German territory will be covered with 5G [111].
- 42% of cross-industry decision-makers expect 5G devices to consume less power than current devices, making them more adequate for elderly remote monitoring [105].
- Studies show that being touched by a caregiver increases the likelihood of protein and caloric intake (positive for the elderly) [112]. The TI fulfills this need through haptic actuators.

## Challenges:

- Haptic feedback technologies have a limited range of application (100-1,000 km). New algorithms are required to use this technology globally [113, p.4].
- Costly haptic sensors and actuators are required at both communication ends to implement haptic touch [114, p.23514].
- Objective evaluation metrics for haptic communication must be developed to ensure comparable analysis across implementations [114, p.23513].
- 5G technology has 2% the range of 4G networks. As a consequence, more devices are needed to cover the same area [115].

## Impact on Independent Living of the Elderly:

The TI is often referred to as the Internet of Skills because of the possibility of executing actions remotely. The TI tackles problems such as social integration, access to healthcare, and remote monitoring. For example, it can provide retired professionals such as surgeons, painters, or music teachers with a way to transmit their skills in a safe, remote form, reducing their loneliness and increasing their sense of usefulness [105]. The Tactile Internet will allow the elderly to feel the internet and their virtual interactions in a more vivid way, allowing them to age with independence in the comfort of their homes.

# SOCIETAL & ENVIRONMENTAL TRENDS

## INFLUENCING INDEPENDENT LIVING OF THE ELDERLY

Feminization of Older Age  
Increased Isolation and Loneliness  
Increase in Infectious Diseases  
Increased Connectedness and Digital Literacy  
The Multicultural Face of the Elderly  
Urbanization and Age-friendly Cities  
Change of Daily Life

# SOCIETAL & ENVIRONMENTAL TRENDS

## Influencing Independent Living of the Elderly

The process of aging has always been at the very core of human existence. No one can escape it, but rather every human being is forced to deal with the consequences of aging. Especially in today's world, independent living of the elderly has become one of the central issues. How this important issue will develop in the future highly depends on certain societal and environmental trends. These include where people live, how and with whom they interact, or what they eat. From this broad range of individual trends, seven key trends were identified. They, not only, influence society as a whole, but also the future of independent living of the elderly.

First, later life is becoming increasingly female. Due to female's higher life expectancy, older heterosexual women usually outlive their partners, making the independent living of the elderly more and more important for women in particular. At the same time, due to growing labor market participation as well as a professionalization of caregiving, women are becoming more financially independent and are therefore seen as powerful consumers of the future.

Second, the elderly are increasingly affected by isolation and

loneliness. With the decline of tight-knitted communities and family structures loosening up, older people are losing an important source of belonging and support. Since loneliness is one of the central Social Determinants of Health (SDoH), this has serious negative effects on the independent living of the elderly.

Third, the elderly are increasingly threatened by infectious diseases. On the one hand, the number as well as the diversity of new types of infectious diseases, such as Covid-19, has steadily increased over the last decades. On the other hand, medical advancements give hope for a quicker and more effective treatment of such diseases.

Fourth, digital literacy and connectivity amongst older people are increasing. Thanks to the broadening acceptance of digital technologies, a growing number of senior citizens are benefiting from the advantages of them. They hold great potential for improving the independence and quality of life of older people and their families, whether they stay in touch with their families, search for important information, or use services without outside help.

Fifth, increasing migration leads to greater diversity amongst the elderly in Europe. Due to the comparatively high economic and political stability in Europe and an increase in violent conflicts in other regions of the world, the proportion of people with a migration background in Europe has reached a significant size.

Sixth, the aging of urban society leads to more age-friendly cities. Due to the megatrend urbanization, older people will spend more of their retirement in cities in the future. More and more cities are trying to consider the needs of senior citizens so that they can live more independently.

Seventh, activities of daily lives are changing rapidly, as working life becoming longer. While familiar activities, such as reading the newspaper, are still among the most popular activities of older people today, senior citizens will pursue a more active lifestyle in the future due to better health literacy, greater prosperity, and better education.



# FEMINIZATION OF OLDER AGE

## Feminization of later life as the older population is becoming mainly female

Globally, women on average live five years longer than men [116, p.5] and the majority of the “oldest old” (i.e., those older than 80) are widowed women [117, p.71]. As heterosexual women are more likely to outlive their partners [118, p.2] it seems particularly important for them to be able to live independently. Historically, women were at high risk to experience poverty in retirement due to the lag in (full-time) employment, wages, and savings [118, p.118], [119, pp.22-29, pp.186-188] and their undertaking of the majority of unpaid labor (e.g., caretaking) [120, p.18]. Wealth differences accumulate with age, resulting in the largest wealth gap around the age of retirement [121]. However, due to women’s growing labor market participation and the professionalization of caretaking, there is an expected shift towards women being more financially independent in old age, and women being the next face of wealth management [118, pp.3-9]. Besides this, women are often mentally better prepared for retirement [122, pp.96-101]. Women are also less prone to loneliness and depression in old age as they often have better social relationships with friends and family and are more likely to draw on social networks and neighbors to preserve connections even when living alone [123, pp.92-106], [124, pp.1155-1162].

### Facts:

- In 2020, men’s life expectancy in Germany was at 78.9 compared to 83.6 years for women [116, p.566].
- On average, women’s pensions are 25% lower than men’s [119], and women are more likely to financially depend on their partner or the state [125, pp.21-36], [126, pp.135-147].
- Worldwide, women influence 64% of consumer purchases, even more so within older age groups [122, p.90].
- Men often have an abstract, optimistic mindset, while women have a more precise conception of the challenges of later life [122, pp.96-99].
- Retirement is related to more significant depressive symp-

toms among men [127, pp.217-221].

- Older divorced or widowed women experience a greater sense of freedom [128, pp.53-58].

### Key Drivers:

- Female employment increased by 6.3 percentage points in advanced economies between 2000 and 2018 [118, p.5], and the participation of women in the labor force is expected to grow further [129, pp.9-16].
- The professionalization of caregiving and family-friendly policies enable more women to participate in the labor market [130, pp.4-9].
- Changes in family constellations, household structures, and gender roles drive the (financial) independence of women [118, p.35], [131, p.21].

### Challenges:

- To further increase female labor market participation, gender equality in personal and family responsibilities (e.g., caretaking and household responsibilities) needs to be improved [121], [131], [132].
- To enhance older women’s financial independence and well-being, the gender pay and pension gap have to be closed.
- A world that is designed around (young) men (e.g., smartphones are often too big for most women’s hands; speech-recognition software is trained on male voices) still needs to adapt to the needs of older women [122], [133, p.111].

### Impact on Independent Living of the Elderly:

Mentally, emotionally as well as socially, women are often better prepared to live independently in retirement [122, pp.96-99] and thus, are better connected and happier at old age. So far, however, women had a considerable financial disadvantage, which made them prone to poverty in old age and endangered their independent living. The growing labor market participation of women as well as changes in gender roles and family constellations and the associated financial independence may enable more women to live independently at old age and make them the primary consumers and wealth managers. In order to support these trends, more family-friendly policies will be necessary.



# INCREASED ISOLATION AND LONELINESS

The elderly are suffering increasingly from solitude

Despite the rapid development of social networks, the elderly are experiencing increased isolation and loneliness [154]. More than one-third of adults aged 45 and older feel lonely, and nearly one-fourth of adults aged 65 and older are considered socially isolated [155, p.19]. On the one hand, the once tight-knitted local communities that provide the elderly with a sense of belonging and support are on the decline [156, p.7]. On the other hand, increased acceptance of individualism and gray divorce drives the loosening of the family structure [157]. Family as a source of meaning and connection is becoming less reliable. These changes in societal structure and norms are forcing more elderly into solitude. As active social engagement and quality relationships are SDoH, their absence can pose an increased risk for dementia and other serious medical conditions for senior citizens [158], [159, p.1]. Hence, understanding the changing social dynamics around the elderly is instrumental in exploring how the elderly can live healthy and independently in the future.

## Facts:

- In 2015, the size of the European Silver Economy was 3.7trn EUR [160, p.3]. From 2015 to 2025, the European Silver Economy is estimated to grow by 54% to 5.7trn EUR [160, p.3].
- Much of the Silver Economy will be driven by digital tools and services that address functional impairments and accessibility requirements since the need for these will increase significantly in the future [160, p.4].
- With 16.5%, Germany has the largest share of the spending power of people aged 60 or over [161].
- From 2019 until 2030, Eastern Europe is expected to

have the highest Silver Economy growth in Europe with a growth rate of 22% for nearly all of its countries [161].

## Key Drivers:

- Multi-generational family structure is declining [162, pp.121-137].
- The marriage rate is drastically declining, as well as increasing divorce rates within the EU [163, pp.74-81].
- Connections within the community are weakening due to new means of communication and urbanization [156, p.7], [164, pp.1-2].
- The importance of religion within society is declining, resulting in people becoming more secular [156, p.265], [165, pp.74-81].

## Challenges:

- Motivating the elderly to re-integrate into communities and expand their social networks can be difficult due to impaired health and mobility [166, pp.179-180].
- Men who live on their own often experience greater loneliness because they are often reluctant to join local community groups and have reduced contact with children and other family members following marital breakdown [167].
- The risk for loneliness and social isolation is increasing for seniors. They are more prone to living in solitude, experiencing family or friends' losses, suffering from chronic illness, and hearing loss [158, p.1].

## Impact on Independent Living of the Elderly:

Community plays an instrumental role in the independent living of the elderly. As the community supports the elderly, the elderly can find a sense of belonging and connectedness in the community [168]. This is crucial as active social engagement improves the overall well-being and reduces cognitive decline amongst the elderly [158, p.51-52]. As local communities decline and families are growing further apart, the elderly are experiencing increased isolation [155, p.20]. This makes them more susceptible to severe physical and mental health conditions that hinder independent living [169, p.1].

# INCREASE IN INFECTIOUS DISEASES

## Infectious diseases are becoming a major health threat to the elderly

In the 1970s, many experts believed that the fight against infectious diseases was over. However, this view was reversed during the last two decades due to the spread of new diseases and the reemergence of diseases long since considered under control [134]. Nowadays, infectious diseases still cause 48% of premature deaths worldwide, with lower respiratory infections being the fourth leading cause of death, causing 3m deaths worldwide in 2016 [135]. This trend is affecting the elderly since they not only have an increased susceptibility to infection [136, p.63] but also have higher morbidity and mortality compared with younger adults [137, p.57]. Furthermore, COVID-19, amongst others, has affected the independent living of the elderly in various ways: from the ability to pursue ADL independently [138, p.487] and the organization of the living situation to risks emerging from isolation [139, p.201].

### Facts:

- The total number and diversity of outbreaks and richness of causal diseases has increased significantly since 1980 [140, p.1].
- The number of countries experiencing significant disease outbreaks has doubled from ~20 countries in 2010 to ~40 countries in 2018 [141, p.7].
- A total of 8.9m healthcare-associated infections are estimated to occur each year in European hospitals and Long-Term Care (LTC) facilities [142].
- The proportion of hospitalizations attributable to infectious diseases among the elderly increased by 14.2% from 16.9% in 2001 to 19.3% in 2010 [143, p.536].
- COVID-19 has shown that age is by far the strongest predictor of an infected person's risk of dying from an infection [144], [145, p.10].

### Key Drivers:

- Global environmental change is supporting the proliferation of vector-borne diseases [146, p.1], increasing antimicrobial resistance [147, p.464], and diversifying wildlife–livestock–human interfaces [148, p.1].
- Climate change is facilitating the spread of insect vectors and their pathogens and introduces them into previously unaffected geographic areas [147, p.464], [149, p.1].
- Decreasing vaccination coverages and poor antibiotic treatment regimes in Europe are resulting in a resurgence of vaccine-preventable diseases and an increase in the likelihood of drug resistance [150, p.1].
- Due to globalization and modern transportation modes, the natural protective barrier against infectious diseases, distance and time, is reducing [141].

### Challenges:

- The global rise in antibiotic resistance threatens to undo decades of progress in treating infectious diseases.
- A globally coordinated approach to prevent emerging infectious diseases and detect possible outbreaks immediately is difficult to establish.
- Benefitting from globalization while simultaneously preventing a broad distribution of historically localized infectious agents contradicts itself.
- Enabling a rich social life for the elderly and protecting them from harmful infectious diseases comes with high costs.

### Impact on Independent Living of the Elderly:

Due to anatomical changes with aging, impairment of immune function, and the presence of co-morbid diseases, the elderly suffer excessively from infectious diseases [137, p.57], [151, p.55]. An infection severely affects seniors' ability to independently carry out ADL [138, p.487] and has been associated with persistent cognitive dysfunction [152, p.1037]. Thus, elderly people have to be protected from exposure. To do this, living situations have to be adapted, health care settings have to be reorganized, and social isolation measures are needed more frequently. These actions have severe impacts on the seniors' mental health and autonomy [139, p.201], [153, p.1].





# INCREASED CONNECTEDNESS AND DIGITAL LITERACY

The elderly's usage of digital technology in everyday life is rising

Although people above 65 are less likely to have access to digital technologies and the internet [187, p.708], digital literacy and usage are increasing, and a great majority of the elderly of tomorrow (50+) are already using the internet. Additionally, the use of ICT by all people is considered a priority by the European Union to increase the quality of life, overcome exclusion and improve social participation and cohesion [188, p.1]. Digital technologies and internet usage enable the elderly to remain independent for a longer period of time [189, p.1] by providing access to online services and products. Fostering the adoption of digital technology among the elderly leads to an acceleration in their reintegration into social life. Having the ability to do errands such as shopping, scheduling doctor or technician appointments online, staying connected with the family via digital communication tools, and participating in civil matters contributes to a more complete, inclusive living.

## Facts:

- The number of households with internet access in the EU-28 increased from 55% in 2007 to 90% in 2019 [190].
- The gap of internet access between urban and rural regions in the EU-28 is decreasing, with 91% of urban and 85% of the rural population being connected as of 2018 [191, p.3].
- In Germany, 54% of people aged between 60-69 years are using the internet daily in 2019 [192, p.375].
- In Germany, people aged between 50-69 spent 42 minutes (91 minutes for people aged 30-49) daily on media internet use in 2019, 8 minutes more than in the previous year [192, p.375].

## Key Drivers:

- Increased internet and digital services acceptance, as well as adoption, are more common among the elderly [193, p.12].
- Electronic inclusion and digital literacy are a priority in the political agenda of the European Union [188, p.1], [194, p.1].
- Governmental initiatives and programs support older people in trying out digital services themselves e.g. "Digital-Kompass", an on-site digital training program for the elderly [195].

## Challenges:

- Broadband internet and digital devices need to be accessible for everyone [196, p.4].
- People with no prior knowledge need to obtain digital competence [197].
- Data security needs to be standardized to establish trust in digital services and consumer data (especially health data), as well as being protected, e.g. through a seal of quality for digital products and systems [198, p.4].
- In the design of devices and applications, developers, manufacturers, and service providers need to focus on self-explanatory technology, high usability, as well as the inclusion of needs and limitations of elderly people [199].

## Impact on Independent Living of the Elderly:

The use of digital technologies and digital literacy is increasing amongst the elderly in today's digital age. Digital products and services bear great potential for improving the independence and quality of life for the elderly and their families [189, p.4]. Such products and services enable the elderly to stay connected with their families, search for important information, guide their decisions and preferences, and use services without external help. Therefore, internet access and digital competence must be provided through initiatives and programs to ensure equality amongst the elderly. Such a competence includes learning to operate smartphones and computers as well as mastering tasks such as e-banking, checking for news, and scheduling doctor appointments.



# THE MULTICULTURAL FACE OF THE ELDERLY

## Increased migration has an impact on the elderly population in Europe

Europe's population is becoming more diverse and so does its elderly society. Germany reported over 10% growth of immigrants between the age of 50-60 from 2017 to 2019 [170]. Other EU countries are showing similar trends [171]. To ensure health and social equity for immigrants in their host country, effective social integration has to happen [172], [173, pp.9-10]. European integration studies show that immigrants have the highest risk of social exclusion and poverty, low education and income, and higher unemployment rates, which illuminates that integration of immigrants still needs to be enhanced [174, pp.48-170], [175, p.4]. Since social determinants like education, lifestyle and culture can have tremendous effects on health and health care access [176, p.1], immigrants tend to have a lower health care utilization and disease prevention attitude than their host country peers [177, pp.219-220], [178, pp.495-496]. On top of the general health risks of their host country population, immigrants can show migration-specific health risks like psychological traumas due to family separation, xenophobia and political prosecution or torture [179, p.129]. To counterbalance these health disadvantages for immigrants, the World Health Organization (WHO) migration and health program tries to provide technical guidance for state-members to strengthen their health care systems on migration-friendly aging and health in Europe [180, pp.1-26].

### Facts:

- The number of international migrants is estimated at 272m globally in 2020, which is surpassing projections that had been made for 2020 [175, p.2]
- 21.8m non-EU citizens are living in Europe, that is 4,9% of the total EU-population and 13.3m EU-citizens are living in a different EU-country [181]
- In 2019, Germany had both the highest number of immi-

grants compared to other EU countries and as compared to the past (State 2019-01-01: 10.1m) [181]

- In Germany, the number of estimated elderly immigrants between 50 – 60 increased by 10% between 2017 and 2019 [171]

### Key Drivers:

- Relative prosperity and political stability of the EU has a pull-effect on potential immigrants [182, p.1].
- Rising conflicts, extreme violence, and economic and political instability force migration and displacement of people globally [175, pp.2-4], [183, p.2].
- Climate change is impacting the living conditions of millions and thus is playing a growing role for migration in the future [175, p.2], [183, p.4].

### Challenges:

- Immigrants have very diverse socio-economic, educational, professional and ethnic backgrounds, making integration a multicomplex issue [173, pp.9-10], [179, p.129], [184, p.2882].
- Cultural differences in disease concepts, language barriers, and differing cultural norms are making the disease prevention approach and treatments difficult [184, pp.2882-2887].
- Migrant population in Europe is considerably higher than reported since many immigration activities are undocumented [185, p.3]. User groups show strongly differing preferences regarding their expectations of the design of analog and digital administrative services [111].

### Impact on Independent Living of the Elderly:

Health and access to health care are two crucial factors for independent living. In Germany, elderly people with a migration background need professional caretaking on average 10 years earlier than their host country peers [186, pp.60-61]. This increased health threat is influenced by socio-economic living conditions as well as health risks due to migration [184, pp.2882-2887]. Immigrants have a higher risk of poverty and a higher unemployment rate [174, pp.48-170], [175, p.4]. This unstable financial situation is having a tremendous impact on how elderly with a migration background are living and which services they can afford to ensure independent living in older ages.





# URBANIZATION AGE-FRIENDLY CITIES

## Urbanization and the aging of urban populations call for age-friendly cities

In 2018, already ~45% of the elderly lived in metropolitan areas, and it is expected that in the future an even higher majority will spend their old age in metropolitan areas [223, p.25], [224, p.35]. In view of this, it has become increasingly important to understand the ambivalent relationship between population aging and urban change. On the one hand, cities ensure a high degree of independence for elderly since they guarantee easy access to medical services, provision of leisure facilities, and general necessities for daily life [225, p.474]. On the other hand, cities are also seen as threatening environments, often creating feelings of vulnerability that are responsible for major detrimental effects on the health of the elderly. In order to tackle these issues, the WHO has started an initiative to develop supportive urban communities for the elderly in 2007 [226, p.1]. Nowadays, the creation of age-friendly cities is a worldwide movement with over 750 communities being member of the Global Network of Age-Friendly Cities and Communities (GNAFCC) [227, p.6].

### Facts:

- In 1950, only 30% of the world's population lived in an urban setting, whereas today more than 55% of the world's population lives in urban areas, and this percentage is expected to rise to 68% by 2050 [228, p.1].
- The share of elderly of the total population in the European Union has increased from 15,8% in 2001 to 20,3% in 2019, and is expected to rise to 29,5% in 2050 [223].
- In the OECD, the number of the elderly in metropolitan areas increases faster than in non-metropolitan areas [224, p.35].
- From 11 cities in 2010, memberships in the GNAFCC grew to 760 communities and cities by September 2018 [227, p.6].

### Key Drivers:

- Demographic change has led to an increasing demand amongst the elderly for age-friendly cities with infrastructure and services that effectively accommodate their needs [229, p.94].
- The declining economic importance of agriculture and a simultaneous increase in the importance of the knowledge economy result in a trend towards urbanization [230, p.60].
- Based on economic considerations, the idea of "aging-in-place", supporting people in their homes as long as possible, has become the guiding policy goal of most European countries [231].
- Increasing awareness of the negative effects of urban change on older people's lives has fostered age-friendly city initiatives [232, p.89].

### Challenges:

- Physical and mental health challenges caused by living in an urban setting [233, p.204], especially in regards to pollution [234, p.1], [235, p.227], [236, p.5], extreme temperatures, falls and accidents make living in cities difficult for the elderly.
- Encouraging social connections and stimulating a sense of community amongst the elderly considering that an increasing number of older people live alone [140, p.32] and have limited personal geographical areas [236], [237, p.100] becomes continuously harder.
- Providing suitable and affordable housing for the elderly poses an immense challenge, as large and economically-growing cities are often characterized by high real estate prices [238, p.1]. Policies should promote the intensification of agricultural production and sustainable management of forest resources.

### Impact on Independent Living of the Elderly:

Urbanization and the trend towards age-friendly cities have several effects on the independent living of the elderly. Cities that incorporate a safe and barrier-free environment, a great service provision (e.g., transportation, health services), and a built environment (e.g., housing, green space) adapted to the needs of the elderly, increase the chance for the elderly to live independently. If a city additionally stimulates civic and social participation, seniors can more easily adapt to age-related changes and their well-being [239, p.434], along with their overall satisfaction [240, p.1] is positively influenced.

# CHANGE OF DAILY LIFE

## Longer working lives, better health, and an active retirement

Activities of daily life of the elderly are changing significantly. While watching TV, reading the newspaper, and cooking rank among their most frequent daily activities in 2020 [200], in the future, they will likely pursue a more active lifestyle [201, p.1]. An increased health-literacy leads the growing middle class to understand the value of health promotion and disease prevention [202, p.275], [203, p.10]. An increased focus on self-actualization is likely to enhance the demand for educational, fitness, and travel offers for the elderly and will result in improved mental and physical well-being [204, p.13], [205, p.300]. Additionally, the workforce will increasingly comprise people of older age driven both by the economic needs of an aging population and the wish to stay productive [206, p.47]. Working longer enables the elderly to find meaning, remain active and connected, and increase their financial independence [207]. This has important implications for the industry, which would benefit from improving and growing product and service offers for the elderly. Additionally, companies should consider this development to counteract ageism and develop working schemes suited for the elderly.

### Facts:

- Among the elderly, leisure participation and satisfaction have consistently contributed to life satisfaction and psychological well-being [208, p.63]. Engagement in physical activities protect from cognitive decline [204, p.13].
- Health education, vaccination initiatives, medical screening, and aid payments in Germany increase based on the "Präventionsgesetz" (law for prevention) [209].
- The employment rate of older workers (age group 55-64) increased from 45.5% in 2005 to 72.7% in 2019 [210]. Low-income countries experienced the most significant loss of forest area and the highest annual net gain in agricultural areas [145], [141].

### Key Drivers:

- Life expectancy and the number of old age people are constantly increasing, leading to an overall aging society [211].
- Globalization and individualization lead to a decreased dependency upon a specific location and a smaller emphasis on family and caregiving than self-actualization [212, p.22].
- The aging of society increases the need for later retirement age and elderly supporting the economy.
- Problems such as non-communicable diseases (NCDs), obesity [213, p.522], and psychological diseases increase the awareness and need for health promotion and disease prevention over treatment [214, p.9].

### Challenges:

- Existing age-related paradigms might prevent the positive perception of working elderly and impair their active participation in society [215, p.2].
- Older workers face difficulties finding employment, and suitable working schemes or positions for the elderly are often non-existent [216]. At the same time, the "early retirement trap" increases the likelihood for early retired people to be in financial hardship [217, p.12]. Governments should thus encourage the elderly to work and companies to retain and invest in them.
- Although adult education has expanded in recent years, a lack of scholarly attention to learning in later life persists [218, p.67]. Policies should promote the intensification of agricultural production and sustainable management of forest resources.

### Impact on Independent Living of the Elderly:

Changes in the activities of daily life (ADL) of the elderly will significantly influence their independent living. Longer working lives have been found to impact life satisfaction positively. They enable the elderly to find meaning and stay active and connected, which are important SDoH [219]. Additionally, longer working lives increase the financial independence of the elderly [220, p.6], who are thereby gaining in relevance as a customer group. At the same time, a more physically active lifestyle and the conscious pursuit of self-actualization lead to increased mental and physical well-being among the elderly [221], [222, p.1].





# LEGAL & POLITICAL TRENDS

## INFLUENCING INDEPENDENT LIVING OF THE ELDERLY

Accessibility Enforcement

Accelerating Digital Health through Regulation

Facilitating Healthy Aging through Prevention

Transforming Nursing Care

Reformation of the Pension System

Rise of the Silver Democracy

# LEGAL & POLITICAL TRENDS

## Influencing Independent Living of the Elderly

The political developments and legal regulations play an essential role in determining the present and future of the elderly living. With an aging society, the independent living of the elderly has been in the focus of political and societal discussions. Aspects such as accessibility, digital health, prevention, nursing care, pension system, and the elderly's growing political influence all contribute to the future of the elderly. Accessibility, including digital accessibility, is a critical contributor to independent participation in daily life. The German government has expressed recognition of its importance by ratifying the relevant UN convention. Despite the high costs of rebuilding infrastructure to ensure universal accessibility, the government is making efforts to achieve it. An example is ensuring internet access for the elderly and incentivizing landlords to make their properties more accessible.

With the rising stress on the healthcare system, digital health solutions' fast development becomes essential, where Germany is still lagging behind. However, from 2019 new regulations are set in motion that facilitate digital healthcare innovations and ensure patient data privacy, paving the way for e-prescriptions and electronic patient records (EPRs). Chal-

lenges posed by COVID-19 further accelerated the process of digitizing health through contact tracing and telehealth services.

Besides easier access to healthcare, the government needs to put forth health prevention efforts due to Germany's aging society and relatively high numbers of preventable deaths. Prevention measures, such as the Preventive Healthcare Act, are already in place. Still, more holistic solutions are needed to improve a broader range of SDoH, which will ensure a higher quality of living for the elderly.

The supply shortage in nursing care poses an additional challenge. Multiple national and international legal initiatives have been aimed at improving compensation and working conditions for nurses. But in most cases, family members remain to be primary caregivers. Thus, burdens of home care must be reduced through adequate financial support and improved compatibility of work and caregiving for family members.

Apart from nursing care, financial security is a significant factor for the independent living of the elderly. The German government faces increasing pressure on its pension system as the demographic change leads to a disbalance between workers and pensioners. Alternatives such as the Grundrente are lacking financial support and are not providing solutions to a broken system. Therefore, reforming the existing system will be a major challenge for the future.

Lastly, the political influence of the aging population poses the rise of the silver democracy. Compared to younger generations, the elderly are more politically active and take a different stance on multiple issues. The resulting polarization will pose a danger to democracy itself, and politicians must unite the voters of all age groups more than ever.

The independent living of the elderly will be impacted strongly by these political and legal trends. In the following they are elaborated on by providing facts, key drivers, and challenges.



# ACCESSIBILITY ENFORCEMENT

## Attempts to enable elderly's participation in society

Accessibility, including access to digital technologies, ensures full participation in all life aspects, despite potential impairments. Thus, accessibility tailored to the elderly is essential for their independent living [241]. As per European law, blatant age-based discrimination is banned [242]. Physical barriers in legacy infrastructure pose a subtler problem [243]. Accessibility to such infrastructure is a challenge that especially countries with aging populations face. Progress has been achieved in state-run companies, for instance, in transportation [244]. However, according to a UN Charter, ratified by Germany among others, private companies are obliged to ensure accessibility - a requirement Germany has not (yet) legislated [241].

In the digital age, participation in society also requires barrier-free access to the digital environment. Due to the decreasing learning abilities and increasing technological complexity, learning how to operate technical devices becomes more challenging with age [245, pp.2-3]. Simultaneously, the benefits of incorporating technology into daily life have grown over the last years. Therefore, governments leverage various initiatives to facilitate older people's access to technology.

### Facts:

- ~13m people in Germany suffer from disabilities and thus are potential victims of accessibility discrimination [246, p.6].
- 25% of German households with one member >65 years are accessible without stairs [246, p.259].
- Research has linked loneliness to severe diseases, including Alzheimer [247].
- In 2019, 84% of all 9.2k railway tracks in Germany were accessible without stairs [248], compared to 14% in 2004 [249, p.28].
- From September 2020, all EU public institution websites are required to be accessible despite impairments [250].
- The government initiative "Digitaler Engel" supports the elderly in gaining internet access at more than 400 locations [251].

### Key Drivers:

- Demand for accessible facilities increases with an aging population [252, p.4].
- Political parties, society, and health insurances recognize that non-accessibility results in increased health costs due to psychological and physical diseases [247].
- The German government has pledged itself to ensure accessibility by ratifying the respective UN convention [253].
- For the public sector, the UN Charter requirements have been put into law as part of the Equal Opportunities for People with Disabilities Act [254].
- The German government incentivizes landlords to convert apartments to accessible properties by providing low-interest loans of up to 50k EUR [255].

### Challenges:

- Disabilities and infrastructure across Europe are incredibly diverse, making it almost impossible to reach full accessibility to all areas of life [256, pp.8-12].
- Due to high costs, private companies, independent doctors, and non-public cultural institutions are hard to convince to voluntarily provide accessible offerings as demanded by the United Nations' legislation [254].
- While costs for accessible new apartments are usually manageable, reducing barriers in existing apartments often results in costs >20k EUR [257].

### Impact on Independent Living of the Elderly:

Ensuring accessibility to a full range of activities is arguably one of the most critical factors for seniors' independent living. As per definition, independent living comes with a choice of residence and reduction of dependence. This is facilitated by accessible apartments and infrastructure. In such environments, the elderly feel encouraged to go out [258, pp.80-87]. Keeping up social contacts can be complemented by accessible digital tools [259]. Failure to provide accessibility will lead to an increase in perceived loneliness and a decrease in physical activity, resulting in higher risks for further health issues and, ultimately in high costs for society [247].

# DIGITAL HEALTH THROUGH REGULATION

Germany's attempt to rise from a digital health laggard to a forerunner

Germany is lagging behind in the digital transformation of the healthcare sector despite its vast potential [260, pp.2-7]. Reasons for the slow development of Digital Health Applications (DiGA) include strict healthcare and data protection regulations [261]. The federal government has recently passed a Digital Healthcare Act (DVG), facilitating digital health innovations [262]. To ensure data protection and privacy in health, the new Patient Data Protection Act (PDSG) provides careful handling of sensitive data. Simultaneously, the PDSG paves a path for digital solutions such as e-prescriptions, digital referrals, and EPRs [263]. These recent regulations allow for fast adoption of DiGAs also beyond COVID-19. Upcoming legislature is expected to continue promoting healthcare digitalization without over-regulating and blocking digitalization of health [264], [265, pp.1-6]. The growing focus on regulation will fasten the development and adoption of DiGAs, which will make the lives of the patients and the health care professionals easier [266].

## Facts:

- Germany ranks 16th among 17 other OECD countries in terms of digitizing its healthcare sector [260, pp.2-7].
- The DVG, approved in December 2019, provides government funding of 200m EUR and aims at faster market access for health start-ups [262].
- The DVG gives rise to DiGAs that focus on all aspects of healthcare: from screening to treatment [264].
- The high demand for digital health solutions during COVID-19 and DVG pave the path for fast integrations, such as telemedicine and warning apps [265, pp.1-6], [264].
- The new PDSG aims at a fast DiGA adoption, such as EPRs [262], [263].

## Key Drivers:

- As recognized by the minister of digitalization in 2018, Germany's strict data protection laws and high requirements for protecting privacy hinder developments in the healthcare system, which stresses the need for more lenient regulations [261], [267].
- Germany recognized that the absence of an effective strategy, political leadership, and a centralized institution dedicated to digital health slows down the digital transformation of healthcare [268, p.4].
- The COVID-19 pandemic is emphasizing the importance of a fast and barrier-free development of digital technologies; digital access to healthcare is one of the most critical dimensions [264], [265, pp.1-6].

## Challenges:

- Challenging DVG processes still hinder the fast adoption of digital solutions: e.g., giving manufacturers limited time to prove the impact of their DiGAs [265, pp.1-6].
- Possible overregulation of the digital health sector can limit and slow down the market access [265, pp.1-6].
- In light of new regulations, risks of a financial shock to the health sector are rising, such as one following the General Data Protection Regulation (GDPR) [269, pp.1-15].
- Low digital literacy and accessibility give rise to a reduction in data sharing among the elderly [270, pp.1-16], [271, pp.5-8].

## Impact on Independent Living of the Elderly:

DiGA provides extensive opportunities for fostering longer and independent living for the elderly. Due to high regulatory and data protection standards, Germany has been slow in digitizing its healthcare sector [260, pp.2-7] [264]. However, the emerging regulations, such as DVG and PDSG, give hope for faster market access and digital technologies that will support the independent living of the elderly [262], [263]. During COVID-19, DVG already showed its benefits, allowing for fast development and integration of telehealth services, contact tracing, and warning apps [264]. Such initiatives will continue to relieve the stress on the healthcare system and allow the elderly to receive healthcare from home.





# HEALTHY AGING THROUGH PREVENTION

## Increased focus on preventive measures in politics and regulation

The aging society gives rise to NCDs [272]. At the same time, according to the Organization for Economic Cooperation and Development (OECD), Germany is lagging behind other OECD nations with higher numbers of smoking, alcohol consumption, and obesity. Germany's mortality rate from preventable causes, such as lung cancer, is higher than the OECD average. Germany is one of OECD's top 5 spenders on healthcare, and its expenses are projected to increase even further in the upcoming years [273].

Therefore, Germany needs to focus on prevention to ameliorate the burden of an aging society on the healthcare system, reduce the health-related inequalities, and contribute to healthy aging [274, pp.1-13].

In light of promoting prevention, the WHO enforced the strategy of "Health in All Policies" (HiAP), recognizing the need for a diversified approach to improving prevention [275, pp.1-3]. The EU is also implementing its most extensive health program aiming at prevention [276]. It is predicted that the collaboration among policymakers will improve prevention for a healthier society.

### Facts:

- In 2016, around 120,000 people died in Germany from preventable causes such as lung cancer, which is relatively higher than in many other Western European countries (e.g., Switzerland) [273, pp.1-4].
- Germany's smoking (18.8%), alcohol consumption (10.9%), and obesity rates (60%) are above the OECD average [273, pp.1-4].
- Since 2013, the WHO has been promoting the HiAP framework for prevention [275, pp.1-3].
- The Preventive Health Care (PrävG) and the Care Provision Strengthening Acts aim to promote health across all areas of life [277], [209].
- In response to COVID-19, the EU4Health program aims to

prevent diseases and increase healthcare access with total investments of 9.4bn EUR from 2021-2027 [276].

### Key Drivers:

- The demographic change is fueling the rise of NCDs such as cancer, diabetes, and lung cancer [272], [274, pp.1-13].
- The rising inequalities in the SDoH across Europe shed light on the importance of preventive measures and lead to new regulations and initiatives [278], [279].
- The workforce shortage in healthcare demands increased preventive measures [280].
- The COVID-19 pandemic sheds light on the need for healthy aging of the elderly [281, pp.526-535].
- Germany's spending on healthcare is expected to reach 12.3% of the Gross Domestic Product (GDP) by 2030 [273, pp.1-4].

### Challenges:

- To achieve the HiAP, many governmental institutions have to work together and establish new effective ways of communication and collaboration across their current boundaries [275, pp.1-3].
- An increasing amount of misinformation causes distrust in preventive measures like vaccination [282], [283]. Counteracting this misinformation in the digital age is exceptionally challenging.
- The health literacy among elderly, racial and ethnic minorities, and patients with existing chronic diseases needs to be improved [284]. Enterprises could suddenly be faced with a host of unregulated issues. These would then have to be resolved in courts, which would increase the time, cost, and administrative effort for all the parties involved.

### Impact on Independent Living of the Elderly:

Physical and cognitive fitness is required to succeed in everyday tasks, like grocery shopping. Being able to complete such tasks is essential for an independent life. Effective prevention measures, such as EU4Health, HiAP, and the PräVG, improve the fitness and the resulting independence of the aging population.

Measures taken to improve SDoH, like income and education, directly affect the independence of individuals. They can also increase an individual's chances of taking preventive measures themselves. New regulations are expected to drive health prevention and close the societal gaps in access to preventive care.



# TRANSFORMING NURSING CARE

## Bridging the supply and demand gap through regulation

With the aging of society, the emerging supply shortage in nursing care has become one of the biggest societal and economic problems in Germany and around the world [285, pp.10-11]. The gap between the demand for and supply of nursing care staff will continue to grow [286, pp.10-11]. By 2030, the number of vacant positions in Germany is projected to increase more than tenfold [286, pp.10-11], [287]. In response to this, the German government has taken a multidimensional approach and started comprehensive legal initiatives at the national and international level, like the introduction of LTC Strengthening Laws from 2015 to 2017 [288, pp.7-17]. The main focus lies on three areas: improving compensation and working conditions in nursing care, attracting qualified foreign workers, and reducing home care burdens. Family members are the only caregivers for more than half of all people in need of care [289]. Thus, one main challenge is to improve the compatibility of work and caregiving and to provide an effective support system for family and professional caretakers.

### Facts:

- In 2017, 81% of the people in need of care were at least 65 years old, and 71% of all people aged 90 and older needed care [289].
- In 2018, the German government launched the multiyear initiative "Konzertierte Aktion Pflege" to improve nursing care staff's training and working conditions [290].
- The Skilled Immigration Act, effective since 2020, aims at closing supply gaps in areas like nursing care [291].
- In response to the COVID-19 crisis, the Second Civil Protection Act was passed in 2020. Increased access to financial aid and flexibility in using family care time aim to support the 2.5m professionals taking care of their relatives at home [292].

### Key Drivers:

- Due to higher life expectancy, the share of the elderly is growing. Thus, the population of those in need of care increases, while at the same time, fewer people are available to work in nursing care [293, pp.6-7].
- The below-average compensation, high workload, and low job satisfaction and prestige decrease the attractiveness of the nursing care profession [293, pp.6-7], [294], [295, pp.50-58].
- The potential of family care declines due to the individualization of society, changing family structures, growing geographical distances of family members, and women's increasing participation in the labor market [286, pp.25-26], [296]. PA makes efforts to avoid lock-in effects with big tech companies [126].

### Challenges:

- The costs of nursing care will continue to increase. Financing options are tax subsidies and higher contribution rates to care insurance [297].
- Labor migration involves challenges like language barriers, cultural differences, challenges of recognizing formal foreign qualifications, as well as high costs and lack of support for recruiting nursing staff abroad [295, pp.86-99].
- Family caregivers are at significant risk of physical and mental health problems that should be prevented to better maintain them as a critical national health care resource [298, p.5], [299, pp.5-7] The current approach in setting standards lacks agility and focus, making the seamless collaboration between public administrations in the EU difficult [151].

### Impact on Independent Living of the Elderly:

Independent living requires a nursing care ecosystem that can provide care tailored to the elderly. Thus, continued efforts to attract nursing staff and facilitate home care are required, given the supply and demand gap's expected development. Especially home care is an essential aspect of independent living since the elderly can remain in their familiar environment and still receive the care they need for healthy aging. It enables them to actively participate in society, maintain a trusting relationship with their caretakers, and stay closely connected with their community and family.





# REFORMATION OF THE PENSION SYSTEM

## Incorporating the effects of demographic change

Every fifth individual over 65 is at risk of poverty or social exclusion in Germany [300, p.54]. Demographic change is forcing pension systems to adapt, which leads to substantial disputes among the political parties [301]. The current system functions on a pay-as-you-go basis, meaning that employee pensions are directly redistributed to the pensioners. But since its ratification, the birth rate has halved [302, p.34]. Reform is needed during the next years before the baby boomers leave the workforce to ensure a safe and high pension for everyone without generational conflicts.

Germany's current government focuses on the "Grundrente", raising the pensions for those who worked hard but still have barely enough [303]. Political observers argue that this initiative focuses on a broken system's symptom by solely helping a few people in need. According to many, a holistic reform is needed. No matter which political party is next to attempt this significant reformation, radical ideas will no longer be inconceivable. These options could include increasing the statutory pension age to over 70, a pension for everyone, or a state fund.

### Facts:

- OECD sees room for improvement of the German pension system in the sustainability of the system, coverage of employees, and gender inequality [304, p.5].
- Initiatives to unify European pension plans are lacking, and 10/27 European countries have a statutory retirement age depending on the life expectancy [305].
- <30% of German residents above 65 years of age approve of the pension system (from 18-50 years old, <9% are satisfied) [306].
- Economists demand raising the retirement age to 71 years from 2030 in Germany [306].
- Realistically, approx. 1.3m pensioners can benefit from the

"Grundrente" with a max increase of 404 EUR per individual [307].

### Key Drivers:

- Both the demographic change and the increased life expectancy put exceedingly more pressure on the pension system.
- A rising number of atypically employed people in the Gig Economy, i.e., part-time or contractually employed, shift the focus away from full-time work, upon which the current system was built [308].
- Baby boomers exiting the workforce are leaving a large financial gap in the pension budget [309].
- The currently stagnating supplementary pension schemes are dysfunctional but will need to play a larger role in dampening the reliance on the state pensions [300, p.53].

### Challenges:

- There is no uniform IT infrastructure for pension insurances to carry out a financial means test, a prerequisite to ensure equal pension for everyone [310, p.14].
- Incorporating partners' income into pension calculations could mean an unconstitutional advantage over couples living together in one household [311].
- Financial support for the "Grundrente" is missing. One solution could be a financial transaction tax for stocks [312]. This would come with the paradoxical challenge of corroding people's efforts to substitute private pensions with stock market investments.
- "Grundrente" only benefits people with at least 35 years of work, excluding many potentially needy people [307].

### Impact on Independent Living of the Elderly:

With pensions as a key pillar, financial security is crucial for independent living [313, pp.19-21]. Therefore, the insecurity about the future of pensions has led to dissatisfaction and rising pressure on politicians. Previous approaches, such as incentivizing private pension, have not solved the problem [314]. The newly introduced tax benefits and pension regulations, such as the "Grundrente," are examples of attempts to fix the system. German politicians need to start reforming a legacy system that correctly reflects the new demographics and includes modern alternatives such as a state fund to secure the independence of its future elderly.

# RISE OF THE SILVER DEMOCRACY

## The increasing influence of the elderly on politics

The aging of society is raising the average age of the electorate across Europe. The elderly show the highest rate of political participation among all age groups [315, p.40]. This growing political influence is what constitutes the Silver Democracy. Simultaneously, authoritarian political parties have risen across Europe such as Front National in France and the Alternative for Germany [316, p.9], [315]. Their success is frequently attributed to the elderly and leads to intergenerational tensions [316, p.9]. Such tensions have also been rising in the UK since the Brexit referendum [317]. These tensions result in polarization and radical demands like the introduction of a maximum voting age [318], [319]. The Silver Democracy is also expected to shape the importance of various political topics for the future since individual priorities change with age: While the individual importance of pensions increases, that of education decreases [320]. Additionally, the current generation of elderly tends to be more culturally conservative [316, p.17]. Challenges like climate change require long-term planning and collaboration across generations. To successfully tackle them, politicians have to unite people of all ages, while still balancing their changing needs and priorities.

### Facts:

- By 2030, the majority of the electorate will be above 50 years in most European countries [320].
- In Europe, 85% of 60+ year-olds participate politically by voting, which is 22pp higher compared to 18-29-year-olds [316] [ p.40].
- In the first round of the French 2017 presidential elections Marie Le Pen, representing Front National, was more popular than her opponent Macron among 35-59 year-olds, but less popular with above 60 year-olds [315], [321].
- In the history of the Federal Republic of Germany, a coal-

tion of the Liberal (FDP) and the Union Parties has always won a majority among voters older than 60 years [322]. The BMI wants to increase oversight on digital companies with large market shares [159].

### Key Drivers:

- The aging of society is shifting the voter demographic towards older age [320]. This increases the political power of the elderly.
- Younger generations are less politically active and choose more independent ways of political participation such as environmental activism [316, p.40]. This weakens their representation in elections compared to the elderly.
- The rise of populism and authoritarian political parties are polarizing the political climate and public discussions [316, p.9], [315].
- Populist views are overrepresented in multiple European countries. Evidence has shown that this can strengthen populist political views and increase polarization [323, pp.3-5].

### Challenges:

- During the current demographic change, the priorities of different age groups need to be balanced out continuously [324, pp.2-7].
- The aging of society will give rise to a new political focus on relieving the stress on healthcare and social security systems.
- The intergenerational divide may develop into conflicts and cause further polarization in politics.
- To prevent further polarization of news media measures like supporting trusted public broadcasters with building up online channels [323, p.42].


### Impact on Independent Living of the Elderly:

The Silver Democracy will influence the independence of the elderly in multiple ways. On the positive side, their growing influence on politics will emphasize the issues important to their age group. This is already becoming evident during the COVID-19 pandemic: Topics like loneliness are now discussed extensively [281, pp.528-529]. On the negative side, political differences and stigmatization may cause conflicts between younger and older generations. In the context of Brexit, the elderly are being blamed for the adverse consequences [324, p.2]. A strong stance will be required to defend against undemocratic ideas like restricting the elderly's voting rights.



# ECONOMIC TRENDS

## INFLUENCING INDEPENDENT LIVING OF THE ELDERLY



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The Emergence of the Silver Economy  
Supply-demand Gap in Elderly Care  
Increasing Pension/Gender Gap  
Elderly Financial Well-being under Distress  
Affinity Towards Private Retirement Provisions  
Aging Working Society

# ECONOMIC TRENDS

## Influencing Independent Living of the Elderly

An increasing average life expectancy combined with a decreased birth rate leads to a demographic change: the European, and more specifically, the German population is getting older. Thus, the German social system and the overall economy are facing various challenges.

As the population ages, the need for health care increases. This rising demand for skilled health care workers comes with the preoccupation that the available supply may not meet it. Therefore, the question arises who will be taking care of the elderly in the future? As this is an issue that cannot be solved overnight, long-term considerations must be made.

In 1962, there were six contributors per pensioner supplying the pension system. This number has fallen to two contributors per pensioner by 2007 and is projected to fall even further. The decline in the pension level of the public pension fund will further increase the risk of old-age poverty in the future, especially for specific groups such as singles, low-income individuals, and women.

This is one of several reasons why the financial well-being of the elderly is under distress. On the one hand, low-income households have less disposable income than 30 years ago. On the other hand, there is an extraordinary rise in living and healthcare costs, particularly for the elderly driving this trend. The low-interest-rate environment and the increasing pension gaps encourage people to invest in private pension schemes and make capital market investments. Financial worries also cause some of the elderly to continue working after their official retirement age. The number of people working after their retirement age has doubled since 2005. However, financial worries are by far not the only reason why the elderly continue to work. Most of them do so because they want to stay active and feel needed. Yet, not all of those who would like to work also find a place to work.

In the meantime, the continuous aging of the society also represents a significant opportunity for companies. As the so-called European Silver Economy would be the third-largest economy in the world, it is a market that should receive well-deserved attention by both private and public sector companies. Here, a shift in their mindset is required. To de-

velop the full potential of an aging working society, companies need to consider older applicants while society as a whole needs to stop seeing them as a fiscal burden only. Further, companies need to start adapting their products to the elderly if they want to exploit the market potential of the Silver Economy.

These economic trends and challenges will be described in depth in this chapter, including facts, key drivers, as well as further challenges and impacts on the independent living for the elderly.



# THE EMERGENCE OF THE SILVER ECONOMY

Europe's aging population represents an untapped potential

Europe, and especially Germany, has been experiencing a demographic change: its population is getting older, mainly due to an increase in average life expectancy and a decrease in birth rates [325, p.7]. Combined with the growth of the seniors' purchasing power, this has given rise to the Silver Economy [326]. According to the European Union, the Silver Economy is defined as the sum of all economic activity that serves the needs of people aged 50 and over [327, p.3]. Europe's Silver Economy is currently the third-largest economy in the world, after China and the USA, and is expected to grow by 54% from 3.7trn EUR in 2015 to 5.7trn EUR in 2025 [211, p.9]. This size makes the Silver Economy an essential part of Europe's economies and a driving force for its countries' economic growth. To tap its potential, however, companies need to change their attitude towards the elderly and stop considering them as a financial burden. While companies would benefit through access to a larger market, the elderly could expect a stronger catering to their needs and the development of products that alleviate age-induced impairments.

## Facts:

- In 2015, the size of the European Silver Economy was 3.7trn EUR [5, p.3]. From 2015 to 2025, the European Silver Economy is estimated to grow by 54% to 5.7trn EUR [5, p.3].
- Much of the Silver Economy will be driven by digital tools and services that address functional impairments and accessibility requirements since the need for these will increase significantly in the future [5, p.4].
- With 16.5%, Germany has the largest share of the spend-

ing power of people aged 60 or over [6].

- From 2019 until 2030, Eastern Europe is expected to have the highest Silver Economy growth in Europe with a growth rate of 22% for nearly all of its countries [6].

## Key Drivers:

- The average life expectancy in Europe has increased from 79.8 years in 2010 to 81 years in 2018 and is predicted to rise further [328].
- From 2010 to 2019, birth rates in Europe have decreased by 9.8% from 4.6m to 4.2m births despite a global population growth of 5% per year [327].
- Due to these developments, from 2010 to 2019, the share of the European population aged 65 years and over increased from 17.6% to 20.3% [328].
- From 2010 to 2018, the median equalized net income of people aged 50 to 64 has increased by 16.1% and 18.4% for people aged 65 years or over [329].

## Challenges:

- The public needs to change its view of the aging population as a fiscal burden to a view of the elderly as an untapped economic potential [330, p.1010].
- Given the imbalance of purchasing power among the elderly in Europe, not all of them will be able to afford innovations [331, p.8].
- The Silver Economy needs to create products for two different lifestyles of the elderly: living in independent households and living in homes with healthcare services [332, p.6].
- For a sustainable Silver Economy, healthy aging must be promoted to keep people aged 50 or over in the workforce as long as possible [160, p.4].

## Impact on Independent Living of the Elderly:

The Silver Economy is indispensable for many sectors across the EU [211, p.8]. Because of its size, it holds a significant share of the economy as a whole and has to be acknowledged as a crucial factor for economic growth. Even though the European Commission has acknowledged its importance by commissioning a comprehensive report on it in 2018, its full potential has not been realized in the market. Yet, we can expect companies to adapt in the future and start developing products and services that contribute to a more independent living for the elderly.

# SUPPLY-DEMAND GAP IN ELDERLY CARE

## A growing demand in health care raises concerns about meeting it

The demographic development in Germany confronts the country as a whole with diverse challenges. Looking after the elderly who need care is one of these challenges that cannot be overlooked [286, p.6]. As individuals age, their health generally decreases. Thus, it is not surprising that the rate of healthcare service utilization is the highest among the elderly [333, p.17], [334, p.354]. Therefore, an aging society comes with the challenge of growing demand for skilled healthcare workers that will not be met by the available supply. In the future, more people will have to be looked after, but at the same time, there will be fewer people available to take on this task [335, pp.5-6]. In addition to this, single-person households, changed family constellations, and women's increased employment will continue to intensify the gap [336, p.6]. Predictions show that this gap will result in a nursing staff shortage forcing governments to simultaneously utilize all options for securing skilled labor [337, p.990]. Some solutions currently being implemented and explored include creating incentives for informal caregivers, attracting workforce from around the world, and increasing the recruitment and retention of health care workers [286, p.8].

### Facts:

- In Germany, the number of elderly people in need of care is expected to grow by 47% from 2.3m in 2013 to 3.4m in 2030 [338, p.60].
- The current care gap is estimated to be of 140,000 workers in Germany [339, p.11]. The Bertelsmann Foundation projects the gap to grow to almost half a million care workers in Germany by 2030 [336, p.54].
- The increase in demand for LTC facilities is unlikely to be met by the current number of facilities and qualified staff members [296, p.2].
- 79% of the elderly in the age group 60-69 and 57% aged 90+ are cared for at home through relatives or friends [296, p.1].

### Key Drivers:

- The number of people with age- and illness-related limitations is increasing. Many require temporary or LTC [296, p.2].
- The need for LTC rises sharply beyond the age of 75. In 2013, 5% of the age group 70 to 74 were in need of such care, while in the age group 80 to 85, the figure is approximately 20%. The proportion increases to about two thirds in the 90+ age group [338, p.8].
- Changes in household compositions such as increasing female labor force participation and more elderly living alone are critical factors of an expected decline in informal caregivers' potential, placing more load on the official caregiving system [340, p.5]

### Challenges:

- The dissatisfaction of nursing professionals is likely to increase due to an accelerated workload and low salaries, leading to further growth of the gap [293, p.7].
- With the shortage of formal caregivers and the reduced potential of informal ones, healthy aging and health in old age are key aspects of health policy planning and measures [335, pp.5-6].
- The nursing care ecosystem is highly complex and involves many stakeholders like political parties, family caregivers, etc., who all have different opinions and interests [341, p.536].

### Impact on Independent Living of the Elderly:

The provision of quality-assured healthcare services for the elderly population is a challenge that must be of utmost priority to promote an independent lifestyle while aging. If no immediate and effective actions are taken to improve this projection, it can be expected that the elderly would receive impersonalized and low-quality health care. Securing and maintaining skilled workers in the labor force, as well as training family members, will help ensure that the health conditions of the elderly are sustained optimally, allowing them to maintain an independent lifestyle for a longer period of time. Understanding the growing gap in elderly care supply-demand will permit governments and institutions to search for initiatives and innovative solutions to guarantee the quality care that elderly deserve.





# INCREASING PENSION/GENDER GAP

## Old-age poverty and gender pension gap present future economic challenges

The pension gap refers to the difference between the last salary as an employee and the pensioner's income [342]. This can result in a financial gap between what the elderly need and what they have. The decline in the pension level of the public pension fund will further increase the risk of old-age poverty in the future [342, p.4]. For example, a continually growing number of pensioners are financed by a decreasing number of contributors. Additionally, the public pension funds expenses have exceeded the income for some years now, leading to an increasing deficit. Worsening economic conditions and financial crises might aggravate this situation [159, p.4]. Further, low-interest rates, rising inflation, and increasing taxes represent a potential financial burden for the elderly. In the coming years, poverty will especially increase for certain groups such as singles, low-income individuals, and women who might not be able to invest in private retirement pensions [343, p.8]. For example, Germany has the 4th biggest gender pension gap out of the EU-15 states. This gap arises through women generally working fewer hours per week and still receiving lower wages [344].

### Facts:

- Pensions have risen more slowly than wages. This pension level ratio of income and pensions fell from 52.9% in 2000 to 48.2% in 2018. By 2036, the pension level is expected to fall below 43% [345, p.3].
- To close the pension gap, a private pension plan would need an interest rate of at least 4.5%, although, since March 2016, the interest rate set by the European Central Bank is maintained at 0% [342, p.4], [346].
- Old-age pensions are generally lower for women than for men because of their lower income as working persons [344]. The older the age cohort is, the more significant the gender pension gap is [119].

### Key Drivers:

- Through the demographic change, the old-age dependency ratio has decreased from 1:6 pensioners to contributors in 1962 to 1:2.7 in 1992 and 1:2.1 in 2017. It will continue to fall [347], [348].
- Low-interest rate phases will also make it more challenging to profit from classic saving strategies [342, p.4], [349, p.3]. The inflation rate increases this effect since it is higher (e.g., 1.4 pp higher in 2019) than the interest rate in the low-interest phase [350].
- Women are more often employed in 'mini-jobs' and take breaks from employment more frequently and longer [344]. This situation could improve due to the changing role model of women.

### Challenges:

- Sustainable financing of the pension system must be ensured to achieve a stable payment of the state pension in the future. This includes the intergenerational contract [342, p.4].
- Contributors have to invest in private retirement provisions to close their pension gaps, which is especially difficult for low-income groups. The extent to which the conditions for classic savings accounts and savings behavior develop will be particularly important [343, p.6].
- The further development of the gender gap and biographical patterns, such as breaks from working life, will also influence pension trends [344].

### Impact on Independent Living of the Elderly:

Adequate financial means are necessary for an independent and self-determined life. To guarantee this future, pensioners will depend on policy reforms and personal savings [342, p.4]. Women are at a greater risk of not being financially independent compared to men since they bear the long-term risk of receiving lower pensions. This is partly due to reduced pension contribution periods because of career breaks and partly due to gender-differentiating policies that pay lower pensions per annum to women owing to longer life expectancies [344]. Closing the pension and gender gap will guarantee the independent living of the elderly and especially of women.



# DISTRESSED FINANCIAL WELL-BEING

Bottom income and wealth are declining while the expenditures are rising

Besides the increasing (gender) pension gap, the economic situation of the elderly with low income is worsening [351, p.184]. The Aegon Retirement Readiness Survey from 2019 states that only 29% of people interviewed over all countries are either extremely or very confident of retiring comfortably regarding their financial situation [352, p.6]. Aegon's country-specific version for Germany from 2016 concludes that 74% of Germans feel that the government should put new laws forward to encourage employer pension schemes [353, p.4]. Meanwhile, the share of expenditures attributed to living & healthcare is continuously rising. Older people struggle extraordinarily as their share attributed to living is growing stronger than the rest of the population. Furthermore, the share of expenditures on healthcare has been rising even more from 2003 to 2018 [354, p.36], [355, p.84], [356, p.80], [357, p.75]. All this stands in contrast to the emergence of the silver economy mentioned earlier. While some people seem to be better off, others do not profit from these positive trends.

## Facts:

- While the overall real wage increased in Germany during the last decades, the lower two deciles have less disposable income than in 1991 compared to 2018 [351, p.184].
- The monthly share of expenditures of the elderly attributed to living and healthcare has risen by 7.6% and 23.6%, respectively from 2003 to 2018, this is 2.6 or 13.3 percentage points more than for the overall population [354, p.36], [355, p.84], [356, p.80], [357, p.75].
- In 2016, only 36% of Germans (down from 43% in 2012) felt that they are saving enough for their retirement [353, p.4]. At the same time, 37% of Germans (down from 49% in 2012) said that they were working on their retirement planning [353, p.4].
- In Germany, 16.8% of the population were at risk of poverty in 2015. In the 1990s, the proportion was 11% [351, p.187].

## Key Drivers:

- The weak growth in lower incomes is due to the expansion of the low-income sector. Immigrants earn less in the first years after relocating, and the adjustment of social security benefits does not sufficiently cover inflation [351, pp.185-186].
- Nearly 70% of German individuals' assets are in the form of classical savings accounts affected by the low-interest-rate environment. This includes assets in property and makes it one of the highest shares among European countries [358, p.7], [346], [359, p.136].
- Institutional support for retirement planning is mostly absent, as only 22% of employees indicate that they receive any support from their employers [353, p.11].
- The housing rate in Germany is continuously low at 47.5%, thus within the EU only lower in Switzerland, while rents are steadily increasing [357, p.75], [360, p.2], [361, p.44].

## Challenges:

- Living expenditures are not likely to decrease in the coming years with the housing price index established by the German Federal Statistical Office rising from 84,4 in 2000 to 128,1 in 2019 [362].
- In 2016, only 6% of Germans were offered online retirement modeling tools and digital tools to manage retirement savings by their employer. Of the ones who received these benefits, 67% and 76% respectively found these services to be very helpful, indicating that implementing more of these measures would strongly help improve the retirement situation [353, p.12].
- To prevent declining incomes, more targeted integration of migrants and support for social housing construction is necessary [351, p.189].

## Impact on Independent Living of the Elderly:

A reduced financial preparedness, together with the absence of institutional support for retirement planning, hampers the financial independence of the elderly, making them highly dependent on the younger generation. One consequence of old age financial problems is an increased risk of mental health problems caused by the feeling of being a burden and the pressure to work until an old age [363, p.86]. Increased old-age poverty also leads to a higher burden for overall society, financially and in social aspects [364].





# PRIVATE RETIREMENT PROVISIONS

## Dwindling interest rates and widening pensions gaps cause people to seek alternatives

After the pension policy reform in 2001, many Germans enrolled in private pension schemes under the Riester and Rürup plans to reduce pension gaps. As part of these plans, the state secures the subscribers with minimum payout guarantees and ensures gender-neutral pension benefits [362, p.6]. Additionally, the state incentivizes adoption by offering generous tax exemptions and subsidies [342, p.8]. In 2020, there was a total of ~16.5m Riester contracts. However, as an individual can subscribe to several Riester contracts simultaneously, the actual number of individuals with a Riester contract cannot be inferred from this number. Since 2008, Riester savings, under a scheme named 'Wohn-Riester', can be used for loan contracts or to buy real estate. Adoption rates for this scheme were fueled by the low homeownership rate in Germany. In addition to pension schemes, savings accounts have been popular private retirement provisions. However, a low-interest environment drives people to also invest in capital markets to earn better dividends [365].

### Facts:

- There was a sizable adoption of Riester contracts in the first decade after their inception. Nevertheless, the total number of contracts remained nearly constant at ~16.5m since 2015 [366].
- 67% of Riester contracts exist as pension insurance contracts and 11% as Wohn-Riester contracts. The Wohn-Riester scheme has seen a steady rise in enrollment with a total of ~1.8m contracts by 2020 [366].
- With the rising popularity of capital market investments, the number of people owning shares reached its pre-financial crisis value of 10.3m people in 2018, and the amount of money invested in Exchange Traded Funds (ETFs) also grows continuously [367, p.3], [364].

### Key Drivers:

- While the ratio of retired to working individuals is projected to reach 60% by 2060, policy reform in 2001 curtailed the pension contribution rate from exceeding 22% in 2030 [342, p.7]. The demographic change and policy reform cause future pensioners to face a gap in their retirement income. Private pension schemes have been introduced to offset the impact of these developments.
- Since 2016, the European Central Bank's interest rate stayed at 0% [368]. This low-interest rate is forwarded to bank customers with interest rates for savings accounts hitting a record low of 0.2% in 2018 [369]. These unattractive interest rates are driving the increase of capital market investments.

### Challenges:

- Both private pension products and capital market investments are complex to understand and compare.
- Riester and Rürup plans are criticized for high administrative costs and their lack of transparency in cost structures [370, p.255].
- Plummeting interest rates affect private pension products, adversely causing their enrollment growth to plateau and nearly a fifth of the contracts to be dormant [366], [371].
- Capital markets are prone to a high risk of losses and require extensive portfolio planning.
- Investments with prolonged lock-up periods affect investors' liquidity. The same is true for Riester pensions that permit only 30% of accumulated wealth to be withdrawn as a lump sum [342, p.22].

### Impact on Independent Living of the Elderly:

Incentivized and disciplined investment into private pension plans will increase financial preparedness for post-retirement expenses, including real estate purchases. These plans, albeit secure, have been subject to lower interest rates. Furthermore, the charges for Riester products are often the topic of negative media coverage. It is frequently stated that the charges almost entirely offset the state's subsidies. Private pension schemes are also criticized for their lack of transparency. Capital market investments promise better returns but are riskier and, therefore, often require expert guidance. Consequently, lower financial literacy makes people more reliant on their financial advisors to plan capital market investments and choose between private pension products [372, p.18].

# AGING WORK- ING SOCIETY

## More people work longer than their official retirement age

The elderly are participating increasingly in the labor force [373]. Since 2005, the share of people working between the age of 65 and 70 has doubled. People work longer not only for financial reasons but also because they want to stay mentally active and want to feel needed [374, p.5], [375, p.2]. Increased labor force participation among the elderly can help mitigate an aging society's negative effects on Germany's social welfare system; it could help tackle Germany's skill shortages. Among the non-working elderly, there is a considerable share of people who want to work [376]. Such an additional income source allows for greater financial independence. Additionally, participation in the work-life also keeps the elderly physically and mentally active, enabling them to live independently longer.

### Facts:

- From 2005 to 2016, the labor force participation rate of the 60 to 64-year-olds doubled to 60% [373].
- In the same period, the rate of people working between the ages of 65 and 70 has increased from 6.3% to 16.3% [373].
- Four in five jobs held by people older than 60 are jobs that are not subject to social insurance contributions (mini-jobs) [375, p.1].
- The most common industries for working people over 64 are the car repair and trade sector (175k people) and health and social care (141k) [377].

### Key Drivers:

- The average life expectancy in Europe has increased from 79.8 years in 2010 to 81 years in 2018 and is predicted to rise further [378].
- Due to the increasing pension gap, poverty among the elderly is rising [343].
- To mitigate an aging society's effects on Germany's social welfare system, the government is raising the official retirement age to 67 by 2029 [375, p.1].

- A survey among soon to be elderly revealed that a large share of the respondents who plan to continue working do so because they want to keep their brain active (63%) and because they enjoy their work (46%) [374, p.5].

### Challenges:

- According to the NEPS-Erwachsenenbefragung, 20% of the not-working male pensioners and 13% of the not-working female pensioners want to work [376]. This share of involuntary unemployment provides an opportunity to help tackle the German skill shortage.
- Involuntary unemployment is further associated with a lack of education. Here educational offers for the elderly might come into play to alleviate the situation [376].
- Most elderly do not want to work full-time: four in five jobs among the elderly are not subject to social insurances [375, p.1]. To tap the potential of working elderly as best as possible, employers need to offer an even greater amount of flexibility.

### Impact on Independent Living of the Elderly:

The increased labor force participation among the elderly can help mitigate challenges in the German social system arising from skill shortages and the decreasing number of contributors to the system. For the elderly, an additional source of income will allow for greater financial independence. Besides the economic effects, the elderly can profit from the psychological effects of prolonged participation in the work. These include the feeling of being needed through community engagement and the overall higher level of activity. In turn, these effects might help the working elderly live independently for longer periods, also after retirement.



# BUSINESS MODEL TRENDS

## INFLUENCING INDEPENDENT LIVING OF THE ELDERLY

Hyper-Personalization

Connecting Stakeholders through Platform-Based Economy

Data-as-a-Service

Reinvention of Offline

Localization of Services and Communities

Shift Towards Flexible Ownership Solutions

Prevention

# BUSINESS MODEL TRENDS

## Influencing Independent Living of the Elderly

Business models can be looked at from an economic perspective, considering only revenue and cost streams, or a rather strategic approach, understanding value creation and value chain architecture. The following analysis follows the more strategic approach to understand how innovative business models can create value for the elderly.

In the Age Technology (AgeTech) sector, all business model innovations can be distinguished by two major underlying meta trends. The first one is accessibility: Business models that have proven to be successful in industries not necessarily related to older people are adapted to address the elderly by lowering or removing entry barriers that keep them from participating today. The second one is need-based innovation: Business models that address very specific and unique needs of the elderly. One prime example of such a need would be end of life planning.

These two meta trends provide guidance when looking at concrete business model innovations that enable independent living for the elderly. One way to deal with elderly specific personal needs from a business model perspective

is Hyper-Personalization, addressing them by shifting from mass-produced to more personalized and targeted products, services, and content. Customers and businesses both benefit from this trend by increasing customer satisfaction and revenue while decreasing customer churn rates. At the core of such highly personalized offerings is the customer data collected, analyzed, and transformed into insights about individual needs. More broadly, data-as-a-service is the trend of gathering actionable insights from data and providing these insights to the customer, most often in the form of a subscription service. Data-as-a-service is gaining traction in Business-to-Business (B2B) business models - enabling Hyper-Personalization - and Business-to-Consumer (B2C) models, especially in the smart home and care sector. While these trends focus more on the individual, community, and platform-based business models serve the need for connectedness and belonging among the elderly. These offerings are often localized to mitigate restrictions that correlate with old age, such as a decline in mobility. Along these lines, business model innovations build on reinventing unpleasant offline experiences through tech-heavy models to increase the ease-of-use for the elderly. Apart from increased convenience,

these reinvented offline models are more scalable than previous models due to digital backbones and automated operations. All business models require the ability of the elderly to pay for the provided services and products. Often, a lack of liquidity poses a challenge. The shift towards flexible ownership solutions offers a solution to this problem by leveraging usage instead of ownership and offering more flexibility and liquidity.

Those seven trends are enabling new solutions to support the elderly's needs in various ways. While some are already implemented in the Age Technology (AgeTech) space, all have great potential to improve the way value is created for the older generation.



# HYPER-PER-SONALIZATION

## Personalizing product and services to improve the wellbeing of elderly

The world is shifting from mass production to hyper-personalization. An extensive amount of data is collected to provide more personalized and targeted products, services, and content [379]. This is particularly important to the elderly as a target group. Indeed, they represent a large and growing sector of the population with non-served specific needs and desires in a vast number of fields: healthcare, homecare, mobility, and education. For instance, Motability (UK) solves the problem of mobility and transportation by providing access to vehicles that are specially adapted to suit senior needs. Besides, personal care is a key need of the elderly as well: Good Care Group (UK) provides a care alternative to a residential or nursing home with highly personalized and cost-effective levels of one-to-one care, support, and companionship. Last but not least is education. Getsetup (US) connects seniors by providing collaborative online classes, taught by other elderly, and working on specific topics suggested by individuals. However, not only do customers benefit from hyper-personalization, but companies also increase their revenue by providing tailored products and services while at the same time decreasing the loss of customers.

### Facts:

- 86% of customers are ready to pay more for a better customer experience [380].
- Marketers experience an average increase of 20% in sales when using personalized experiences [381, p.2].
- Due to the lack of focused marketing, 63% of 50-64-year-olds claim that they don't relate to advertising shown on television [382, p.9].
- Leveraging on personalization in different areas has been proven successful by Amazon, Shopify, Spotify, Netflix among others [383].

### Key Drivers:

- An increase in availability and accessibility of data gives the potential for a full insight into a customer's buying journey, by collecting customer data which is a company's most valuable commodities [384].
- Technological advances in 5G, AI, and sensors in, on, and around us enable companies to collect and analyze more data than ever before [385].
- Customers are more willing to share their personal information when they feel that individual benefits derive from it [386].
- Increasing governmental and business initiatives towards building a transparent and safe online customer relationship enhances customers' trust in online services [387].

### Challenges:

- Challenging implementation: in 2017, only 6% of organizations have achieved complete implementation of hyper-personalization [388].
- The collection of personal data is difficult due to new regulations, especially in the EU. Companies are required to have a trusted intelligence system to secure the participation of the consumer and other stakeholders, by storing data privately and securely [385], [387].
- The stigma being associated with an older demographic: companies are uncertain about how to target older people and through which pathways [382, p.15.].
- Organizations should understand that data is no longer an asset to be owned and monetized, but rather, to be curated and shared in order to drive better outcomes [385].

### Impact on Independent Living of the Elderly:

The hyper-personalization of services within the senior sector of society is essential because it covers an unserved segment of the market. It signifies a potential increase in the quality of life of senior citizens. The resulting advancements created by market investment towards this sector can have a crucial impact: these enhanced services could be offered at lower prices or be used by governments to provide more efficient public services that everyone has access to proper and high-quality care which will no longer be a privilege but a reality.

# PLATFORM BASED ECONOMY

## Enlarging product and service offerings for elderly through networked solutions

Platform-based business models are addressing the increasing demand for digital services to make processes more convenient by connecting stakeholders, both consumers and producers, on an online network [389, p.2]. Aggregation, social, and mobilization platforms constitute the three common platform types that facilitate transactions, interactions, and mobilization [390, p.83]. They share the distinct success factors of network effects, which give rise to higher benefits the more users join the platform, and scale effects, making it possible to deliver holistic services at low or no marginal costs [391, p.15]. Personalized data are collected to feed AI algorithms to help manage the platform [392]. Digital platform solutions, which specifically target the elderly and their relatives, are growing rapidly. For instance, Birdie (UK) and Five Good Friends (Australia) offer fully integrated care solution packages that aim at connecting the home to the healthcare system [393], [394]. Moreover, Afilio (Germany) provides consultancy services, embedded in a comprehensive knowledge platform, to ensure legal and financial security in case of severe illnesses or death of aging relatives [395].

### Facts:

- Companies with a platform business model are valued four times higher per dollar of revenue generated than legacy business models, which remain focused on offline services or production [392].
- 86% of the German population have used internet services before. In turn, only 14% stayed offline due to a lack of interest, the degree of complexity, and perceived missing benefits [396, p.18].
- Consumers are expanding their purchases to platform services to capture better experiences in new verticals, such as family communications, travel, exercise, hobbies, and religion. This translates into a global market of consumer subscription software of 150bn USD by 2023 [397].

### Key Drivers:

- COVID-19 is intensifying the need for digital services, as many users are confined at home. Since the outbreak, adoption among the most “digitally resistant” customers has grown strongly [398, pp.3-4].
- As the proportion of the population 80+ is projected to double by 2050 in the OECD, there is a vast business potential for digital platform providers to offer solutions for growing societal challenges, such as LTC management (cf. Birdie) [32, p.3].
- Scaling costs close to zero accelerate the spread of platform solutions across all industries [392].
- Legal regulatory framework changes (DiGA, EPR) have the potential to accelerate new platform solutions within the healthcare space [399], [400].

### Challenges:

- Barriers to accessing and using the internet for the elderly must be removed through low-threshold information and education services. These measures avoid the exclusion of certain groups of older people [401, p.15].
- To obtain a better balance between the benefits and risks of a digital platform, policymakers need to review regulation to ultimately overcome society’s data privacy concerns [391, p.77].
- Ensuring the protection of personal data, especially health data, is vitally important to gain trust among users of digital platform solutions [402, p.22].

### Impact on Independent Living of the Elderly:

Independence in older age groups is enhanced by achieving healthy aging, where interactions with friends, relatives, and mutual support within a community can significantly contribute to overall health [416] [p.3]. Apart from a growing number of social platform solutions that serve the need for connectedness and belonging, transactional platform solutions enable the elderly to live longer in their own homes. This is achieved through the efficient matching of care workers and patients among other fields of application. For the staff of care providers, digital solutions decrease the time spent on administrative tasks, while relatives benefit from staying informed at all times through enhanced communication modes.





# DATA-AS-A-SERVICE

## Leveraging data insights to empower elderly and their caretakers

Data-as-a-service means to not only provide data but actionable insights to people to help them make better-informed decisions. Providing these insights as a subscription service has proven to be a successful business model in several industries. Many of these industries, such as personal health (e.g., Fitbit) and smart manufacturing (e.g., Siemens Digital Factory), are not explicitly targeted at older people. Companies have recently started to realize the untapped potential of adopting this business model to services targeted towards elderly users. B2C oriented start-ups, like UK-based Howz, collect and analyze smart home data to understand changes in an elderly user's use of everyday objects and offer these insights in the form of subscription services. While at the same time, the concept of data-as-a-service is gaining traction in B2B models, as well. CarePredict and RemindMecare, for instance, offer actionable insights to care facilities, empowering them to deliver better senior-care. Despite being a relatively recent trend, data-as-a-service has already conquered a variety of different industries related to the needs of older people like cognitive care (MyndYou raised 4m USD in 2020) and health (Pillo Health ~13m USD total funding since 2015) [403], [404].

### Facts:

- From 2016 to 2019, the number of connected wearable devices has more than doubled worldwide, increasing from 325m to 722m. By 2022 the number is forecasted to reach more than one billion [405].
- 58% of adults aged 65 and above agree that technology has had a mostly positive impact on society. Almost 75% of internet-using elderly say they go online daily, with about 10% of them stating to be online almost always [406, p.4].
- The amount of data created in a year (called the Global Datasphere) is expected to grow from 33 Zettabytes (ZB) in 2018 to 175 ZB by 2025 [407].

### Key Drivers:

- Steadily increasing adoption rate of new technologies among elderly users: Occasional internet usage of the 70+ age group went from 4% in 2001 to 45% in 2018, a disproportionate increase compared to the younger age groups [408, p.4].
- A general willingness to share data: Before COVID-19, a small decline in willingness to share data was observed, but the most recent data suggests that consumers are more willing to share personal data during a crisis [408].
- 5G is enabling universally connected devices with high reliability [409].

### Challenges:

- Willingness to share data among older people: Recent studies suggest that older people might be less willing to share their data, by about 15 percentage points, than younger people [410].
- Adoption of technology devices: Almost half of adults 65 years and older and 40% of those aged 50-64 feel they need assistance in learning and using a new technology device, compared to only 20% of those aged 18-29 [411].
- Companies that succeed may have to "blitzscale" to avoid being acquired by Tech Giants as valuable data insights scale exponentially with the amount of data available to a company [412].

### Impact on Independent Living of the Elderly:

With data-driven insights, behavioral changes that can prevent serious risks, like malnutrition, falls, and depression, can be recommended to help the elderly live a more self-determined life. Having access to this data allows them to live autonomously and mitigates unnecessary risks to their well-being, thus enabling the elderly to live independently for a longer time. These trends not only directly impacts the elderly themselves but also their loved ones and relatives. In the future, data-as-a-service will become even more critical, as personalized insight is a promising solution to address the highly diverse needs of the elderly.



# REINVENTION OF OFFLINE

Unpleasant offline experiences are reinvented through tech-heavy models increasing ease-of-use for elderly

The demographic development in Germany confronts the country as a whole with diverse challenges. Looking after the elderly who need care is one of these challenges that cannot be overlooked [286, p.6]. As individuals age, their health generally decreases. Thus, it is not surprising that the rate of healthcare service utilization is the highest among the elderly [333, p.17], [334, p.354]. Therefore, an aging society comes with the challenge of growing demand for skilled healthcare workers that will not be met by the available supply. In the future, more people will have to be looked after, but at the same time, there will be fewer people available to take on this task [335, pp.5-6]. In addition to this, single-person households, changed family constellations, and women's increased employment will continue to intensify the gap [336, p.6]. Predictions show that this gap will result in a nursing staff shortage forcing governments to simultaneously utilize all options for securing skilled labor [337, p.990]. Some solutions currently being implemented and explored include creating incentives for informal caregivers, attracting workforce from around the world, and increasing the recruitment and retention of health care workers [286, p.8].

## Facts:

- Pioneering health-tech start-ups have created the trend: OneMedical for general practices (IPO in 2020), Octave for mental health (raised 11m USD in 2019), Modern Animal for pet hospitals (raised 13.5m USD in 2020), and Tend for dentistry (raised 36m USD in 2019) [413], [414], [415], [416].
- The elderly are the most frequent visitors to doctors' offices with 59% visiting 3 to 10 times and 21% more than 10 times a year – significantly higher than for other age groups, e.g., out of the people up to 50 only 62% go more than twice a year [417, p.5].
- Co-living has been popular among the younger age group and is now opening up to the elderly with start-ups such as "The Embassies" in Switzerland [418].

## Key Drivers:

- Demand for convenience: Complicated processes are hindering the elderly from performing ADL, and therefore, in silver societies, products such as easy-to-open packaging are more highly demanded, underlining their strong demand for convenient products and services [199, p.8].
- Increasing e-commerce: E-commerce is also driving new forms of business in formerly traditional industries such as health. In 2016, 19% of consumers had purchased medical or health products online; in 2018, the number rose to 27% [199, p.18].
- Technological advances: New offline models leverage process improvement and include enhanced technologies such as video communication for telemedicine and machine learning algorithms for better personal insights [419].

## Challenges:

- Convenience is perceived differently among the generations. Some rather time-consuming offline activities can be an exciting part of the day of the elderly, as the lower adoption rates of services such as online food delivery highlight [19].
- Despite lower overhead costs, value-added services often come at a higher price [420]. Consequently, adaption is limited, and companies might remain more niche.
- Regarding adoption in Germany's health care space, 89% of the population is covered through the public health insurance scheme [421]. Addressing these patients requires a complex and bureaucratic legal structure.
- The German regulatory setup further limits the consolidation of clinics and the creation of medical chains [422, p.12].

## Impact on Independent Living of the Elderly:

Reinventing offline models for the elderly could make the underlying services more convenient and accessible. With increasing age, recurring doctor visits and growing care needs become a serious part of many elderly' lives. More user-friendly applications would enable them to live more independently - booking their appointments easily and renting their rooms or apartments with value-added services within a few clicks. This combination of digital and offline is particularly compelling for younger elderly, who are comfortable with online platforms and entering a life phase in which they value convenience more than ever before while strongly relying on offline services.





# LOCALIZATION OF SERVICES AND COMMUNITIES

## Hyperlocal businesses for a less lonely and more independent life

Hyperlocal businesses enable the creation of communities, and the delivery of products and services from local stores and retailers to the end customers, often in less than an hour. Prominent examples of hyperlocal communities are Nextdoor hub (455.2m USD total funding) and the German version, nebenan.de, where neighbours go to build connections, stay informed, and help each other in their everyday lives [423]. There are two types of hyperlocal business models: hyperlocal services and hyperlocal delivery. The hyperlocal services provide home tasks services, laundry service, medical, etc. The hyperlocal delivery focus on the delivery of food, groceries, pharmaceutical drugs, electronic devices, home necessities, etc [424]. The hyperlocal trend is growing significantly among the elderly as well, especially during the COVID-19 pandemic, since they are the most vulnerable age group and have to spend a lot of time inside, often alone. Hyperlocal start-ups such as EvrCare and EMOHA are focused specifically on the elderly's needs, of which 90% are not related to health, but to the routine challenges of life [425]. Companionships, house tasks, grocery shopping, and transportation, are only some of them.

### Facts:

- The hyperlocal market size was valued at 1,324.2bn USD in 2019 and is estimated to reach 3,634.3bn USD by 2027 with a CAGR (compound annual growth rate) of 17.9% from 2021 to 2027 [426].
- Hyperlocal sector funding is led by Swiggy, which has raised 1.6bn USD, and Zomato with 972.6m USD capital investment [427] [428]. Dunzo, a local delivery marketplace, has raised 88.4m USD (including funds from Google) [429].

- Mintel found that 43% of the over-65s in the UK have shopped more online following the crisis, compared to 42% amongst all adults. In May 2019, only 16% of over-65s shopped online at least once a week showing a huge shift to digital spending by the elderly in recent months [430].

### Key Drivers:

- During the COVID-19 pandemic, all over the world the adults aged 65+ are advised to self-isolate and take extra precautions since the risk of dying for this group age is higher [154].
- In the US, about a quarter of older adults aged 65+ living independently in their communities are socially isolated, and 43% of those over 60 feel lonely [155].
- Elderly populations suffer from age-related diseases, such as rheumatoid arthritis and osteoporosis, resulting in impaired mobility [431].
- According to the US Census Bureau, about 13.8 million seniors age alone, thus relying even more on local communities [432].

### Challenges:

- It is difficult to expand a hyperlocal business since it is only focused on a particular geographical area. Some of the obstacles to scale are language barriers, differing government regulations, and lack of infrastructure [433].
- There is high competition in the hyperlocal market. Big e-commerce companies, such as Amazon, have a competitive advantage to take over the market, because of their strong brands.
- Grocery shopping and running errands are considered social activities for the elderly, which also include the aspect of human interaction [434].

### Impact on Independent Living of the Elderly:

Hyperlocal businesses will play an important role in the elderly living independently. All products the elderly need, such as groceries, pharmaceutical medicines, and home necessities will be delivered to them in less than an hour in the future. Additionally, the hyperlocal businesses will take care of services such as transportation, home tasks, or healthcare. This way the elderly can choose how to use their time and live without restrictions that come from old age, such as a decline in mobility. Another impact from hyperlocal businesses will be on companionship and interpersonal connections through communities, thus making the elderly live a less lonely life.

# FLEXIBLE OWNERSHIP

## Flexible ownership serves elderlies' increasing liquidity needs

Business models offering forms of flexible ownership have conquered various industries, such as real estate, mobility, and entertainment. Value creation leveraging usage instead of ownership has three significant advantages for consumers: more flexibility, less fixed capital required, and easier access to products with high barriers of entry. In a silver society facing old-age poverty, the elderly are particularly concerned with financial constraints and, thus, are becoming an increasingly important target group of such models [435]. For instance, in the German real estate sector, the idea of successful American equity release models, such as Figure and Hometap, was adapted to the elderly segment. Start-ups such as Wertfaktor and Heimkapital address the large percentage of homeowners among the elderly living at poverty risk. Their business models allow customers to tap into their homes' equity value without giving up control over the property by partially selling their house (up to 50%) [436]. In other industries, smaller investments are targeted through flexible solutions, such as subscriptions for cars, appliances, furniture, or entertainment. While equity release is set up in a one-off transaction model, most flexible ownership solutions entail a subscription model with recurring service.

### Facts:

- In Germany, there are 7.6m 60+ owning real estate [437]. At the same time, the old-age poverty risk is increasing steadily (from 11% in 2005 to 16% in 2019) [435].
- American equity release models raised significant amounts of equity: Hometap (112m USD) and Figure (300m USD), while also traditional real estate player Engel & Völkers entered the equity release segment with its product "Liquid-home" [438], [439], [440].
- In mobility, pay-per-use and car-hailing have been established successfully with companies like ShareNow and Grab. Despite low digital access, already 14% of the elderly use services such as Uber or Lyft in the US [441].

### Key Drivers:

- Ownership is perceived as decreasingly important, also by the elderly, as they are rather driven by new experiences such as education or travel than by material belongings [442, p.24]. This shift in buying habits results from a changing societal perception of success and status [443].
- The rising risk of old-age poverty increases demand for liquidity and more efficient allocation of financial resources, amplified by stricter loan regulations and a lack of offerings for reverse mortgages post-financial crisis of 2008 [444].
- Technological and legal advances enable online platforms to make products and services scalable. Since 2018, Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) regulation allows digital signing through companies like IDnow [445]

### Challenges:

- The concept of sharing models is not yet well-known among the elderly and typically marketed entirely online, making it more challenging to address them.
- Many sharing models struggle at a small scale, making it difficult for companies to enter. Even established players like ShareNow face profitability issues [446].
- Small yet recurring costs change consumer behavior, and critics of the sharing economy point at the risk of fuelling detrimental spending habits [447, p.993].
- Liquidity comes at increased cost, which limits adoption. To avoid significant upfront investments, consumers pay a premium for the provision of capital and availability of services.

### Impact on Independent Living of the Elderly:

Flexible ownership solutions enhance financial independence and freedom of choice, which are crucial for a self-determined life for the elderly. Releasing fixed capital, the models allow the elderly to spend more on memorable experiences such as further study and travel instead of possessions. Furthermore, they require less commitment and are, therefore, better adaptable to seniors' changing needs and abilities. The contracts mostly involve buyback options or monthly terminability, allowing the elderly to explore various options with less financial risk. Hence, they present an attractive opportunity for all stakeholders.





# PREVENTION

## New players in the disease prevention market fostering healthier habits

Prevention aims to reduce risks or threats to health and can be subdivided into: primary, secondary and tertiary. Primary refers to preventing disease or injury before it occurs by utilizing legislation, education, or immunization. Meanwhile, secondary prevention aims to reduce the impact of a disease or injury that has already occurred. Lastly, tertiary prevention softens the impact of an ongoing illness or injury that has lasting effects [448]. Nowadays, researchers believe that disease prevention rather than treatment is more beneficial to individuals and society as a whole; therefore, stressing the importance of primary prevention. Health and activity applications and digital medical devices are increasingly contributing to healthcare advances in prevention and cure. The independent reimbursement scheme DiGA (2019) further strengthens these solutions. Unlocking insurances as an income stream rapidly changes the revenue generation strategy and allows companies to invest in product development instead of marketing since their solutions can now be added to the catalog of prescribable treatments. The first start-ups, such as Selfapy and aidhere, have already successfully passed the DiGA application process.

### Facts:

- By 2024, the preventive healthcare technologies and services market will be valued at 432.4bn USD globally, and the global sports and fitness apps market is expected to witness a CAGR of 20.4% during the forecast period (2019–2027) [449], [450].
- Germany is among the top five spenders on health care, both as a proportion of GDP (11.2%, projected at 12.3% in 2030) and per capita (5,986 USD) [451].
- Several successful healthcare start-ups have entered the market: Selfapy (raised 6m in 2020 and certified as DiGA), Temedica (raised 17m EUR in 2020 and partnered with over 100 insurance companies), YAS.life (raised 3.5m EUR) [452], [453]. The provision of digital public services for businesses in the EU has increased from 67 services in 2013 to 84 in 2018, an increase of 25% [308].

### Key Drivers:

- This growth is driven by the development of screening devices, fast and extremely accurate AI-driven diagnostic tools, smart devices that minimize medical errors, and an increase in the use of vaccinations [449].
- Recently, a new law was implemented, providing an independent reimbursement scheme tailored to DiGA through the DVG. This improves an old regulation under which health insurance companies refunded money on a case-by-case basis [454].
- Baby boomers tend to visit doctors around 1.5 times more often than their Gen Z counterparts. The younger generation is more health-conscious and requests wellness options beyond traditional medicine, such as yoga, acupuncture, and healthier lifestyle choices [455].

### Challenges:

- Finding a beneficial threshold: more significant preventive health expenditure share is associated with better economic performance. However, after a critical prevention share, negative impacts on the population's health and the economy's growth are expected [456].
- The applications need to prove their quality, safety, and positive effects on patient healthcare to receive certification. These are challenging to measure in a short period [262].
- There is a requirement for manufacturers of digital applications to negotiate remuneration amounts with GKV-SV [262].
- There are many applications on the market with little differentiation, such as Nike Training Club, Strava, and Freeletics, resulting in a saturated market and intense competition for customers.

### Impact on Independent Living of the Elderly:

With the growth of the preventive medical sector, which was induced by governmental incentives and company initiatives, more people will follow a healthy lifestyle. The ambitious shift to prevention strategies could decrease the number of heart attacks by up to 36% and the number of strokes by up to 20% resulting in an increase in the average life expectancy by 1.3 years [457]. According to several research models, a 10% increase in life expectancy at birth increases per capita real GDP growth rate by 0.81%. A healthy nation has a higher productivity rate and hence better economic performance [456].

# SCENARIOS

The following chapter describes four scenarios of different futures. The scenarios are plausible, relevant, challenging, consistent, and recognizable from the present and near future signals. All of the scenarios are equally plausible and derived from two identified key drivers. They present far-reaching visions of how the Independent Living of the Elderly might look like in 2040. Personal narratives tell a story of an ordinary day in 2040 to allow an in-depth look into the future. Finally, identified signposts indicate the progress towards each scenario. They emphasize possible paths from the present to each of the four scenarios.

## SCENARIO OVERVIEW

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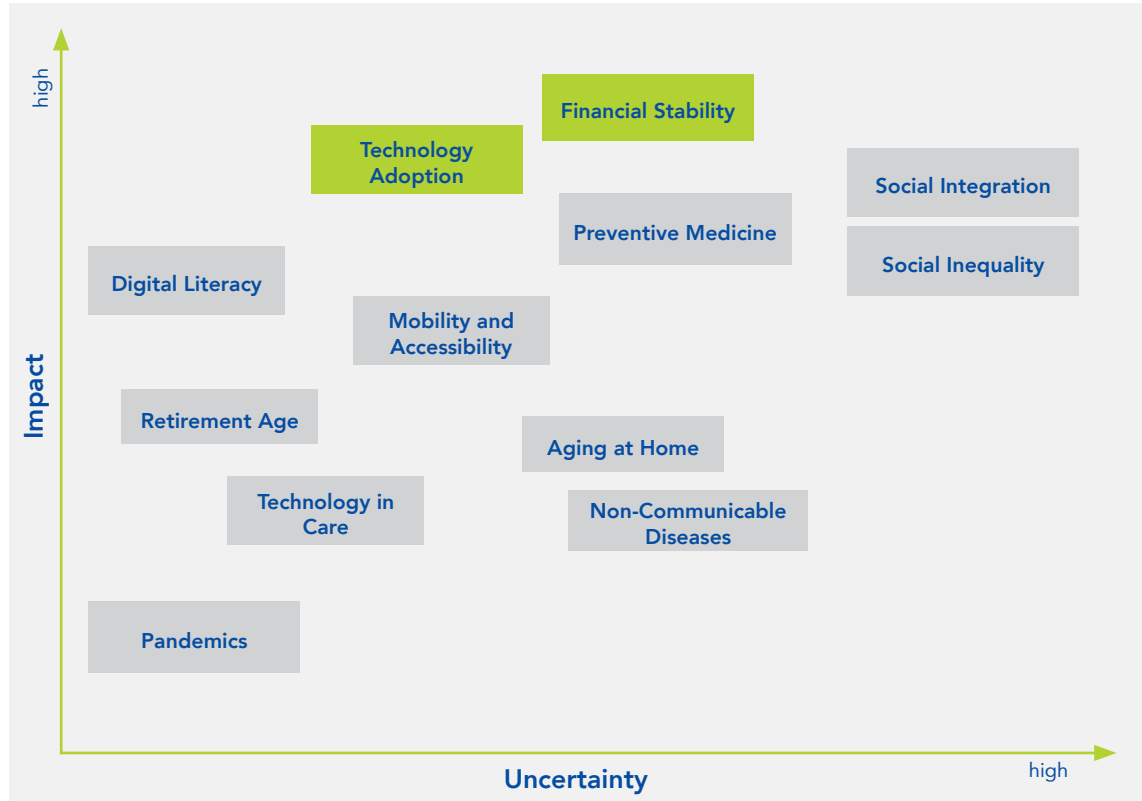
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# DRIVER MATRIX

Based on the research conducted during the Basic Phase of the Trend Seminar, drivers that would determine the nature of the independent living for the elderly were identified. These drivers are forces that shape the future for the elderly and are usually exogenous to individual stakeholders. All the identified drivers have a high impact on the elderly, and their outcomes have a high degree of uncertainty. Hence, these drivers are modeled with plausible bipolar extreme outcomes.

The adjoining matrix ranks the identified drivers according to impact and degree of uncertainty. Using these dimensions, we selected two key drivers that help us describe future scenarios: 1) financial stability of the elderly, and 2) their intention to use technology. Within the matrix, these key drivers are highlighted in green. The following pages contain a detailed description of the key drivers as well as a brief overview of all other drivers in the matrix. Finally, the scenario matrix illustrates the scenarios which describe the four outcomes of these key drivers.



# KEY DRIVERS

## Bad financial situation

In this equally plausible outcome, old-age poverty is widespread within the lower socio-economic class. It is difficult for the elderly from this strata to accumulate wealth and sustain their living expenses. They are partly cut off from the economy because they struggle to find well-paying jobs and purchase goods that most others can afford. Even among the elderly that are financially well-off, the future financial outlook is very uncertain due to potential financial crises in the next years. They fear that they will not be able to sustain their current lifestyles. There is a gaping difference between the financial resources of the poorest and the wealthiest elderly.

## Financial Situation

The financial situation is a determinant factor for the independent living of the elderly. It is strongly connected to their mental and physical health and decides if they have the means to take an active part in society. A good financial situation for the elderly has two dimensions. First, they must not experience poverty. This means that they have the means to cover at least their basic expenses for housing, health care, food, and transportation. Second, their standard of living must not be expected to decline in the foreseeable future. The macroeconomic environment highly influences both dimensions.

## Good financial situation

In this extreme yet plausible outcome, old-age poverty is nearly wiped out. The elderly of the lower socio-economic class are able to cover their basic expenses comfortably and do not have to fear future financial hardships. They have the necessary means to participate in society and play a contributing role in the economy, for example, through meaningful consumption. The future financial outlook is perceived positively among the government as well as the elderly themselves. Major macroeconomic downturns that would negatively influence their financial situation seem very unlikely.

## Low Intention

In this scenario, the older person is decoupled from the advancements in technology because the intention to use technology gradually reaches a plateau while emerging technologies eventually outgrow existing abilities. A small range of established and more basic technologies, such as smartphones, wearables, and some smart home applications, can still be handled intuitively but, advanced emerging technologies will be inaccessible for the older person. Due to insufficient facilitating conditions and a lack of perceived usefulness, the elderly person stops the continuous learning journey and falls behind the current technologies. Limited interaction with technology in combination with learning difficulties turns into a vicious circle, which additional assistance, encouragement, and friendlier interface designs cannot break.

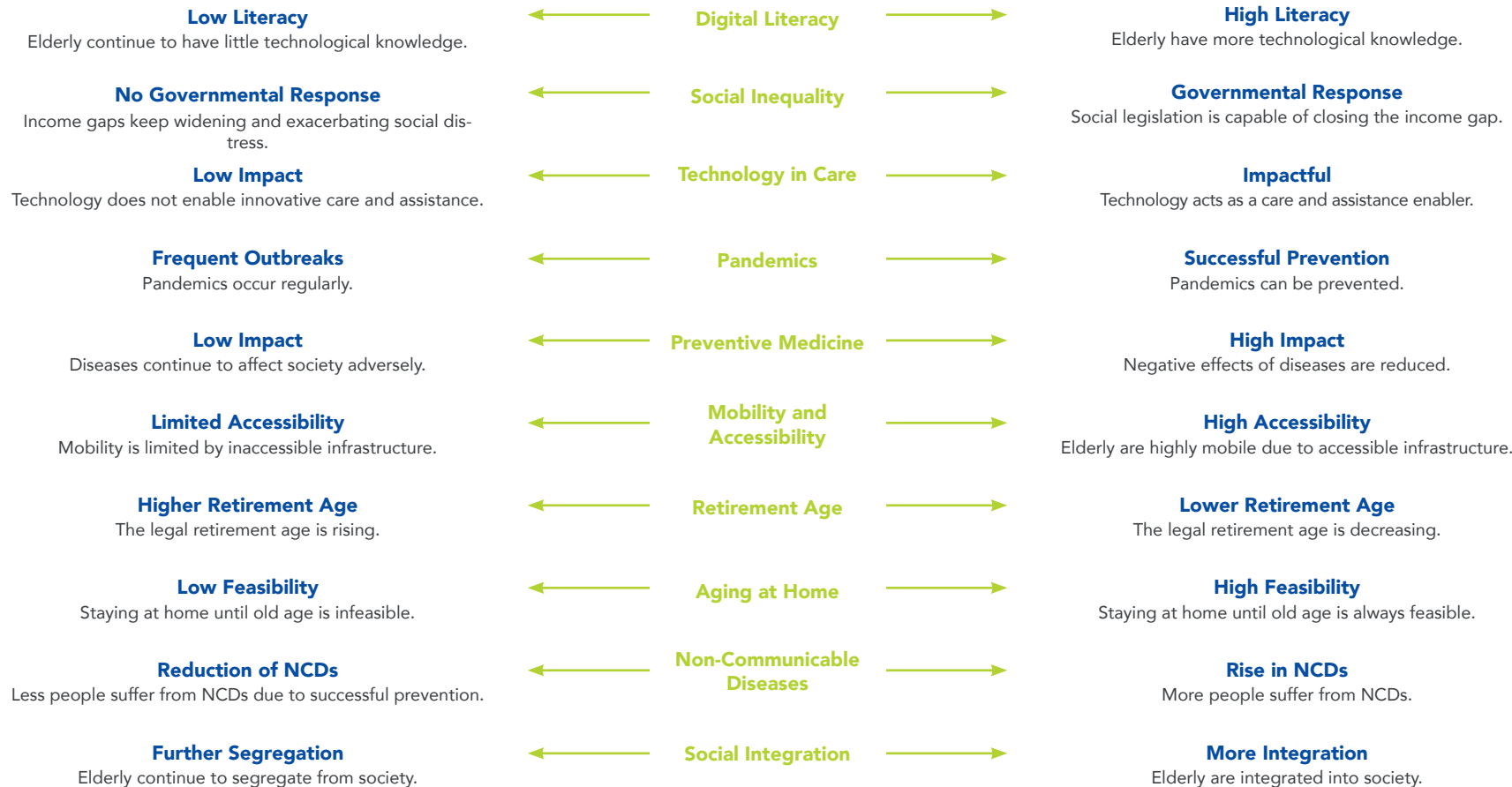
## Intention to Use Technology

The intention of the elderly to use established and emerging technologies is a key concept borrowed from the Senior Technology Acceptance and Adoption Model (STAM). It describes the "intention to use technology" as primarily determined by the perceived usefulness of technology and the user context. The latter also includes social influence (for instance, children urging parents to use technology) and other facilitating conditions. The ease of learning and the exploration experience are key determinants that can directly cause acceptance or rejection of technologies.

## High Intention

In this scenario, the intention to use technologies is fueled by and grows proportionally to the high perceived usefulness of technology, a supportive user context, and the social influence. The older person appreciates advances in technology and can see its relevance for her daily life in which technology is already an integral part. Moreover, the older person is motivated to use established and emerging technologies even if constraints or impediments must be overcome and proactively seeks technology education. Frequent interaction with technology sparks excitement, and the inclusive design of new technologies facilitates the process from the intention to use to actual adoption.

# OTHER IMPORTANT DRIVERS





# SCENARIO MATRIX

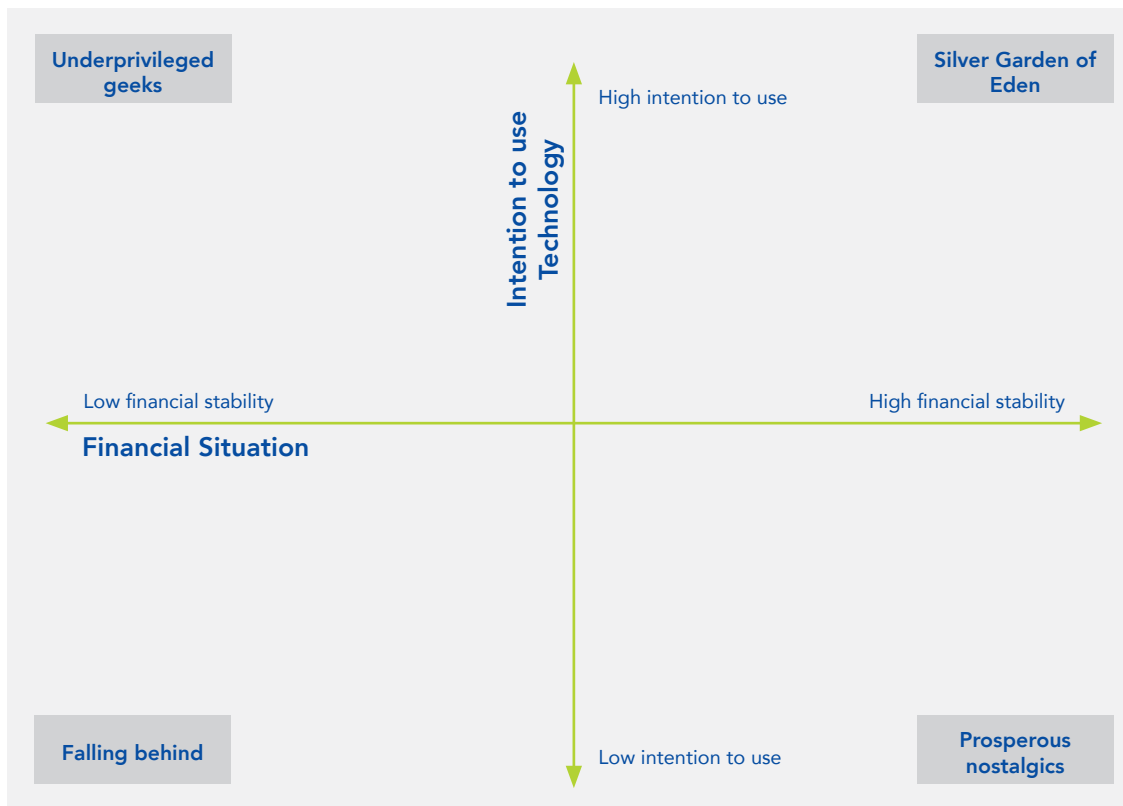
The two key drivers and their outcomes create a scenario matrix. Each driver represents one of the axes, with bipolar outcomes on the respective ends. The four scenarios are obtained by combining the outcomes of the two drivers. Plausible and consistent outcomes of other important drivers are also included in each scenario.

**Underprivileged Geeks:** The scenario “Underprivileged Geeks” describes a future in which the elderly are financially distressed but are eager to use existing as well as upcoming technologies. A majority of them lack the financial means to buy modern assistive appliances. Many of them are forced to work post-retirement to supplement their dwindling pension incomes.

**Silver Garden of Eden:** “Silver Garden of Eden” depicts a scenario in which the elderly are financially stable. During the last 20 years, it was possible to ensure the financial stability of the elderly through an effective governmental response. Furthermore, the elderly are keen to use technology as they notice its advantages, and educational efforts for digital literacy have proven successful.

**Prosperous Nostalgic:** The scenario “Prosperous Nostalgic” describes a future in which the elderly are financially independent. However, they are reluctant to use novel technologies. The elderly are financially well-off but are reluctant to use existing as well as future technologies. Technological advancements are ubiquitous, but the elderly are agnostic towards them and occasionally resent them as well.

**Falling Behind:** “Falling behind” is a scenario where the elderly have come closer to each other to cope with financial distress. Furthermore, the elderly do not accept technological advancements and thereby isolate themselves from the rest of society. The elderly come closer to each other to cope with financial and technological challenges but, at the same time, detach themselves from the rest of the society.



# UNDERPRIVILEGED GEEKS

## A Day in 2040

Karin dreams about walking along a beautiful tropical beach somewhere in South-East Asia when an unpleasant noise wakes her up at 8:00 am. Annoyed by the sound, she finds herself in her small one-bedroom apartment in a prefabricated construction on Cologne's outskirts. Since her alarm clock broke last year, she has found neither time nor money to buy a replacement. Therefore, ALLI, her smart speaker, also serves as an alarm. ALLI mumbles the current temperature and a few other facts in English. A German discounter supermarket had promoted ALLI a few years ago. At the time, Karin was very keen on buying her first smart assistant. Karin was disappointed when she realized that she couldn't change the language settings and wouldn't be able to use all functionalities due to her limited English skills. "All this talk about NLP, and I still can't change the language settings," she thinks. Technology companies had learned over the years that many people around Karin's age were keen on using technology; they just could not afford it. Therefore, manufacturers started selling cheap solutions to the mass market. Nonetheless, Karin understood the essential information, including her appointments for the day: she will see the doctor in the afternoon and visit Charlotte, for whom she works as a "granny-nanny".

After getting ready for the day and injecting herself with insulin, Karin goes to the small kitchen, as instructed by her smartphone. Her smart fridge proposes her a breakfast: wholegrain oat flakes with low-fat yogurt and berries. Even though Karin eats this meal frequently, she appreciates the acceptable taste at a low cost. Moreover, it is well suited to her diabetes. For most of her life, Karin did neither take care of her diet nor her physical health and consequently developed diabetes type 2 when she turned 52. Now, 20 years later, she lives a lot healthier but must cope with the consequences of her illness.

While eating her breakfast, Karin watches the news. As usual, the primary coverage is on climate change. The German government has hit a new spending record trying



to counteract its effect, which has triggered demonstrations against these decisions. Karin notices that many of the people participating in the protests are her age. She has a slightly different view on it. Of course, Karin recognizes that the billions spent on fighting climate change could be used to raise pensions. Thus, narrowing the growing wealth gap, especially prevalent among the elderly. However, she also has a 35-year-old daughter, Sarah, who she loves more than anything. For decades, Karin has worried that climate change would adversely affect her daughter's future. Therefore, she is grateful that the government is finally taking a climate-first approach in its decisions. While sinking deeper into thoughts

about the society and the future, a vibration on her shoulder draws her attention – for the second time today, her thoughts are interrupted by technology. It is time to prepare for her doctor's appointment. The autonomous public bus will fetch her in 30 minutes.

The autonomous bus safely takes Karin to a large, centrally located health center without any traffic congestion. As always, her health file is automatically read out by a robot at the reception as soon as she enters. The health center has two waiting rooms; the first, on the left, is large and crowded. To the right, there is a comfortable lounge-style waiting area.

## Underprivileged Geeks

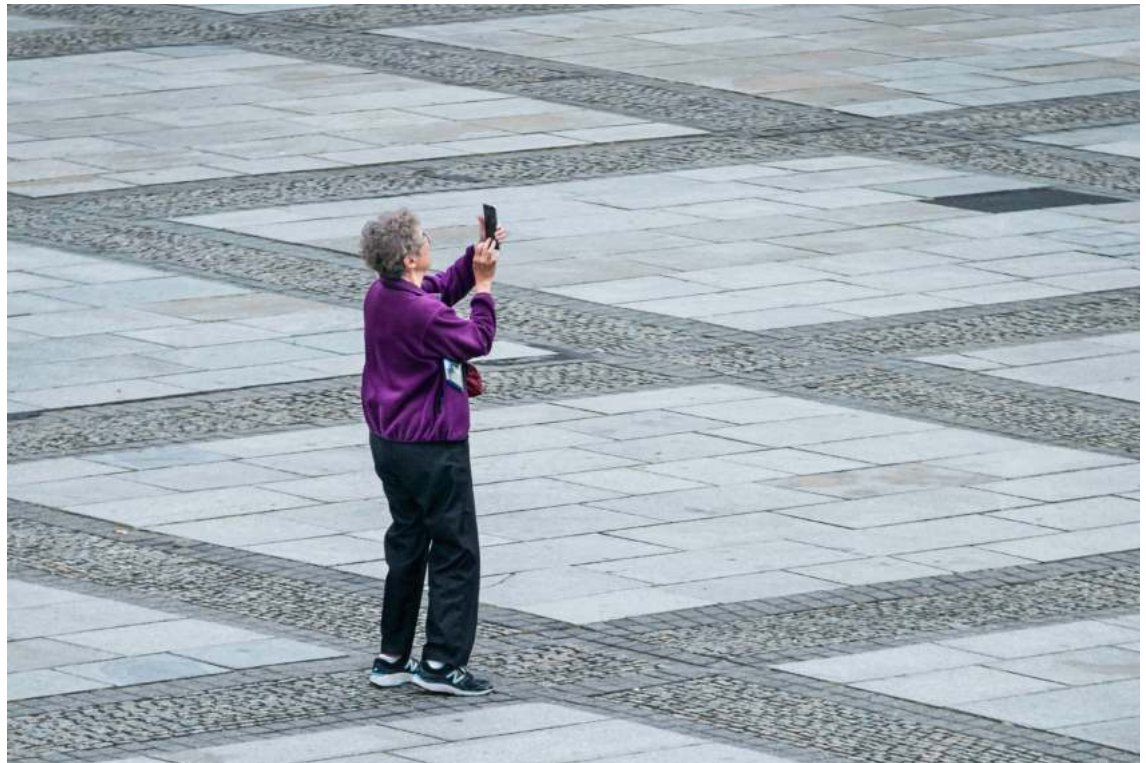
A physician aid receives the patient in front of her and guides him to the right. A robot guides Karin to the left, where all seats are already occupied. Karin frequently schedules virtual consultations since she prefers to avoid long bus rides. Still, this time, an in-person visit was inevitable since she did not buy the latest virtual-reality glasses. In the clinic, assistant robots run through the aisles carrying blood samples, equipment, and even patients on stretchers. On her way to the treatment room, Karin accidentally gets in the way of one of the robots, which skillfully detects her and swerves. When she enters the room, the doctor has already opened Karin's digital medical record and discusses her medical test results with her. Finally, he hands her multiple brochures about the additional, most costly, services the clinic offers. "An artificial pancreas?" she exclaims baffled. "Indeed, it would make frequent insulin injections unnecessary". "Unfortunately," the doctor continues, "the surgery is not covered by your health insurance, and you would have to pay it yourself." Karin is a little disappointed after the meeting. Over the years, the number of services covered by her insurance plan has declined dramatically. Her pension already barely covers her rent and living expenses, and recently she received the grim news about her retirement subsidy not being increased this year. Her husband had saved and invested a few thousand Euros, but the returns remained below expectations. As she is waiting for the bus, her digital assistant reminds her of the call with her daughter later. Maybe her daughter could help her, covering the cost of the procedure the doctor proposed.

When she arrives back home, her smart home phone notifies her of an incoming call. Karin picks up the phone - it is her daughter. After exchanging pleasantries, Karin quickly updates Sarah on her recent doctor's appointment. After chatting for a while, Karin finishes the call since she has to leave for her "granny-nanny" job in a few minutes. Every day, Karin goes to an older woman to look after her and earn some extra money. While walking from her house to the bus station across the suburbs, Karin recalls her apartment at the center of Cologne, where she used to live with her husband. Unfortunately, after her husband died, Karin could not afford it anymore and moved to the suburbs. "Well, times change" she says resignedly while rushing up the 15-minute walk from the bus station to the house where she works for the 92-year-old Charlotte.

A few years ago, after Charlotte's stroke, her daughter Anne didn't want her mother to live alone anymore. Charlotte finally agreed to move in with Anne, even though Anne

works most of the time. As Anne is very concerned about her mother's safety, she decided to install multiple monitoring systems to prevent her frail mother from getting hurt. Several fall detection systems surround the house, sending messages to emergency services and Anne if anything were to happen to her mother. Virtual assistants are available in every corner of the house. These assistants connect with assistive robots that prepare food, clean, and even help old Charlotte take a shower. However, even all this technology cannot prevent Charlotte from feeling lonely when her daughter is on one of her frequent business trips. That is why she hired Karin as a "granny-nanny" — to keep Charlotte in company and give her the chance to talk to someone other than a box of transistors.

Karin enjoys spending time with Charlotte but working in their modern home also glaringly demonstrates to her the things she will never be able to afford. For speaking to her family, Karin uses simple calls interrupted by commercial ads in the free version, which she does not quite like. "I wish I could feel closer to them," she laments. In contrast, Charlotte's daughter has set up a hologram communication system for her mother, and Karin often helps Charlotte find the right application and start the hologram. After her chat with Anne, Charlotte mentions once again what a shame it is that Karin still has to work at her age. Karin, unsure what to say, responds with a faint smile, pointing out that otherwise, they would not meet daily, and Charlotte would have to be alone with all that "frightening" technology.



## Underprivileged Geeks

After a long ride on two different autonomous buses, Karin finally arrives home. She climbs up the four floors to her small one-bedroom apartment without any detection systems or mobility aids. Slightly out of breath, Karin reaches her apartment door and asks herself how long she would be able to stay fit enough to go to work every day. "Not that I have much of a choice" she sighs. Her husband died relatively young, leaving Karin behind as the sole earner and with all their family's financial responsibilities. However, after taking time off work to take care of their children, Karin had never really been able to re-establish her career, let alone save and financially plan for retirement.

Now, without her side job, she couldn't even afford her one-bedroom apartment in the suburbs. Thinking back, she never expected her old age to be like this. When she was young, technology seemed promising for the aged. She thought she would retire and live comfortably with the aid of her digital servants. Interrupting her in her thoughts, AI reminds Karin to go to sleep as her alarm will go off in less than 7 hours to start her daily routine all over again.



## Signposts

- Public pension systems are distressed. Governments increase retirement age, still a majority of the elderly population suffer from old-age poverty.
- A low-interest-rate environment continues to prevail, causing the elderly to either endure lower dividends or make riskier investments on the capital market and incur losses due to insufficient financial literacy.
- Automation exacerbates the income divide in the society as those with less specialized jobs are more likely to be replaced with machines.
- Climate change becomes a focus for government spending leaving limited public funds to combat old-age poverty.
- Financial hardship causes people to work past their retirement age. Often these jobs require some technical know-how, and this encourages technological literacy among the elderly.
- An increasing influence of Asian suppliers triggers cheaper but unreliable tech options to flood the European markets.
- Healthcare Robotics and AI-based medical procedures make significant advancements but are expensive and not covered by standard health insurance contracts.
- The government introduces public digital training programs to bolster digital literacy.
- Strong data privacy legislation is introduced, making the elderly less wary of technology.
- Wearables are especially common among the elderly who can find cheaper variants and receive health insurance refunds for using them. On the other hand, health monitoring devices and smart home appliances are popular but not affordable for many among the elderly.

# SILVER GARDEN OF EDEN

## A Day in 2040

Bright midday sun is shining on Michael's face as he is leaving the elementary school where he just finished volunteering. He walks along the trail back to his countryside home while thinking about his students and feeling grateful for their engagement during his writing workshops. As a 78-year-old former journalist, volunteering at the local school makes him feel valued and gives him a sense of purpose.

While walking home, Michael feels hungry and thinks of the vegetable curry he had for dinner together with his wife, Susan, last night. "Anna, warm up yesterday's curry. I'll be home in ten minutes", he says out loud to notify his virtual home assistant. Anna starts preparing the meal. Michael's face is recognized when he arrives at the doorstep of his home, and the door opens automatically and Anna's warm voice greets him: "Welcome home, Michael. Your lunch is almost ready." Michael and Susan have lived in this house for over twenty years and plan to do so until they pass away. A lot has changed since they first moved in. Voice control and smart assistants were added, financially supported by governmental smart home substitution programs and initiatives. Over the years, it has become easier for Michael and Susan to use digital devices as they increasingly fulfill their day-to-day needs. After their daughter Vanessa first showed them how IoT devices work, they realized that the quality of their daily life would greatly improve if they started using the technology. Since then, they kept up to date with new developments thanks to the city and local communities that provide free technology courses and ensure high-speed 6G Internet access in their rural area.

As Michael walks into the house, he hears a loud "ping" sound from his implanted earplug, notifying him that his monthly basic income has arrived on his personal blockchain-powered account. Additionally, as part of the government initiative to counter the financial distress of the elderly, he received a large payout. Excited about the news, Michael misses the doorstep and falls, landing uneasily on the hard, cold floor of his beloved home. He feels a stabbing pain in his hip and is unable to get up on his own. Anna gets worried



and asks: "Michael, are you conscious?" "Yes, but I cannot move. My hip hurts a lot". "I know that you are afraid of injections", Anna sympathizes, "but this one goes directly in your blood so that you won't feel a thing. The implant at your left outer hip does not respond, and your blood pressure has increased slightly. Given that your knee sensor receives feeble signals, you might have suffered a pelvic fracture. However, it could also be a ruptured hip ligament. I would call an air ambulance", suggests Anna. "Alright", Michael agrees. "Don't worry, the ambulance will arrive in 5 minutes. I already shared your electronic patient records with the hospital. I also notified Susan and your daughter about the accident. And

I stopped heating lunch and canceled your afternoon yoga class. Let me know if I can do anything else". "Thanks, Anna."

Arriving within 5 minutes, two medical assistants carefully carry Michael to the air ambulance. He feels safe and enjoys human company after the accident. He is also happy that Susan was notified and will be at the hospital with him. Susan receives the notification about the accident and it does not take her long to get to the hospital. There is no longer traffic like it was known in 2020 when vehicles were not coordinated with each other. However, Michael also laments interrupting her during the election day. He knows how important

## Silver Garden of Eden

volunteering is for Susan. She worked as a lawyer her whole life and now keeps consulting her old firm based on her extensive and highly valued knowledge in the area. Although she loves to contribute her life-long professional experience, she enjoys taking on new voluntary tasks in politics. She often works remotely now and loves to record podcasts on the side.

Michael arrives at the hospital and is rushed through the doors where Tommy, the robot nurse, greets and checks him in. Due to waiting time optimization, Michael does not have to wait long until he meets the doctor. Tommy pours water for him syncs accident data from Michael's wearable. He then summarizes the current sensor measurements of blood pressure, temperature, and oxygen saturation in a digital report and sends the updates to Michael's doctor. Tommy also reassures Michael that his family is notified about the accident, and they know that he is already in safe hands. Tommy's Operating System was recently updated, enabling

him to run AI algorithms and predict a patient's possible diseases. In the past, this has highly contributed to reducing the spread of communicable diseases and thereby also fighting pandemics. Looking at the result, Tommy predicts with a probability of 67% that Michael might get Alzheimer's disease in the next five years. Therefore, Tommy offers him to pass the waiting time by playing an Augmented Reality (AR) "brain fitness" game, which keeps neural connections healthy and challenges working memory for prevention. Meanwhile, Susan arrives with an autonomous bus just in time to attend the doctor's consultation.

A traumatologist enters the room. The doctor is already familiar with Michael's accident and his patient history through electronic records. She engages in a friendly conversation with Michael while taking a quick look at his hip through her AR glasses, which display the image of an ultrasound scan of his injured area. Within seconds she diagnoses

Michael with a ruptured hip ligament and gets automatic personalized suggestions for his treatment: pain killers, bed rest, and an exoskeleton for two weeks followed by a 3D printed synthetic human bone hip replacement. Finally, she schedules weekly hologram consultations with him until the surgery and leaves Michael and Susan with Tommy. Tommy sends the prescription to Michael's smartwatch, equips him with scheduled painkiller injections, and sets up a fitted exoskeleton that allows him to move independently until the surgery. Finally, Tommy walks Susan and Michael out of the hospital, where they are picked up by an air taxi and brought back to their home.

Walking into their house, Michael and Susan bump into their neighbor and long-term friend, Dominik. After noticing Michael's exoskeleton, Dominik asks: "Hey Michael, what happened?" Michael responds: "It's nothing serious, it's just my hip. All these new technologies they come up with these days are incredible! I can't even feel that I broke my hip; I can still move around freely." "I agree", continues Dominik, "my Neuralink 7.0 brain implants have saved me from dementia. I wish you a quick recovery, Michael! Come by tomorrow. We can play a round of AR chess." They wave at each other, and Michael and Susan enter their home.

In the evening, Vanessa and her son, Miro, arrive to see how grandpa is doing. Vanessa feels terrible that she was not there at the time of the accident to help. But she is glad that she managed to come with her son and spend the evening with her parents.

After dinner, Susan goes to her study room to deliver a presentation about AI fairness and non-discrimination policy remotely - the topic of her Ph.D. Only now, at the age of 76, she found the time and the opportunity to earn a degree through a digital university. She reduced her working time at 65, but retiring completely is not common anymore. While Susan is giving a presentation, Michael and Miro, his grandson, gather near the fireplace where they engage in cybersports. However, Miro is more curious about the exoskeleton and asks: "Why are you wearing these robot legs?". Michael replies: "These robot legs help injured people, like myself, move around easily. Miro, technology keeps advancing and allowing us to stay healthy and independent longer. Do you see this smartwatch?" "Yes! My mom has the same!" "Exactly", replies Michael, "it tracks every move that we make. This morning it recognized when I fell and immediately notified the ambulance. The watch also keeps track of



## Silver Garden of Eden

my vitals and notifies me if I need to contact my doctor.” “Cool!”, Miro gets excited, “So it knows when you are sick even before you know it?!” “Exactly!”, agrees Michael, “but you also need to keep in mind that all these benefits come with a price.” “Really? How much are you paying for it, grandpa?” “It’s not about the money, Miro. These devices are collecting and storing a lot of sensitive personal data. Imagine that details about your life and health, such as where you are, how you move, what you eat, and how you feel, are always available for others to see. It is becoming harder and harder to maintain data privacy. But maybe, by the time you are my age, privacy will be well protected while you can still enjoy all the amazing benefits of technology”, says Michael, smiles at Miro, and they continue playing cybersports.

### Signposts

- Germany establishes a citizens’ investment fund financed by reforming its tax and social systems.
- 5G network set up - free access for everyone and satellite coverage in remote areas.
- 95% of the elderly use the internet daily.
- After a successful trial, all EU countries agree on a universal basic income.
- Insurances give free wearables with health functions to their customers.
- 70% of the elderly invest in the stock market, boosting the economy and their inheritance.
- Old-age poverty drops to a record low of 5%.
- AAL technologies reduce the workload of caregivers by 50%.
- 5 European unicorns in the age-tech market with an edge in usability and accessibility.



# PROSPEROUS NOSTALGICS

## A Day in 2040

The beeping chirp of an analog alarm clock shakes Carl out of his nightly reverie. It is a crisp September morning in Munich. As the first sun rays warm his face, Carl rolls out of bed. He is a structured and efficient man. At 73 years of age, he only recently retired from his job as a mechanical engineer at the car production plant. He lives on his own and cares very much to follow his own opinions - no matter how much his family urges him otherwise. He is mentally sharp, although he has a minor heart condition. Every morning, his personal nurse Lara comes by to check on him. Carl looks forward to these visits. He is content with the personal care he receives from Lara and enjoys the pleasant conversation they have about the news. Precisely on time, Lara rings the doorbell, and Carl lets her in. "Good morning Carl! How are you doing today?" Lara asks.

"Quite well, thank you very much. I only experienced a little bit of chest pain during the night. How has your day been?" Carl happily replies. Lara looks a little worried and asks him, "How long did it last? We need to be careful with chest pains. Please give me a call the next time it happens. Your vitals are looking great this morning, though."

"Oh, it was only for a few seconds. I barely woke up," Carl assures her. Lara reasons, "Okay, but I think we need to be more careful with this, you know it is a possible early heart attack indicator. I think you should consider buying one of those smart mattresses with the vitals measurements integrated. Then I can get a notification right away if something like this happens again and find out if it is happening regularly". Carl listens closely but quickly responds, "No, I don't need that kind of fancy technology in my house. I can just call you on my cell phone if it happens again." Lara relents and turns the conversation to their usual topics of politics and cultural events again before she soon heads off to her next patient.

A few hours later, Carl's TV blinks and shows an incoming hologram call from his daughter Fiona. Not adapting well to the most up-to-date hologram conference tool, Carl picks up



the phone call using the video chat app. On the other side, Fiona sees the 3D projection of Carl forming in front of her through the virtual presence device. "Hi, Dad! How are you doing? Are you free for lunch today at around 12?"

"Hi Fiona, honey, I'd love that! Let's eat at Ristorante Martinelli?"

"Hm, that place with the in-person waiters? It's quite expensive. But I guess if you want to, let's go there! I'll reserve a table. See you soon!"

"Wonderful! See you then!" The call drops, and Carl smiles happily. He loves seeing his daughter and visiting traditional restaurants like in the olden days. Using his smartphone app, Carl requests the public bus to stop near his house. He quickly collects his cell phone, wallet, and good Sunday hat and walks over to the bus station. When the yellow electronic bus arrives, Carl greets the human driving assistant and takes an empty seat next to a lady wearing a big black box. "It must be one of those AR headsets I saw in the commercial," he thinks to himself. He can hear a quiet voice speaking from the headset. It seems that the lady was doing a virtual city tour and hearing facts about the buildings they pass. At that moment, she turns her head, and the headset slightly



## Prosperous Nostalgics

bumps into his head. Annoyed, Carl rubs his head and turns to look out the window on the other side. There he sees the postal drones flying in neat rows towards their destinations. He misses the days when it was only real birds flying along outside the bus.

His phone vibrates, which is his signal that he has arrived at the restaurant. The square is a bustle of people traveling in 1-man e-cars, rolling on their smart shoes, shopping robots doing their business, and people walking on foot. He makes his way to the restaurant, where a kind human waitress takes him to his table. Once seated, he enjoys the view of the majestic old town hall building. He remembers when the rumble of conversation and cars filled the square, instead of electric vehicles' quiet buzz. In the restaurant, it feels as if he traveled 20 years back. Families sit at tables, chatting happily about their lives, and enjoying delicious food.

"Hi Dad, how are you?" his daughter Fiona's voice carries easily over the relatively quiet square. "Sorry I'm a bit late. I just came by Hyperloop from Berlin in 25 minutes. Isn't that incredible?" Fiona makes her way from the autonomous drop-off zone to their table. She works as a health and sustainability consultant for the German state and cares a lot about her father's well-being. "I've been doing well, thank you, how about you? I'm looking forward to the great human-prepared food here!" Carl replies. "Yeah, it'll be great. Look, this is my health monitoring watch. It measures my current health status and suggests a meal from the restaurant's menu that optimally suits my nutritional needs! For example, right now, it's telling me to order the Pasta al Salmone with a salad side. Here, you can put it on and try it!" Fiona explains excitedly. "No, no, I already know what I'm getting. I'm having the lasagne bolognese as always."

Once the food arrives, Carl is in a great mood. Fiona decides to bring up a topic that has been on her mind for a while. She begins, "Dad, I think you should consider switching to a robotic care assistant. I'm worried about you being alone at home all day. I would feel more comfortable if you measured your vitals more consistently and had an easy way to contact me if anything happens." Carl grumbles and thinks to himself, "Not this again...". "It would be a lot cheaper, too," Fiona continues, "and provide you with a larger range of care services, allowing you to stay home for longer. It also has cleaning and entertainment functions." At this point, Carl interjects, "Look, Fiona, I know you mean well. But I really don't want this. I like when Lara comes by every day, and we



talk, and I feel more comfortable knowing it's a real person checking on me." "I get that, daddy, but at some point, it's not so safe for you anymore to be home alone without the robo-caretaker. Please promise me you will at least think about it?" she asks him pleadingly. After a longer pause, Carl acquiesces, "Fine. I promise to think about it." The rest of the lunch is very cheerful, and Carl does not hesitate to pick up the lunch tab. Since the 2028 Public Pension act, his pension allows him a relatively comfortable lifestyle. The profits from the automatization of industry allowed governmental pensions to rise, and his ETF investments helped him secure enough private savings to support his favorite activities.

This evening, he has plans to visit an orchestral performance of Dvořák's "From the New World" Symphony together with his friends. This concert is quite a special treat since most of the orchestra's musicians are real, and only a few supporting

robotic musicians are present. After lunch, Carl takes the bus to a park near the Concert Hall. There he enjoys a solitary walk before meeting his friends at the concert entrance. They begin an avid discussion about classical music when Carl spots a young man in line to enter the hall. "Look at that," he exclaims, "I haven't seen a young person at this concert hall for years!" His friend Amanda replies, "Wow, you're right. They usually only go to VR concerts!" "I guess the interest in real classical performances hasn't yet died out," Carl remarks with a tone of contentment in his voice. They enter the hall and take their seats. As the music swells, the drums' melody and beat slowly wash over them, and the wave of sound slowly draws them into another world, where only thoughts and sensations exist.

## Prosperous Nostalgics

After the concert, Carl wishes his friends a good night, and they all depart into their separately requested busses to their homes. As he arrives and heads to bed, he can still hear the sounds echoing inside his head. Carl feels deeply gratified. Shortly after 10 pm, he drifts off into a blissful sleep, silently humming the melody of "the New World".

### Signposts

- Digital Literacy Index shows: elderly still lack knowledge of new technologies.
- Elderly block introduction of entirely virtual voting.
- COVID-25 outbreak successfully prevented by UN pandemic protocol.
- 2028 Public Pension Act increases basic pension and makes old-age poverty a subject of the past.
- Purchasing power of elderly at record high and expected to stay stable due to a strong, automation-driven economy.
- Prevention through health monitoring has decreased the level of NCDs and saved Germany 40bn EUR this year.
- Elderly's demand keeps smartphone sales in 2035 high.
- Long after their introduction in 2037, Brain-Machine-Interfaces still get rejected by elderly.



# FALLING BEHIND

## A Day in 2040

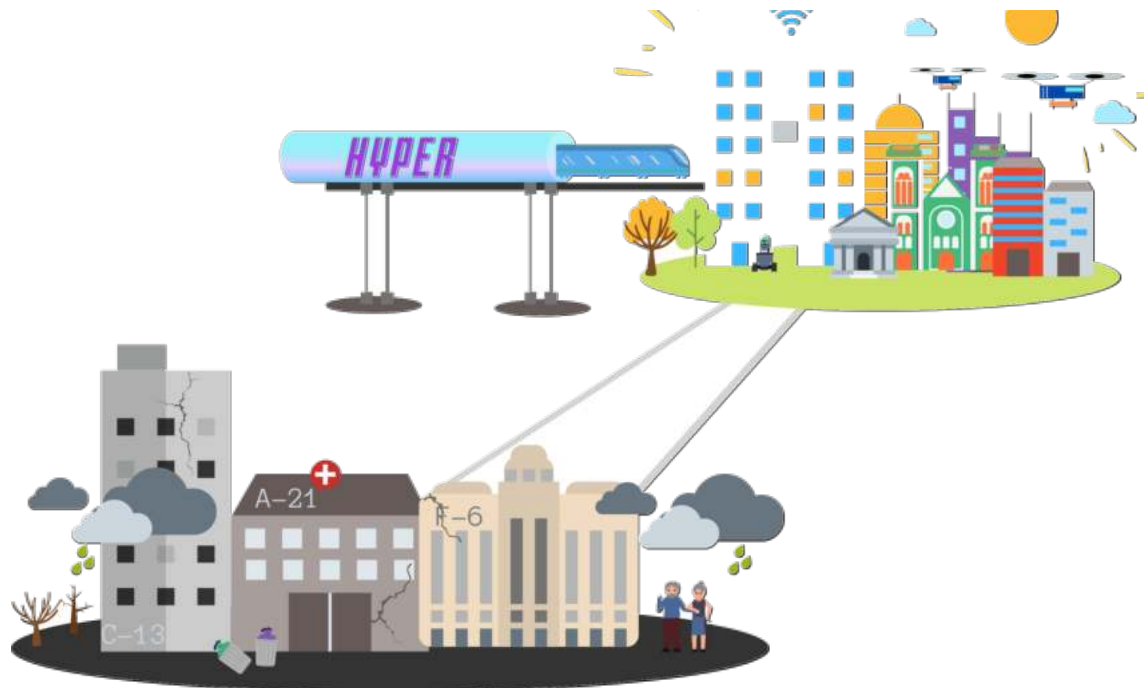
At 6 am, Thomas's old iPhone alarm starts ringing. As usual, he is already awake. Falling into a deep sleep is difficult when you are 72 years old, especially when the summer heat worsens every year. His body is soaked in sweat. "Stupid air conditioner, supposed to be smart but can't get the job done," he mumbles. Moments like these make his life significantly more unendurable. Thomas wishes he could afford to live in his own house, not in a nursing facility's shared apartment on the city's outskirts. He would be living a more independent life.

His two flatmates, also in their 70s, are already awake trying to fix the air conditioner. "I could not sleep at all," complains one of them. "I have been trying for two hours now, but I cannot figure out how these stupid glasses work!" complains the other. Thomas reluctantly puts on the AR glasses and tries to help. Feeling dizzy and sick, he gives up after a few minutes and takes them off. "Who thought about the elderly when developing these devices?" thinks Thomas, now irritated. He misses the good old days when a technician would come to fix it.

He walks to the bathroom to manually inject insulin before having breakfast. Thomas does not trust alternatives such as an artificial pancreas. Even if he did, he could not afford them without supplementary private insurance. Until 2030, a sufficient statutory health insurance system in place would have allowed him to get a better diabetes treatment.

Afterward, Thomas shuffles through the indistinguishable corridors to the fully automated canteen on the first floor. As he arrives, he thinks about the lovely breakfasts he used to have with his wife in their small and cozy apartment. She died from COVID-35 about four years ago. Without her additional income and his declining ability to walk up the stairs, Thomas had to move into a state-provided nursing home.

Having finished his morning routine, Thomas is ready to go to work at the local community center. For several years now,



autonomous buses have been offering free public transport. But Thomas shuns the free offer. He feels unsafe without a driver. Despite his worsening arthritis, he prefers to walk for about 30 minutes. The way to the center is not a nice walk. It leads past grey and smeared buildings. Here and there, you can see elderly people begging desperately for work or getting their cardboard shelters ready because they have not been assigned an apartment in nursing homes yet. A loud buzzing sound interrupts Thomas's thoughts. He notices several drones flying by and the autonomously driving vehicles coming from downtown.

Finally, arriving at his mini-job as a receptionist, he immediately starts setting up the chairs for today's lecture on "How to Use Modern Technologies". The course is part of three sessions imposed by the government to increase digital literacy among the elderly. "What nonsense," he thinks to

himself, "nobody will attend, just like the last time." His thoughts are interrupted abruptly as a young woman in her 30s walks through the door. She is loudly complaining, "How is it possible that I cannot check-in with my biosensor at the entrance? We are in 2040 and not 2030!". Thomas is annoyed but tries to put on a fake smile and manually checks her in. He is not happy with his job. However, his shared apartment would be unaffordable without it. Back in his younger years, as a translator, things seemed to be simpler. Thomas loved learning about new languages and cultures until advances in machine learning made his job obsolete in 2025.

It is lunchtime. Usually, lunch breaks on Mondays are his least favorites. Due to his financial hardship, he has to get lunch at the local food bank twice a week. But today is different. His old friend from school, Sabine, who lives in the countryside in a lovely age-friendly community, has promised to call him.

## Falling Behind

During the call, Sabine sounds very excited, she has started painting lately, and her piano lessons are going well. No matter how much Thomas likes to hear from his childhood friend, he envies that Sabine is one of the very few who can afford to live in a fancy community where she can freely pursue her passions and live independently.

Back at the center, Thomas leans back in his chair and lets his mind wander. His thoughts are interrupted as he looks up to the unevenly spread screens across the entrance hall. The

screens show advertisements for a populist party that arose over the last years, targeting mainly the elderly. "At least they take us seriously," he sighs, but his children have told him multiple times, "It's just not that simple." However, his flatmates are supporters. "We need to retake control of our own lives," and "The environmentalists are right for worrying about nature, but first we need to take care of ourselves," they told him the other day.

Thirty minutes after finishing his shift, Thomas starts heading to a weekly medical check-up close to his living complex. After standing in line for more than forty minutes, he enters a sterile white room with an assistant robot standing in the corner and a large screen in the middle. A friendly, young female voice emerges, "Hello Thomas, this is Cosi, your virtual nurse. Would you like to talk about your sugar levels?" Thomas asks whether he could speak to his doctor directly, but with little success. No doctor is currently available. Cosi continues with her treatment. "I see you were taking a walk today, great! And be careful with your diet. You ate a lot of processed food with a high content of carbohydrates and fat today," she informs. Frustrated, Thomas leaves the room. He knows that the food offered at the canteen and the local food bank is not tailored to his nutrition needs, but he cannot afford to change that. His mood further worsens on his way out when a holographic assistant reminds him that he has several open invoices from his last appointments.

Thomas goes back to his apartment to settle the open invoices and check on his current financial situation. A look at his balance does not improve his mood. After the 2037 post-pandemic recession combined with the pension system's collapse, there were no savings left. The meager monthly pensions are barely enough to cover the most basic living expenses. To feel better, Thomas decides to take some time for his favorite hobby, reading. However, he always has a hard time finding new books. Nowadays, they are mostly digital or replaced by VR-supported formats. Paper versions are available too, but they are rare and hard to find. Most big publishers do not provide new publications in the traditional written form anymore since they are more costly and harmful to the environment. After searching without success for a paper book online, he decides to re-read one of his few books for the third time.

At 7 pm, Thomas decides to call his kids in the US. He tries to video call his daughter, but instead, her Avatar Twin appears, "Hi, I am currently in a meeting. Is there something I can do for you?" Thomas hangs up. Lately, he has the feeling that he has talked more to the Avatar Twin than his actual daughter. Next, Thomas video calls his son, who immediately answers the phone. "Hi dad, why don't you call me with the VR goggles that we sent you for Christmas? This way, we could see you so much better. You know your grandchildren love using them." Thomas complains that the glasses are uncomfortable, and he is too old to learn new technologies. He asks his son if he already found a new job and whether



## Falling Behind

he and his sister may afford to get him a single apartment in the building. He would love to have his own space and maybe try a new hobby. But just at the moment when his son wants to answer, the connection breaks down. The screen of his iPhone displays, "system error, please try to restart your device." With tears in his eyes, he puts his cell phone aside. Thomas feels alone and misses the times when he was an independent man living on his terms.

### Signposts

- The statutory pension system partially collapses after the baby boomers' retirement, causing a further rise in old-age poverty. Reforms have been mainly unsuccessful, with the elderly receiving a minimal income.
- The legal retirement age rises to 71 years. Most of the poor elderly above this age try to find one of the few available mini-jobs.
- The German government starts subsidizing the construction of sizable low-cost nursing care facilities to accommodate the number of elderly facing financial hardship.
- Barely any elderly have visited at least one of the government-sponsored Technology Familiarisation classes to improve digital literacy.
- Signpost 5: Another pandemic imposes high costs on the German government and strongly harms the overall economy.
- NCDs continue to rise because new treatments are too expensive for most of the elderly population.
- Failed tax reforms trying to embrace the taxation of possession fail and cause social inequality to rise further.
- A majority of manual industry jobs still available in 2020 are fully automated. Most new jobs require technology skills, making it hard for less tech-savvy people like the elderly to find work.
- The elderly's decision not to adopt emerging technologies deepens the divide between generations and causes further social segregation.
- Health insurance companies are hopelessly underfunded for the rise of NCDs and have no choice but to reduce services for the elderly.



# IDEATION

The following chapter describes five novel business models in the field of this Trend Report. Each of the business models is described using the Osterwalder Business Model Canvas.

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# SLEEPi

Noise-reducing pillow that uses selective noise-cancelling technology to cancel out snores

In Germany, 24 million people suffer from snoring. Specifically, the elderly are at an increased risk for a decrease in sleep quality due to snoring. Sleep is important as a prevention factor for different cardiovascular diseases, obesity, diabetes, and even neurological diseases, including dementia and depression. In addition, snoring can stress relationships due to conflicts and negative emotions and sometimes even force couples to sleep in separate rooms.

Sleepi is a pillow that uses non-intrusive noise-canceling technology to ensure high-quality sleep. The pillow is intended to be used by the snorer's partner or any other person in the surroundings. Two integrated microphones detect the snores and considering that each snorer's noise has a unique acoustic, it uses a real-time adaptive algorithm to emit counter-waves through two integrated speakers to cancel out snoring sounds selectively. Sleepi needs to be

charged every five days by easily connecting it to the power outlet through a USB-C cable.

Sleepi is orthopedically designed with a cross-cut memory foam cube filling that can accommodate a range of sleeping positions and provide the user with high-comfort sleep. The electronic devices are carefully placed and protected by a comfort foam that disguises them while still enabling them to perform their noise-canceling tasks. Finally, all of this is enclosed by a bamboo cover that is washable and hypoallergenic.

This cutting-edge technology, paired up with a high-comfort design, aims to be an essential wellness tool in every household to provide the highest quality and healthy sleep. Sleepi strives to be considered as a health prevention device to diminish sleep deprivation and all the adverse effects



that come with it. By improving the sleep environment and ensuring a good night's sleep, Sleepi wishes to play a role in making relationships thrive. With this in mind, Sleepi can also provide all the mentioned benefits when acquired by hospitals and hotels.

 **Key Partners**

- Suppliers - Electronics, pillow manufacturers
- Researchers
- Launch partners
- Offline retailers
- Health insurances

 **Key Activities**

- Pillow design, production, and distribution
- R&D
- Marketing
- Customer relations and service
- Partner network development

 **Value Proposition**

- Healthy and high-quality sleep in a snoring environment
- Non-intrusive technology built in a pillow that analyzes and cancels the snoring sounds
- Health prevention through reduction of sleep deprivation effects
- Less conflict in relationships by providing a better sleeping environment
- High-comfort orthopedic pillow

 **Customer Relationships**

- Research-backed product
- Customer support
- Online community with an expert blog
- Special deals for large corporate orders

 **Customer Segments**

- B2C**
- Individuals with snoring partners, snoring individuals
- B2B**
- Hospitals, hotels (rooms for 2+ people)

 **Key Resources**

- Human capital - Researchers, tech experts, sales, test participants
- Data
- Patents

 **Channels**

- Own online shop
- E-commerce platforms
- Offline retailers like furniture, department, medical supply, and mattress stores

 **Cost Structure**

**Fixed Costs**

- Research and development
- Customer trials
- Marketing
- Employees

**Variable Costs**

- Material
- Production
- Distribution and transportation
- Revenue share for sales partners

 **Revenue Streams**

- One-time acquisition of the product
- Further planned in-app purchases





## Value Proposition

Sleepi acknowledges the importance of sleep. Enough sleep and 'quality' sleep are essential for a person's physical survival, health, general and emotional well-being, as well as optimal social interactions. A sufficient amount of 'quality' sleep is vital for a person's physical survival and proper functioning. An important factor for sleep disturbance is loud, intrusive snoring which results in sleep interruptions and sleep fragmentation, affecting the partner in bed and others surrounding the snorer.

Based on proven research in active noise control technology, Sleepi has developed a pillow that allows the customers to enjoy a night with healthy and high-quality sleep. This non-intrusive technology uses a Machine Learning algorithm that analyzes the snoring sounds with a microphone during the night. Considering that each snorer's noise has a unique acoustic, it uses a real-time adaptive algorithm to emit counter waves to cancel out snoring sounds selectively. An optional free app allows for minor updates in the pillow's software in case it is needed. The pillow is orthopedically designed with a cross-cut memory foam cube filling that can accommodate a range of sleeping positions and provide the user with a high-comfort sleep.

The elderly are at increased risk for a decrease in sleep quality due to snoring. Sleep is important as it is a prevention factor for different cardiovascular diseases, obesity, diabetes, and even neurological diseases, including dementia and depression. Sleep deprivation can lead to arguments, lost patience and cause psychological problems, such as personality changes, mood disturbance, and depression. Moreover, sexual dysfunction and irritation/aggression is another common effect. By improving the sleeping environment and ensuring a good night's sleep, Sleepi envisions not only to prevent relationship problems but also to protect the physical and mental health of those affected by snores throughout the night.



## Customer Segments

Sleepi offers value for B2C as well as B2B customers.

**B2C:** Due to Sleepi's primary objective of supporting high-quality sleep, end-users constitute the primary customer

segment. As Sleepi does not reduce the snoring itself but its sound, the main customers are the people sleeping next to or close to a snoring individual, such as spouses, partners, or relatives. As snoring can be a significant stressor for the individual experiencing the snoring noise and associated lack of sleep and the relationship as a whole, both parties are motivated to find a solution. Hence, Sleepi focuses on adults of all ages who experience low sleep quality and reduced sleep quantity because of their snoring partner.

**B2B:** Hospitals and high-end hotels with shared bedrooms compose Sleepi's secondary customer segment. Hospitals are interested in their patients' fast recovery and high-end hotels in their guests' pleasant and relaxing stay. Since shared bedrooms are common, they are motivated to offer their patients or guests additional services to ensure a good night's sleep. Besides additional paying customers, hospitals and hotels provide Sleepi with an additional marketing channel where end-users can get in first contact with the product. On the other hand, hospitals and hotels can market themselves as patient-/guest-oriented and offer their patients/guests a more recreational and pleasant stay.



## Customer Relationships

**Research-backed product:** For the adoption of the product, it is crucial to create trust in the safety and effectiveness of the noise-reducing pillow and its underlying technology. Using physicians and sleep clinics as intermediaries conveys medical safety. Communicating the research behind the product via articles and blog posts by sleep expert's demonstrates effectiveness and trustworthiness.

**Customer support:** For simple inquiries, Sleepi offers a chatbot service to reply to questions in real-time. This enables us to serve a significant number of customers with immediate responses at all times. While such simpler cases can be resolved quickly, more complex cases need more individualized support. In this case, Sleepi employees offer individual support via a hotline and answers can also be found in the online knowledge exchange community. Online community with an expert blog: After acquiring one of Sleepi's pillows, customer engagement with the brand will be increased through an online community. This community serves as a platform for users and experts to share knowledge about sleeping habits, health, and snoring. Through the

app, customers can access an online community to pose questions to sleep experts and exchange experiences with other customers. Blog posts about new research on sleep and snoring complete the platform.

**Special deals for large corporate orders:** For corporate clients such as hospitals and hotels that place large orders, Sleepi offers special discounts.



## Channels

Sleepi uses a combination of online and offline channels to market and sell their product. Influencer marketing, advertising on social media, and referral campaigns raise awareness among individual end consumers. Sleepi's key partners' promotional activities, including health insurances, doctors, and clinics, are key components.

Furthermore, Sleepi runs a website serving as the first touchpoint with potential customers. The website demonstrates the product's features and benefits interactively through explanatory videos, pictures, and written information. Additionally, customers can purchase the product directly in the integrated online shop. Apart from their online shop, Sleepi sells its product on e-commerce platforms and various other online and offline retailers. These include furniture stores, department stores, mattress stores, as well as medical supply stores, among others.

Besides selling to individual end consumers, Sleepi aims to sell its product to business customers like insurances, hospitals, and high-end hotels through direct contact by sales representatives.



## Key Activities

**Pillow design and distribution:** The pillow will be designed in-house whereas the production will be outsourced, integrating different suppliers. The pillow will arrive in the customers' hands after ordering it online or buying it directly at one of Sleepi's partner retail stores.

**R&D:** Being aware that new technologies require further development, Sleepi aims to have an R&D team working on further improving the noise-canceling technology as well as

## Sleepi

understanding the improvement points of the pillow. These activities will also lead to algorithm and software optimization efforts.

**Marketing:** Even though word of mouth is expected to be an essential tool, Sleepi will still target marketing. Advertisements will appear in traditional media such as television, radio, magazines, and new media channels like social media and websites. Appearance in events such as conventions, conferences, and product fairs will also ensure reaching interested businesses.

**Customer relations and service:** Understanding the customers' needs and expectations is of great priority to provide them with quality service. Sleepi will have an available workforce to answer product questions as well as for technical support.

**Partner network development:** It is of the utmost importance to build and nurture relationships with partners. Sleepi strives to create an environment with partners that will validate the product and the value propositions.



### Key Resources

Sleepi needs skilled employees with expertise in software and hardware development as well as extensive knowledge and data about cutting-edge noise-canceling technologies and snoring patterns to develop the pillow and the underlying algorithm.

As Sleepi's product integrates both hardware and software components, experts in these fields are needed first to build a minimum viable product and then continuously improve it

based on customer feedback. Particularly, employees with expertise in machine learning are a key resource for Sleepi since the pillow's noise-canceling technology is trained using advanced machine learning techniques. Hardware engineers are required to design the pillow, choose suitable fabrics, and integrate all hardware components, including speakers, microphones, and battery packs. Software developers and data scientists are mainly responsible for developing the underlying algorithm of the noise-canceling technology as well as analyzing user data to obtain a better understanding of individual snoring patterns and to further improve the product based on the insights.

Apart from hardware and software developers, key human resources also consist of researchers, employees in sales, marketing, customer support, and customers for user research and trials.

In terms of digital resources, notably, the algorithm itself can be considered as Sleepi's key resource. The continuous improvement and update of the algorithm is crucial for Sleepi's long-term success and its value proposition.



### Key Partners

**Suppliers:** Sleepi outsources the manufacturing of the pillow fabrics and the electronic components to external partners. As Sleepi wants to provide its customers with the highest quality while concurrently maintaining low costs, Sleepi aims to work together with reliable and high-quality manufacturers that are efficient in their processes.

**Researchers:** As a research-backed product, the development of Sleepi's noise-reducing pillow is conducted in collaboration with research experts in the field of noise-canceling technology. To provide the latest noise-canceling technology and high standard pillows, Sleepi closely works with experts in this field and researchers examining factors of healthy sleep and snoring prevention.

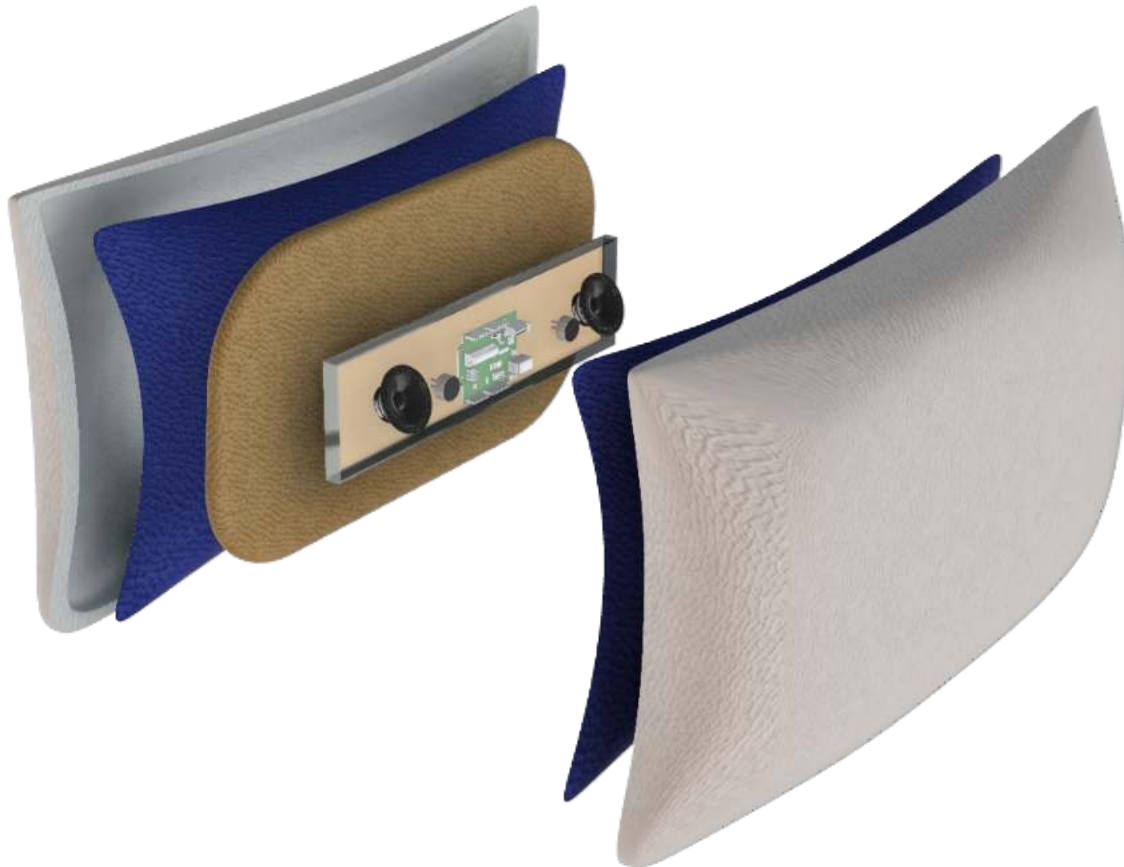
**Health Insurances:** After validation of Sleepi's preventive value, health insurances will initiate partnerships. Partnering with health insurance companies and creating reimbursement policies for the noise-reducing pillow increases acceptance and sales numbers.



## Sleepi

**Offline Retailers:** To reach all customer segments and offer customers the possibility to try out the product, Sleepi collaborates with offline retailers such as bed and bedding shops as well as department stores.

**Launch Partners, Experts & Influencers:** Collaborations with sleep experts and other companies can increase Sleepi's visibility and popularity. The targeted companies for collaborations are those tackling the issue of snoring and the importance of sleep for good health, such as sunrise alarm clocks, snoring masks, and health influencers.



## Revenue Streams

Sleepi generates most of its revenue through pillow sales. The estimated price for the pillow is 30 EUR, which ensures competitiveness and profitability. In a competitor analysis, similar solutions were identified and benchmarked. Noise-canceling earbuds, vibrating pillows, and noise-tracking pillows appear to be direct competitors that are positioned in a price bracket comparable to the one proposed by Sleepi. As the perceived value provided by Sleepi is considered similar to the one offered by the competitors' products, the selected price has to be attractive for the customers to choose Sleepi over the available alternatives.

As a future feature and an additional revenue stream, it is planned to use the already developed app for in-app purchases. In combination with the frequently updated software, the hardware of the integrated speakers can be used to play special guided meditations and white noise. Meditative tracks and white noise will help the user relax and fall asleep. For this, customers can purchase single tracks or can select a subscription model with a monthly fee to access unlimited tracks.

## Cost Structure

There are three main types of costs that are relevant for Sleepi. Initial investment costs arise for the development of the product, the set-up of a legal entity, as well as the establishment of first partnerships. After the initial investment, fixed and variable costs incur for daily operations.

**Initial costs:** Initial costs result from company formation, including notary and registration costs. Furthermore, significant upfront investment is required to develop the minimum viable product and the underlying algorithms and potentially buy existing patents. Additionally, an initial budget has to be dedicated to the establishment of first partnerships.

**Fixed costs:** After the initial set-up, Sleepi needs to invest in sufficient operational infrastructure and resources to achieve smooth operations from the beginning. Costs incur for employees, office space, and work equipment. Furthermore, continuous investment in research and

## Sleepi

development to further improve the product and the underlying algorithm are high fixed costs. To reach as many customers as possible and achieve high customer satisfaction, marketing campaigns, customer trials, and user research are additional fixed costs. Costs also arise when Sleepi decides to patent the pillow's noise-canceling technology to secure its technological advantage.

**Variable costs:** Variable operating costs arise for the material of components, the manufacturing of the pillow, and its distribution to customers. Apart from that, a significant portion of the variable costs are revenue shares for sales partners, advertising, and ongoing customer support.

### Scenario Fit

**Underprivileged Geeks:** In the scenario of "Underprivileged Geeks", a high intention to use technology is paired with a bad financial situation leaving the elderly with little means to afford technology and non-essential products. While the elderly might be very interested in using the noise-reducing pillow with its simple technical set-up and use, they might struggle to afford it. In this scenario, Sleepi must be aware that even a competitive price will still not necessarily suffice to reach the target consumers. Different types of customer relations must be considered to enhance the attractiveness and the willingness to pay.

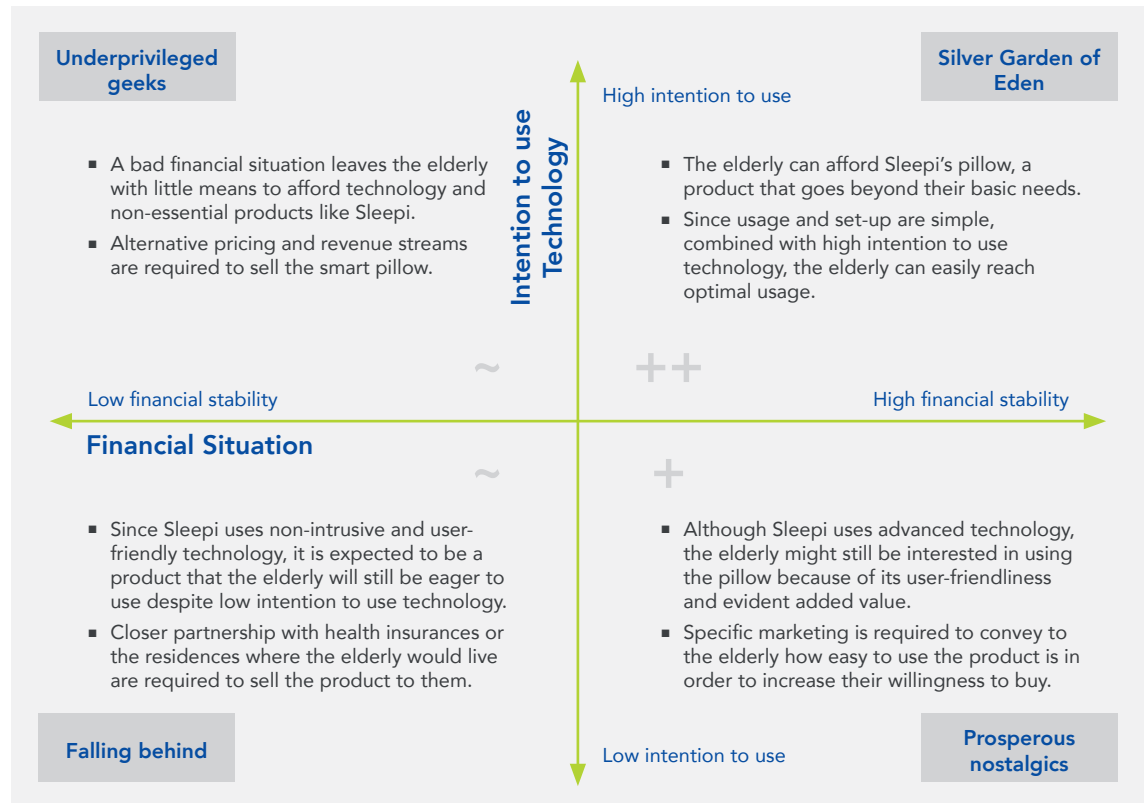
**Silver Garden of Eden:** The "Silver Garden of Eden" scenario describes a future where the elderly face a good financial situation and have a high intention to use technology. Thus, the elderly can easily afford Sleepi's pillow, a product that goes beyond their basic needs. Simultaneously, due to the elderly's high intention to use technology, they are willing to use Sleepi's technology. Since usage and set-up are simple, the elderly can easily reach optimal usage. In this scenario, market penetration should be a more straightforward task and therefore the target values for a profitable company can be easily achieved.

**Prosperous Nostalgics:** In the scenario "Prosperous Nostalgics", the elderly face a good financial situation but have little intention to use technology. Their good financial situation allows the elderly to afford Sleepi's pillow easily. Although Sleepi uses advanced technology, the elderly might still be interested in using the pillow because of its user-friendliness and evident added value. The set-up of the

pillow is straightforward, and little technological knowledge suffices to attain optimal usage. Sleepi has to acknowledge the need to create customer relationship programs to convey to the elderly how easy to use the product is and increase their willingness to buy.

**Falling Behind:** The "Falling Behind" scenario portrays a future where the financial situation of the elderly is detrimental, and at the same time, they have little intention to use technology. In this scenario, the elderly might find themselves struggling to buy products outside of their basic necessities, and for this reason, they might not afford to buy Sleepi. Since Sleepi uses non-intrusive and user-friendly

technology, it is expected to be a product that the elderly will still be eager to use. For Sleepi, it will not be easy to enter the market. A good approach would be to establish close partnerships with health insurances or the residences where the elderly would live to provide the product to them.

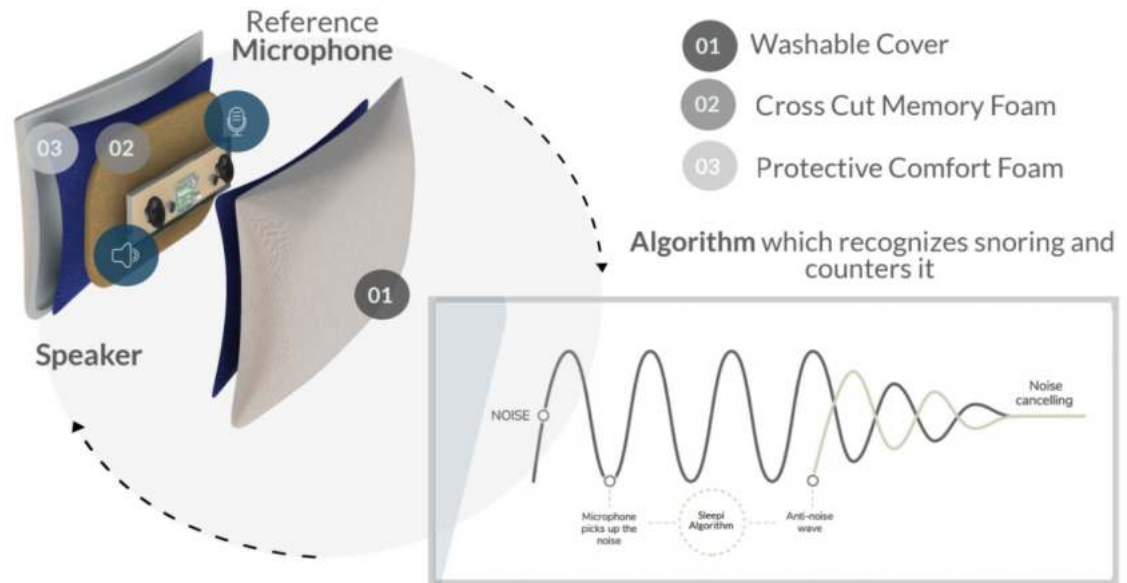


Challenges

- Entering a market with established competitors might not be an easy task. Not only direct competitors in manufacturers of smart pillows must be taken into account but also incumbents in noise-canceling technology that want to spread their use cases.
- Establishing a competitive but also profitable price must be targeted from the early stages of development.
- Performing further research and development on the optimization of the algorithm to cancel out the different types of snoring must be prioritized.
- Improving the targeted noise reduction sound waves to function in all different sleeping positions should be the aim of further research and development.
- Designing and manufacturing a pillow that is comfortable for different tastes in pillows (shape, size, hardness, height, etc.) is of utmost priority.

Outlook

Despite the competition in the noise-canceling market, Sleepi aims to be the leading sleep-related noise-reduction technology provider. After establishing customer trust and Sleepi's position in the pillow market, Sleepi may offer additional features such as white noise and guided meditation played on Sleepi's speakers as well as sleep analysis. Individualized sleep analysis could provide users with valuable insights into their sleeping patterns and ways to improve their sleep quality besides noise-canceling. At this point, Sleepi is designed as a one-time purchase, but with additional features such as sleep analysis could also develop towards a smart pillow on a subscription basis. In the future, the algorithm could further be trained to effectively cancel out other noises in the sleep environment besides snoring sounds and thus offer additional value to people living in noisy urban areas. Furthermore, Sleepi may provide personalized pillows with further adjustable neck support, height, and shapes, and foster collaborations with corporate partners such as hospitals, sleep clinics, and insurances.





# COM2-GARDEN

Turning unused company premises into elderly-led green spaces

Employees' mental health is one of the top concerns for corporations. In the workspace, poor mental health causes a series of problems such as decreased productivity and increased absenteeism. These problems cost companies an estimated 225bn USD per year [458]. As a result, a growing number of companies are willing to invest in preventive measures to decrease mental health problems among their workforce. These measures are not a sunk cost: For every dollar spent on mental health preventive programs, the median return on investment due to increased productivity is 1.62 USD [459]. One example of these measures is the exposure to nature and green, such as plants and gardening, which increases productivity, reduces stress, and cleans air toxins [460].

As a socially-oriented business, COM2-Garden's mission is two-fold: first, to help companies positively impact the men-

tal health of their employ-ees, and second, to integrate the elderly into their local communities. COM2-Garden offers the setup and management of green spaces and gardens for companies with unused premises, such as rooftops or interior courtyards. In these green spaces, employees can relax, chat, and even garden while enjoying stress-free breaks before returning to work. COM2-Garden fosters the community spirit within its gardens by organizing workshops and events where employees can interact and learn from gardening experts. By using COM2-Garden, companies invest in their employees' mental well-being, which, in turn, increases their productivity, happiness, and work satisfaction. COM2-Garden employs retired elderly as the primary workforce for garden management. For those elderly in financial hardship after retirement, employment by COM2-Garden improves their financial stability. On the other hand, those without any financial problems can also experience the positive aspects of

gardening. Furthermore, COM2-Garden tackles one of the main concerns for the elderly after retirement, the increase in loneliness and disconnection from society. COM2-Garden connects the elderly to other people, thus decreasing their loneliness and improving their integration within society.

By trusting COM2-Garden, companies improve their business, their culture, and their employees' work life. Additionally, they invest in their local community, enhance their public image, and improve the independent living of the elderly.

 **Key Partners**

- Local Gardeners and Garden Markets
- Architects and Landscape Designers
- Network of Local Initiatives

 **Key Activities**

- Provision of on-site equipment and gardening supplies
- Ensuring a seamless onboarding process
- Implementation of a digital platform for operational and educational purposes
- Managing and fostering a physical community
- Design and branding

 **Key Resources**

- Gardening resources
- Human resources
- Knowledge base
- Digital infrastructure

 **Value Proposition**

- Increased productivity and reduced stress among employees by offering green spaces and hands-on activities
- Companies increase their reputation as well as their ties with the local community
- Providing the elderly with a meaningful task and a responsibility in the project
- Allowing the elderly to earn extra money

 **Customer Relationships**

- Counselling by leading experts
- Development of a digital community platform
- Organization of offline events
- Creating a sense of ownership by assigning elderly teams to a specific garden
- Creating workshops to train the elderly in gardening techniques

 **Customer Segments**

- Large Public or Private Enterprises
- Active, Inquisitive, and Retired Elderly

 **Channels**

- Magazines
- Ads in public transportation, billboards, and radio
- Flyers
- Pop-up events
- Word of mouth
- Blog posts and articles
- Featuring partner companies during pop-up events
- Contacting HR departments

 **Cost Structure**

**Initial Investments**

- Marketing
- Partner acquisition
- IT infrastructure

**Fixed Costs**

- Office space
- Wages

**Variable Costs**

- Materials
- Wages

 **Revenue Streams**

**Installation fee**

- Initial equipment setup
- Initial seeding by gardening experts

**Subscription fee**

- Monthly fee for renting the equipment
- Monthly fee for taking care of the gardening facilities
- Community management
- Events creation

## Value Proposition

COM2-Garden connects the elderly with public or private enterprises by turning unused company premises into elderly-led community gardens and green spaces. COM2-Garden matches companies that want to make their workspaces greener and improve their employees' mental health with the elderly who want to have rich social interactions. Therefore, COM2-Garden adds excellent value to both stakeholders. For companies, it is highly attractive, as it offers various advantages without caring about its implementation. By partnering with landscaping architects and garden markets, COM2-Garden takes care of every step in the journey of transforming the workspace into a relaxing, attractive, and engaging environment - from planning and setting up green spaces to managing them. These green spaces allow employees to break from their stressful day-to-day work, reducing their stress levels and eventually increasing work satisfaction and productivity. As COM2-Garden's mission is not only to improve employees' mental health but also to foster the local community, and socially integrate the elderly, the primary workforce consists mainly of retired seniors. This unique feature provides enterprises with the opportunity to enhance their public reputation while strengthening their ties within the community. In addition to providing constant maintenance of the green spaces, COM2-Garden offers complimentary workshops held by gardening experts. Thus, companies can significantly enhance their employer branding by delivering such an innovative perk to their employees. As the primary workforce, the elderly benefit from COM2-Garden, which provides them with a meaningful task and community. Working side-by-side with like-minded individuals, the elderly experience a feeling of responsibility and an often-needed sense of purpose. As the elderly work together in teams and engage with younger employees, COM2-Garden also strengthens the cross-generational bond. These social aspects improve the mental health of the elderly, which further supports their independent living.

## Customer Segments

**Large Public or Private Enterprises:** COM2-Garden's primary target customers are large enterprises with big office spaces, traditional working methods, and an outdated

infrastructure. One of the biggest challenges that all firms face is the rise in their employees' mental health problems. Additionally, in today's working world, companies are left with declining staff retention. While almost all companies have to deal with these issues, larger corporations with their often-unattractive workspaces have a tough time competing with younger startups in employer branding and talent attraction. Therefore, any additional innovative way to keep up the morale and improve employees' mental health, and boost staff retention, is precious to these companies. Another potential customer group that is worth targeting are public sector employers. They face the same issues as large and traditional firms and usually own entire buildings with lots of office space, resulting in multiple options to set up a garden.

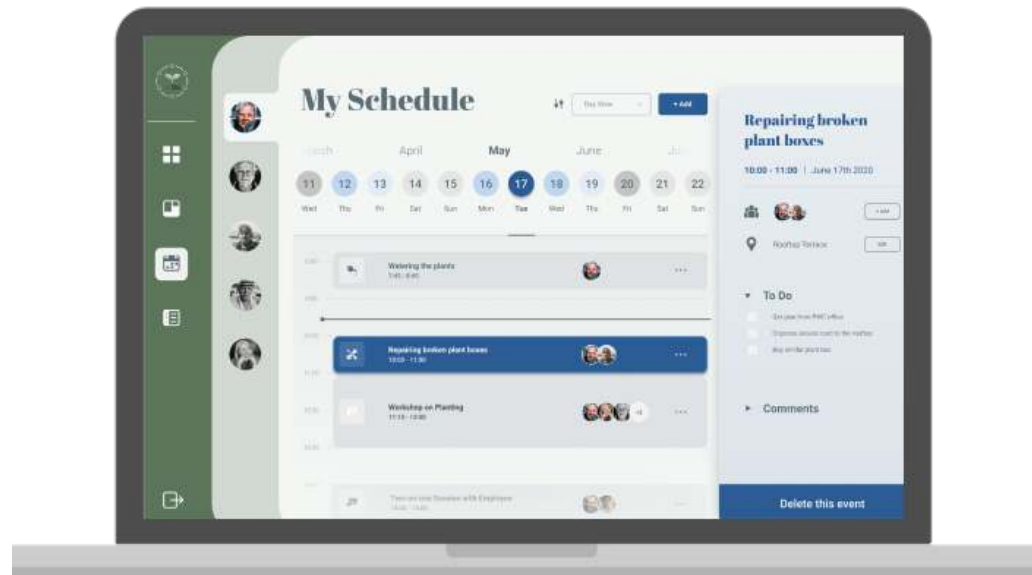
**Active, Inquisitive, and Retired Elderly:** COM2-Garden targets retired 60 – 80-year-olds that have a passion for gardening and engage with technologies on a basic level. Shortly after retirement, the elderly often face the problem of feeling lonely and disoriented. Finding a purposeful task that keeps them active and building up a new community outside of work often proves to be a significant hurdle. The elderly

that are still fit, curious, and retired now have the time to live out their passion. For them, COM2-Garden offers the perfect opportunity to have rich social interactions with like-minded elderly and younger generations. Therefore, they become part of a community and can reactivate the feeling of having meaningful tasks and responsibilities.

## Customer Relationships

**Carefree Onboarding:** Companies and public institutions appreciate the goodbye-worries package provided by COM2-Garden. From the community partner's initial interest in setting up a social garden, COM2-Garden offers an all-round carefree onboarding. Leading experts create a plan with the best garden set up, take care of local government permits, and even propose a seed selection depending on regional availability, weather conditions, and local gardeners' expertise. Thus, COM2-Garden offers a personalized solution to each client.

**Management by Experts:** Community partners value the expertise brought by COM2-Garden specialists. Community







managers lead and coordinate gardens and establish work schedules, team creation, and task distribution. Experts define daily tasks and add them to our community platform on an ongoing basis. The platform also notifies the elderly about the schedule to perform the tasks. Additionally, experts train and support the elderly in their work by organizing onboarding and learning workshops such that the elderly grow as gardening professionals. By connecting local experts with local elderly, COM2-Garden fosters the local silver economy while also guaranteeing the highest quality in delivering the services.

**Community Creation:** The elderly value the community behind COM2-Garden as they feel more socially integrated through an online and offline community. Through the web platform, the elderly can choose their work slots and adapt it to their peers' schedules to work together in the garden. Additionally, the elderly can check for urgent tasks and interact with community managers that are available if the elderly have doubts about their work or any relevant problems emerge. Thus, COM2-Garden creates a social atmosphere where the elderly can interact with each other and build long-lasting relationships.

## Channels

**Channels for the Elderly:** To reach the elderly, COM2-Garden targets the channels that older people, especially those interested in gardening, are the most likely to interact with. Since COM2-Garden is a local project, pop-up gardening and vegetable selling events in different neighborhoods attract the interested elderly. Additionally, COM2-Garden distributes fliers specific to the local neighborhood projects to increase the reach among residential areas. Community partner companies and people who are already part of COM2-Garden naturally trigger word of mouth. Furthermore, advertisements are placed in German Magazines, such as "Landlust" and "Mein Garten," which are popular among gardening enthusiasts. Ads in public transportations and radio also reach a broader elderly demographic. All advertisement efforts emphasize the gardening benefits such as stress relief, better mental health and an increased physical activity. Advertisements accentuate the project's community aspect, for example, by featuring the elderly who are already a part of the community and provide information on how COM2-Garden projects work. Finally, ads feature the well-known local people that are highly respected by the elderly and are engaged in COM2-Garden.

**Channels for the Companies:** COM2-Garden reaches the private and public companies as potential community partners by approaching their HR departments, which are responsible for employee satisfaction, well-being, and retention. COM2-Garden's experts in sales carry this out. Blog posts, social media activities, and media articles featuring the companies that already engage in COM2-Garden's sustainable solutions increase these services' desirability among other companies. Pop-up gardening events serve as recruiting opportunities to attract the interested elderly. These events also feature the existing community partner companies (e.g., with their logos) increasing other companies interest.

## Key Activities

**Provision of On-Site Equipment and Full-Range Gardening Supplies:** Taking away the community partners' logistical hassle is one of COM2-Garden's fundamental principles since doing social good does not need to come at extra managerial costs. Once a new partnership is formed, COM2-Garden installs and provides a full range of gardening utensils.

**Ensuring a Seamless Onboarding Process:** COM2-Garden offers a feasibility study for interested community partners free of cost. The feasibility study includes an analysis of the physical premises and highlights the benefits of joining the community platform. COM2-Garden provides a demo tour through the digital platform and an analysis of how the employee performance and satisfaction are expected to increase within the company by adopting COM2-Garden's solutions.

**Managing a Digital Platform for Operational and Educational Purposes:** The digital backbone of COM2-Garden complements the offline experience by matching the elderly with community partners according to parameters such as the distance from the elderly home to the garden. Moreover, this digital platform makes task scheduling more efficient and delivers high-quality educational content on gardening to the elderly and employees alike.

**Managing Physical Community:** In addition to the digital platform, COM2-Garden employs several community managers who coordinate teams of the elderly and serve as a link between them and community partners. This ensures smooth communication and a high-quality assurance of the performed gardening work. Community managers also initiate and plan community events, such as gardening workshops.

**Design & Branding:** To strengthen the sense of inclusion and belonging, COM2-Garden provides all community members with personalized merchandise, such as sweaters or hats. COM2-Garden builds up a strong brand identity that ultimately helps to gain coverage in press and social media.

## Key Resources

**Gardening Resources:** COM2-Garden equips the elderly with the tools needed to take proper care of the green spaces at the community partners' companies. Depending on the green space's size and type, the necessary equipment is provided. That means that a pre-defined number of shovels, watering cans, buckets, and hoses are provided. Moreover, the right amount of soil, seeds, and fertilizer gets delivered regularly. To overcome logistical hurdles, COM2-Garden partners up with wholesalers with extensive experience in gardening supplies.

**Human Resources:** The interaction between humans is at the core of COM2-Garden's founding initiative. Therefore, particular emphasis lies on internal and external HR processes. The core team of COM2-Garden consists of diverse employees, including developers, community managers, and professional gardeners. Overall, the elderly make up the largest group of employees, forming the primary workforce of COM2-Garden.

**Knowledge Base:** During the onboarding process, the elderly get trained extensively by local professional gardeners. Throughout the two-day course, they learn the essentials of gardening. The content is presented offline in live-sessions and online as short 2-min tutorials on the digital platform, which allow the elderly to review specific sessions in their own time. Employees of partner companies interested in learning more about gardening can also access this extensive knowledge base to improve their gardening skills in their free time.

**Digital Infrastructure:** The platform links the online and offline world. It comes with separate logins for the elderly and employees of partner companies, serving their specific needs. The digital platform can be accessed through an app and a webpage to maximize the number of reached customers. The UI is clean and structured, so the elderly can effortlessly adapt to it.



### Key Partners

**Local Gardeners and Garden Markets:** The most important partners of COM2-Garden are local gardeners as they have the necessary knowledge about gardening to create an appropriate setup for each client. Professional gardeners decide which seeds are particularly suited for which environment and season. Besides making essential gardening decisions, local gardeners use their knowledge to instruct and train the elderly regularly. Additionally, gardeners' expertise helps the elderly establish routines for taking care of the plants, for example, when and how to water, prune, or winterize the plants. Furthermore, professional gardeners are available for consultations and regular check-ups for plants' pest control. Besides, the elderly receive the necessary equipment, such as potting soil, seeds, and gardening tools, obtained at a lower price through cooperation with gardening equipment suppliers.

**Architects and Landscape Designers:** COM2-Garden offers

companies a complete solution. Therefore, it is essential to seek close cooperation with architects, who analyze the project's feasibility, draw up design proposals for the companies, and obtain the required permits from the city administration. Afterward, COM2-Garden's landscaping architects and horticulture experts set up gardens for the client companies. With partnering architects, COM2-Garden develops a set of gardening components that customers can adapt according to their needs. Independent of which location clients want to set up their gardens, COM2-Garden, together with its partners, finds the best solution to adapt to the client's desires.

**Network of Local Initiatives:** COM2-Garden only employs elderly to take care of the company gardens. Therefore, it is essential to partner with initiatives where the elderly are keen on participating. By partnering with initiatives such as senior centers and social associations, COM2-Garden increases its reach within the local elderly community.



### Revenue Streams

COM2-Garden combines a subscription business model with an initial installation fee. Such a model ensures recurring monthly revenue and upfront payments to finance the initial acquisition of the required material.

**Installation fee:** The installation fee includes the gardening project design, the equipment setup, and an initial seeding by COM2-Garden experts. With the initial feasibility study, in-house experts, such as architects, analyze which type of garden is suitable for each client. From council permits to garden design, COM2-Garden provides a wide range of services covered by the installation fee. Depending on the client's desires, the equipment, and therefore the installation fee, differs. COM2-Garden offers two basic types of gardens, indoor and outdoor. The indoor garden costs 80 € per m<sup>2</sup> to set up. The outdoor gardens include seasonal and permanent gardens. The seasonal garden costs 170€ per m<sup>2</sup>, it is in production 3 to 5 months a year depending on the location. The permanent garden costs 220€ per m<sup>2</sup> and is in production all year round. Considering the client's wishes, garden type, and location, COM2-Garden proposes an initial seed selection and management plan.

**Subscription fee:** The monthly subscription fee includes garden and community management as well as event creation for the elderly and the employees of the client company. COM2-Garden charges 20€ per m<sup>2</sup> for this service. Gardens

are managed by skilled elderly who are trained and coached by gardening experts. Apart from skilled labor, COM2-Garden organizes gardening training workshops and stress-relief events for the client's employees. During these events, employees and the elderly can socialize. As a result, the client can positively impact their social community and their employees' mental health.



### Cost Structure

**Initial investment costs:** COM2-Garden requires an initial investment in the online platform, the setup of physical spaces for the community partner companies, and the preparation of marketing activities. To develop the online platform, COM2-Garden needs to hire developers and other technical talents. Consequently, COM2-Garden has to set up an efficient and reliable HR operation to ensure high-quality recruiting. The construction of gardens requires an initial investment in materials and partnerships with local experts such as architects and gardening experts. Initially, COM2-Garden has to attract the elderly to the platform. Therefore, COM2-Garden initiates marketing activities within the local communities targeting this demographic. These marketing activities involve a large but crucial upfront investment.

**Fixed costs:** COM2-Garden bears fixed costs such as investments in offices and work equipment for the platform's operational infrastructure and IT resources. Furthermore, COM2-Garden needs a broad set of employees in very diverse areas to support its operations. Lastly, financing costs arise from the initial investments made.

**Variable Costs:** First, marketing and sales activities through various channels are needed to raise awareness and acquire new customers. The planning of gardens is a major variable cost since the feasibility consulting and planning differ significantly from one location to another. Furthermore, the payment to experts (e.g., gardeners and architects) and fees for partners and material costs are significant cost drivers. In addition, COM2-Garden costs increase due to the rent of warehouses to store garden material. Costs also arise from paying the elderly, who take care of the gardens. Payments are also made to the professional community managers, who coordinate the gardening activities. The elderly are paid relatively above the average wage.

Scenario Fit

**Underprivileged Geeks:** As elderly geeks have become increasingly tech-savvy, they are happy to use the online community platform to connect with other elderly who also show passion for gardening. Through gardening, COM2-Garden allows the elderly to make meaningful contributions in their old age. Furthermore, since elderly geeks are also underprivileged, they have more motivation to engage with COM2-Garden projects in their neighborhood and earn an additional income. At the same time, gardening and frequent interaction with green spaces ensure improved mental and physical health, leading to happier and healthier lives. This is especially relevant for Underprivileged Geeks as they might be under great stress due to their financial conditions and would benefit from the therapeutic advantages of gardening. Thus, underprivileged geeks are the happiest with COM2-Garden as it satisfies their enthusiasm and willingness to engage with technology while also providing the financial security they need.

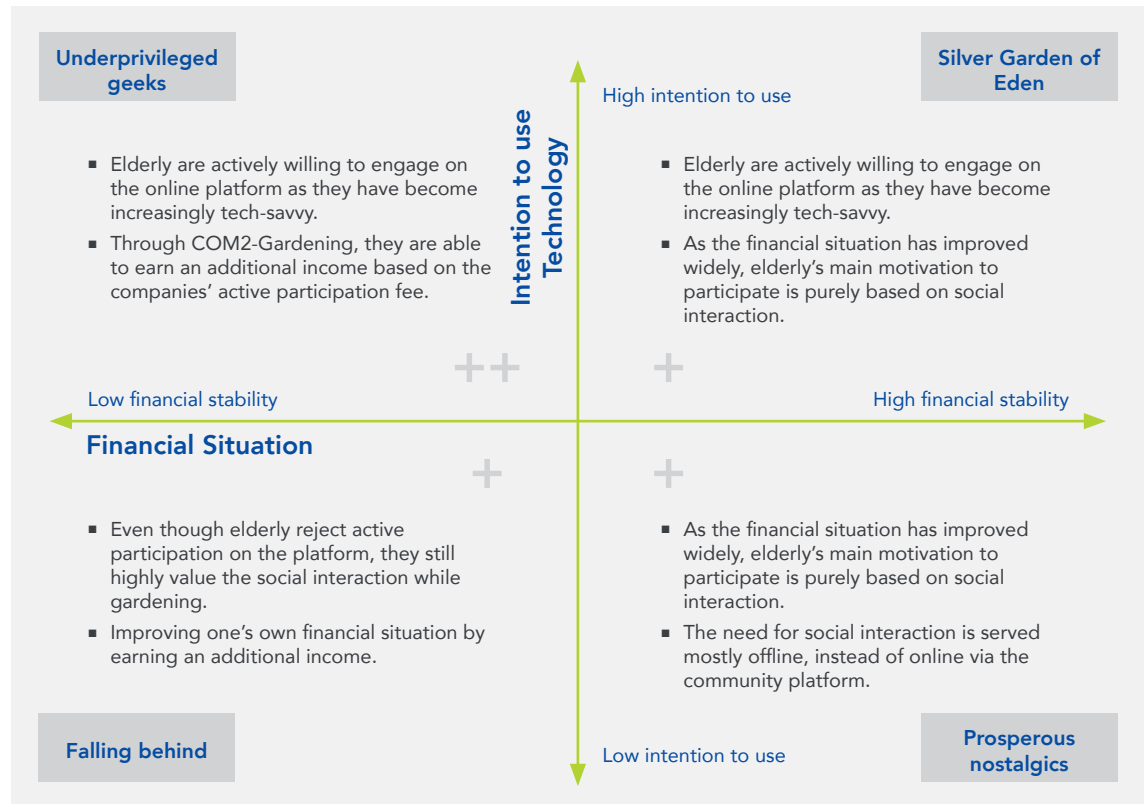
**Silver Garden of Eden:** In the Silver Garden of Eden, where the elderly are wealthy and highly tech-savvy, COM2-Garden is very popular. The elderly have no reason to worry about an additional income because they are already financially stable. However, COM2-Garden still provides value for them. Social interactions and a sense of purpose are essential and desired by the elderly regardless of whether they live in a Garden of Eden or a crumbling house. Therefore, wealthy elderly have the time and willingness to engage in an online community platform and participate in gardening projects to feel valuable while meeting other elderly from the neighborhood. Furthermore, the elderly can interact with younger generations and pass on their knowledge and expertise in gardening. Finally, they can improve their mental and physical well-being by frequently interacting with green spaces and enjoying the therapeutic benefits of gardening.

**Prosperous Nostalgics:** The Prosperous Nostalgics have no financial worries and are also not concerned with staying up to date with technological advancements, let alone using technology in their daily lives. As they are prosperous, the elderly are less motivated to engage with COM2-Garden to gain more income. Instead, their primary motivation is to get socially integrated within their community and feel valuable even after retirement. Furthermore, these Prosperous Nostalgics benefit from their frequent interaction with green spaces and gardening's therapeutic nature while improving their mental

and physical health. Even though the elderly are motivated to create more green and sustainable spaces, they cannot use technology, such as online communities. Therefore, to adapt to their nostalgia, COM2-Garden enforces more archaic means of recruiting, employing, and managing the elderly who are interested in filling their lives with more meaning and social interaction.

**Falling Behind:** In this scenario, the elderly are reluctant to use new technology while their financial situation is a major concern. As a consequence, COM2-Garden's community platform has a straightforward and elderly-friendly UI to increase their participation. Simultaneously, as the elderly

have very low intention to use technology, COM2-Garden puts more emphasis on alternative and more archaic means of recruiting solutions to the platform, such as local distribution of fliers, newspapers, and public transportation ads. Despite the elderly's rejection of the online community platform, they still value the offline social interaction that COM2-Garden offers, which benefits their mental and physical well-being. Additionally, due to their impaired financial well-being, the elderly have more motivation and incentive to engage in projects that provide them with an additional income. Therefore, COM2-Garden offers integrates the elderly in gardening projects that give them a sense of purpose and provide them with much-needed additional income.



### Challenges

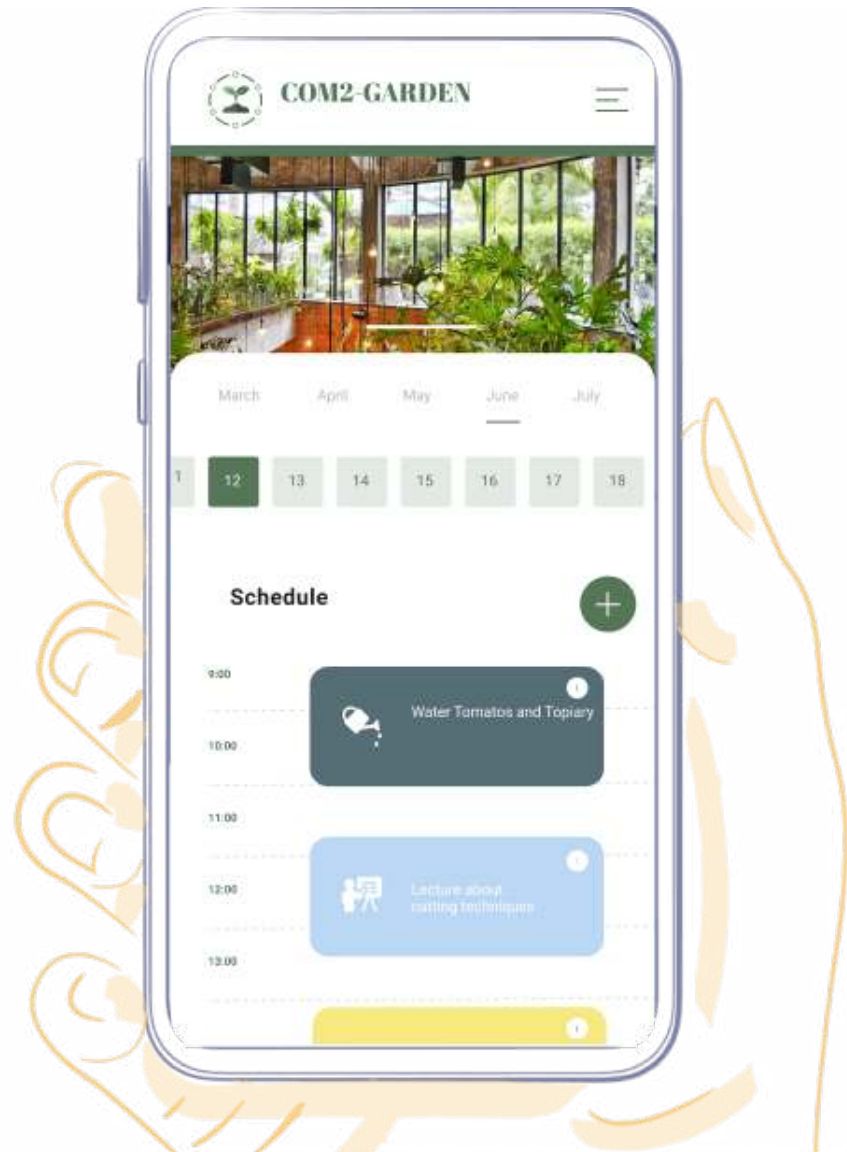
- Creating green spaces requires high capital expenditures. These expenses act as a blocker for companies to sign up for COM2-Garden, therefore, making market entry challenging.
- Operational tasks, such as storing and transporting gardening equipment, need to be designed in a lean manner to minimize tied capital.
- For the initial pilot project to be successful, it is essential to partner with highly trusted experts in gardening who are willing to work with older people.
- To keep the churn rate low, it is crucial to have high-quality learning content on the platform, targeting the interests of corporate employees and the elderly alike. Moreover, the elderly need to be provided with technical assistance in case they struggle when using the digital platform.
- Expanding the business to other cities is time-consuming as a new network of de-centralized partners has to be formed.

### Outlook

In the future, COM2-Garden plans to expand beyond the B2B sector. Private households, especially in rural areas, offer the opportunity to tap into the B2C market. In contrast to large businesses, the main customer group will be full-time working employees living in suburban areas struggling to keep up with the gardening chores of their private green spaces. With the addition of private households, COM2-Garden can focus even more closely on the community building aspect as, in most cases, such homes already have green spaces. This opens up the possibility to extend the range of offered services to other tasks, such as mowing the lawn or harvesting fruits.

With a growing number of users, the digital community platform will serve as a powerful tool to stay connected, even after joint gardening sessions. Similarly, the knowledge base will steadily expand and ultimately turn into the go-to-page for gardeners across all generations. Long-term, COM2-Garden will offer a separate alumni section for the elderly to maintain close ties to friends and peers they have met during their active time at COM2-Garden.

COM2-Garden fosters social integration of the elderly by giving them valuable tasks to carry out with like-minded peers. This reduces the sense of loneliness and tackles the development of mental diseases early-on.



# FABULA

Empowering the elderly to share their stories

More than 80% of the US population would like to write a book [461]. Unfortunately, most people never do so. Being an author was even the most desired job in the UK in 2015 [462]. Even though many people feel like they have something to share, they seldomly actually bring their thoughts, experiences, and memories to paper.

The process of gathering all information about relatives is lengthy and tedious. Fabula makes this process very easy. Fabula is a platform that guides its users through a storytelling process and helps them collect valuable memories. The platform enables automatic transcription and editing to create biographies by collecting stories about the user's past step-by-step. In addition to the predefined topics, users can receive questions from their family members. Users can then select one topic and record their memories in a spoken format. The interview is interactive with automatically generat-

ed follow-up questions based on the user's answer. The more stories a user provides, the better the automated questions become.

Therefore, individuals are encouraged to record more stories to ease the information keeping process. The audio will be kept, converted to text, and analyzed to improve the questioning process and deliver fully developed stories. After recording, the user has the option to refine, correct, and illustrate their written story. By focusing on the audio recording, Fabula drastically reduces the hurdle of writing everything by oneself and directly offers textual improvements, particularly concerning grammar rules. The outcome is either individual stories, a book in print format with clustered memories, or an audiobook with all the original voice recordings that can provide solace and remembrance even long after a person has passed.



Fabula aims to guide the user through the story writing process and supports the reflection of lifelong memories, boosting mental health and making sure that essential family memories will not get lost across generations.

**Business Model**

 **Key Partners**

- Provider of NLP software
- Publishing network

 **Key Activities**

- UX Design
- Web App Development/Maintenance
- Question and input analysis

 **Value Proposition**

- Enable life reflection through a guided process
- Digital story sharing via text or audio
- Turning aggregated stories into a printable book

 **Customer Relationships**

- The elderly entrust their data to the platform
- Customer acquisitions through referrals and word-of-mouth
- Continuous support, especially for the publishing process

 **Customer Segments**

**General Characteristics**

- 60+ who can use a simple UI on a web app
- Children and grandchildren who buy it as a gift

**Individual Characteristics**

- Like to write a book and feel unheard
- Have exciting story but need a guided process
- Dealing with the past (trauma, relationships, failures)
- Facing death with an urgency to leave behind a legacy

 **Key Resources**

- NLP algorithms
- Input from the users in the form of voice and texts

 **Channels**

- Multi-channel marketing with an offline focus
- Online advertisement targeted at both elderly and their relatives
- Nursing homes and nursing home chains

 **Cost Structure**

**Fixed Costs**

- Tech development
- Office and human resources
- Customer acquisition

**Variable Costs**

- Publishing costs
- API costs
- Server/hosting

 **Revenue Streams**

- Freemium model
- Commission for publishing
- Monthly subscription fee after five stories
- Speech-to-text, automatic editing
- Sharing via link/email

**Basic**

- Guiding questions

**Premium**

- More than five memories
- Publishing for a surcharge

 Value Proposition

**Enable life reflection through a guided process:** Fabula helps the elderly reflect on their lives by turning their stories into shareable media. After selecting a story category on the intuitive website, they can choose a question they want to answer. These initial questions can also be posted by close ones who have received an invitation from the elderly. Fabula then records the elderly's voice and, through speech-to-text technology, converts this audio into text. During the recording, the intelligent interviewer guides the elderly by inquiring about what they have just shared. After the elderly answer the questions, they get the chance to edit, add pictures, save, or share the story. In the editing mode, they can manually amend the story and get suggestions for improvement through a NLP that gets better the more stories a user has told. The user can then examine if the conversion was performed correctly and accept suggestions for word changes, summarizing, and deleting filler words. In the future, Fabula wants to add the option to scan and upload hand-written stories to users' profiles that will be converted into text as well.

**Digital story sharing (text or audio):** When the elderly finish creating their story, they have the option to generate a link that they can share with their close ones via email. Besides the link, recipients also need the unlocking credentials that the elderly include in their sharing message to access the story, catering to the elderly's privacy concerns. On the website, the recipients can read the story or listen to the recorded voice of the elderly.

**Turning aggregated stories into a printable book:** Elderly can share their records digitally and in print. After having their stories consolidated into one document, they can request a cover design, manual editing, and, ultimately, the book's publishing, all on Fabula's elderly-friendly website. They can also consolidate their recordings into one coherent audiobook that is easy to share.

The whole process encourages the elderly to share what they have lived through, from answering targeted and meaningful questions to printing their book. It helps them leave a legacy, work on past grievances, and connect with their loved ones.

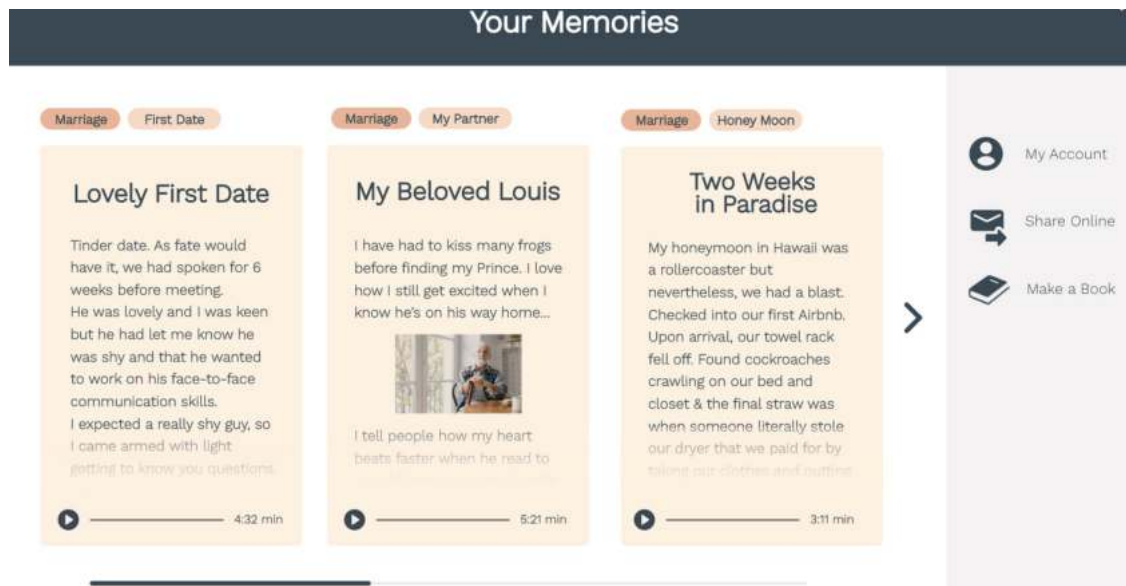
 Customer Segments

**General characteristics:** Many elderly would like to see themselves find meaning during a later stage in life. Hence, Fabula's primary target group is the elderly, who are at least 60 years old. Fabula's secondary target group is (grand-) children, who would like to know more about their grandparents and have their knowledge archived for the future. The ability to operate a simple web application and access to a computer are essential to use the product effectively. Despite the user-friendly, co-created web application, basic sensory and motor skills are a prerequisite to Fabula, excluding the elderly with severe impairments from using it.

**Individual characteristics:** Many people would love to write a book in their lifetimes. Fabula offers them the perfect opportunity to do so without going through the cumbersome process on their own. By guiding the elderly and providing them a framework, Fabula acts as an enabler for anyone who has exciting stories to tell but lacks the experience to formulate them. The process of writing stories about one's life acts as a reflection and benefits those who struggle with pain, failures, or times of hardship in their past. For example, a target persona is an older person recovering from a life-changing disease or accident, which triggered a sense of urgency to record his/her legacy. People greatly benefit from Fabula in their twilight years as they can record their lives as printed or digital stories for loved ones to read, even long after they are gone.

 Customer Relationships

**The elderly entrust their data to the platform:** The elderly are a demographic group wary of sharing data online, especially highly personal data, such as stories. This worry is a fundamental issue for Fabula and makes data privacy one of its primary concerns. Fabula is transparent about data storage, uses state-of-the-art encryption to keep the customers' stories secure, and makes sharing easy while keeping the stories only visible for designated recipients. Thereby, Fabula creates trust and makes users feel safe when using this service. Customer acquisitions through referrals and word-of-mouth: Fabula's target group uses the internet less than other population segments. Besides offline and online channels, Fabula reaches the elderly through incentivized referrals and word-of-mouth. One woman in an elderly community might be enthused about reestablishing a strong connection to



## Fabula

her children by interacting with them through Fabula's story sharing feature. She might ask her friends to give it a try. This person-to-person marketing fosters the trust customers have in Fabula.

**Continuous support, especially when publishing:** Even though Fabula strives for an automated experience, users also have the option to get human support. Especially for the printing and publishing feature, they can contact Fabula with any open questions. Because sharing stories is a highly personal activity, Fabula aspires to come as close to a family-like relationship as possible.

### Channels

**Multi-channel marketing with an offline focus:** Fabula employs multi-channel marketing with a focus on offline communication. Fabula uses (local) newspapers, billboards, ads, leaflets, brochures, and posters to convey the value proposition in simple terms. Fabula does not overload the elderly with information about the features or intricacies of the product. Instead, it appeals to the social aspects such as sharing or letting loved ones propose questions for stories.

**Online advertisements targeted at both elderly and relatives:** Fabula does not assume that relatives make all the buying decisions for the target group. However, giving a Fabula subscription to the elderly as a gift will be a common entry point. Therefore, Fabula targets its online advertisements partly towards younger people who are children or grandchildren of the elderly. Through this channel, Fabula presents itself as a remedy for loneliness and meaninglessness to appeal to the support people want to give to their parents and grandparents. Since over half of the people aged 65 and older use the internet regularly, Fabula also uses highly targeted ads aimed at the elderly on channels such as Facebook and senior forums.

**Nursing homes and nursing home chains:** Before Fabula applies a marketing strategy to Germany and all of Europe, it will focus on capturing small elderly communities. This way, Fabula gains traction and builds up trust in its brand. These communities can be found in, among others, nursing homes. Fabula tries to convince the management of these to let it advertise its product. Because Fabula supports reflection, is entertaining, and does not imply extra work on their side, the nursing homeowners are likely to support the product. Even though this process is not scalable, it is an appropriate one for the beginning because it allows Fabula to be close to its customers. Similarly, Fabula collaborates with nursing home

chains that can, when won over, advertise the product widely. The nursing home distribution adds another layer of trust for the elderly that they need for worry-free service usage.

### Key Activities

**UX Design:** Fabula targets the elderly who are often less familiar with digital services than consumers in other age categories. Therefore, it is paramount to ensure a straightforward solution to promote user satisfaction. Thus, the product requires continuous investment in UX research and design to create an optimal UI.

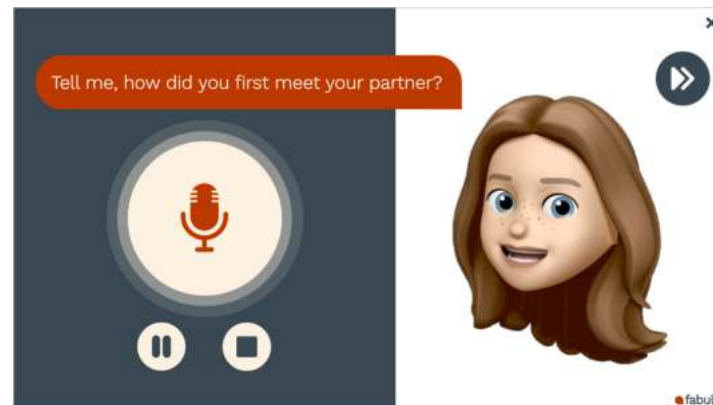
**Web App Development/Maintenance:** The front end - a web application - will need to be developed by experienced developers. It further needs to be continuously updated to integrate the newest features. Furthermore, regular bug fixes and system maintenance will be necessary to ensure the app's smooth functioning.

**Question and input analysis:** One key feature of the product is an engaging and interactive interviewing format. To ask relevant and related questions, an in-depth understanding of each of the questions' possible responses is required. A group of data scientists will examine the semantic dependencies between the questions and answers to achieve this. Thus, a mapping of follow-up questions can be constructed to ensure a truly interactive experience. In the long run, the semantic map of questions and answers can be integrated into the NLP algorithm to support a highly customized and engaging interview format.

### Key Resources

**NLP algorithms:** Access to state-of-the-art NLP algorithms is crucial to make the key features of Fabula feasible. On the one hand, an accurate voice-to-text algorithm enables the software to transcribe the user's speech. Its understanding allows it to pick up the speech and transform it into text, although some elderly may have a slightly lower volume and use dialects while speaking. On the other hand, the software offers editing and summarizing suggestions on the text output. This feature assists the manual editing done by the user and ensures a seamless editing process. The quality of the editing algorithm's advice will also improve over time and gradually reduce the amount of manual work involved. The long-term product vision is to have the editing process entirely automated.

**Input from the users in the form of voice and texts:** Due to the service's nature, the platform accumulates large data sets of text and voice input by the user that direct responses to the questions. The data sets are the basis for further optimization of the speech-to-text algorithm. It will help predict user output when voice's clarity is lacking; it is also useful to understand the semantic path dependencies of the user's answers. This enables Fabula to continuously improve the interactivity of the interview process.







### Key Partners

**Provider of NLP software:** NLP algorithms are prerequisites for Fabula's features. However, developing NLP algorithms in-house requires significant resources and may be difficult in the short run due to budgetary constraints. Therefore, it is crucial to forge partnerships with state-of-the-art NLP providers, such as Google, for the solution's success. For the minimum viable product, Fabula invokes Google's NLP Application Programming Interface (API) and concierge services where humans partially edit the text. This integration enables Fabula to create a proof of concept with minimal resources. In the medium and long run, Fabula will work together with NLP providers to develop algorithms specifically tailored to stories. The large amount of story data expected to be generated on the platform would enable this NLP research.

**Publishing network:** Some users wish to have a tangible end product such as a hard copy. The platform achieves this high publication quality by cooperating with publishers, freelance editors, and graphic designers to offer premium manual services. The editor summarizes and edits the written text while the graphic designer creates illustrations for the cover page. The publisher is responsible for printing and binding the pages into a book. As a premium add-on feature, this hardcopy costs extra. By having the publishing network as a key partner, the users who are willing to pay will benefit from the streamlined chain of services.



### Revenue Streams

**Recurring revenue stream:** Fabula's primary revenue model is based on a subscription fee. The users can choose between a basic free and a premium version on the Fabula website. In the free version, a user has access to all the premium version features but can only record five stories in total, which can be of any length. These features include speech-to-text, grammatical correction, and sharing options. The option to share one's story ensures a word-of-mouth effect and a higher customer attraction. After recording five memories, the user is obliged to switch to the premium version. This version is billed at EUR 9.95 a month with a discount for yearly subscriptions. Users can cancel subscriptions every month and receive notifications if they have not used the service over a long period, as Fabula does not want to exploit its users.

**Non-recurring revenue stream:** After collecting enough stories, the users can print their memories into a book or convert

them into an audiobook. For this, they need to pay extra to cover professional editing and printing costs. In addition to these costs, Fabula will take a commission for the publishing. Fabula plans to automate both of these services in the medium to long term.



### Cost Structure

**Fixed Costs:** Since Fabula revolves around a digital web application, it can limit its fixed costs to technological development and other standard expenses, such as office expenses and human resource costs. The development costs pose the most significant challenge as Fabula needs to interface with NLPaaS (NLP as a service) providers. To integrate their APIs and develop an easy-to-use and intuitive website is the product's largest initial investment. For customer attraction, Fabula will need to run marketing campaigns specifically targeting the elderly and their (grand-) children, which are two vastly different target groups. Fabula can address the younger generation through online ads using search words related to old age. Fabula also considers conventional advertising platforms like running offline ads in local newspapers for the older target group.

**Variable Costs:** Compared to its development costs, Fabula's running and variable costs are much lower. The users' data can be securely stored with cloud providers, which charge for storage based on the data volume. Since Fabula needs support for the conversion of speech-to-text, syntactic and grammatical correction, and potentially abstraction and summarization tools, it pays for the API access based on the number of users. Finally, if the user decides to pay an additional fee for the premium subscription, there will be publishing costs, such as paying a professional editor. Fabula plans to pass such expenses on to the user as charges for premium features.

Scenario Fit

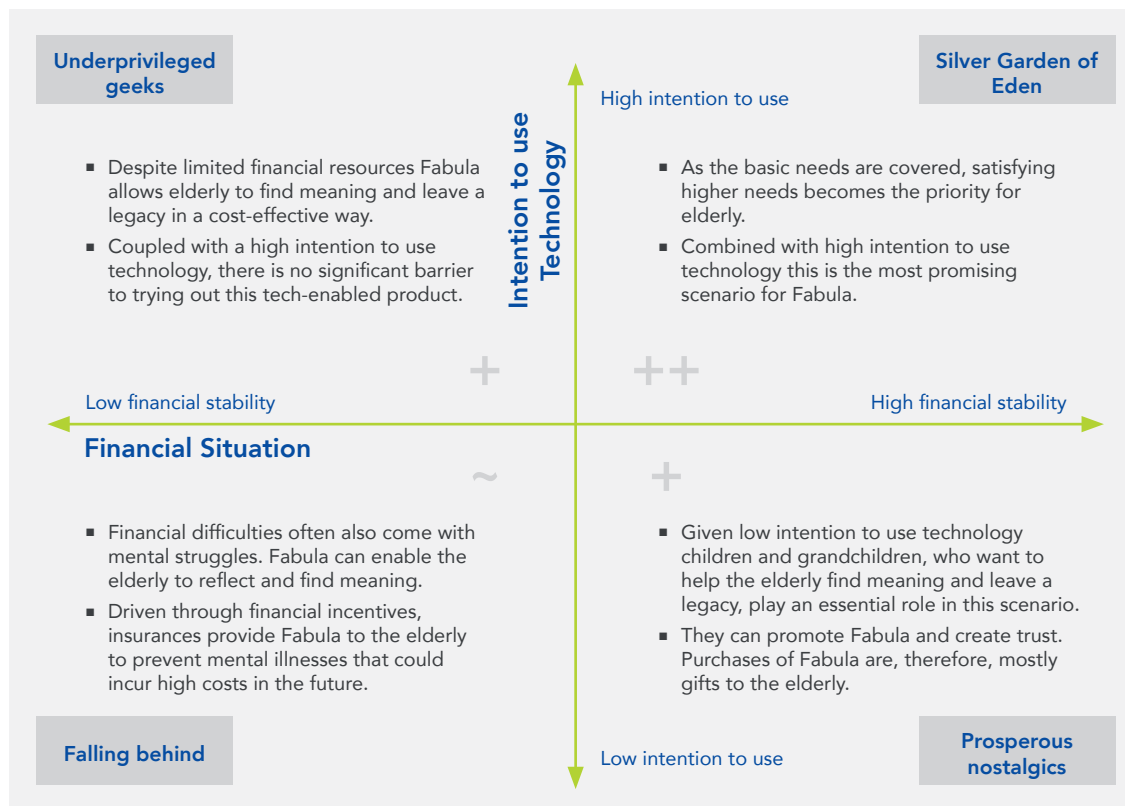
**Underprivileged Geeks:** When the elderly are generally suffering from unstable financial situations, it is probable that they are struggling to fulfill their basic needs, such as health and accommodation. This situation will limit their intention to pursue fulfilling activities such as finding meaning. As the interaction and editing features of the product are tech-enabled, they are scalable and more affordable. Hence, even the underprivileged users can record their life stories and leave a legacy in a cost-effective way. Coupled with a high intention to use technology, these users have no significant barrier to adopting this product. Hence, Fabula is attractive to a substantial proportion of the elderly population in this scenario.

**Silver Garden of Eden:** As the general financial outlook for the elderly is positive, almost all of them have enough means to fulfill their basic needs. With the basic needs covered, seniors have the financial freedom to pursue fulfilling activities. These activities encompass a search for meaning and the intention to leave a legacy beyond one's life span. Therefore, the elderly would find Fabula an attractive product, as it exactly fulfills these needs. Additionally, with economic resources to spare, the elderly across all social segments are likely to find the product affordable and may even have a high demand for premium services, such as manual editing and publishing. As the elderly have a high intention to use technology, they are willing to use a tech-enabled product like Fabula, allowing it to fare particularly well in this scenario.

**Prosperous Nostalgics:** In this scenario, the elderly deal with needs beyond their basic ones as they can already comfortably cover these. Additionally, they have time since working is not a necessity. These two factors strongly support the adoption of Fabula. However, the scenario comes with a low intention to use technology that impedes their willingness to talk to a digital interviewer. In this case, children and grandchildren, who want to help the elderly find meaning and leave a legacy, play an essential role as they are the ones who can promote the product and create trust. Purchases of Fabula are, therefore, mostly gifts to the elderly. Once they give the product a try, they open up more and are willing to continue using it. Because they can afford premium features that can further increase the perceived usefulness, Fabula becomes even more attractive during initial usage.

**Falling Behind:** As with most tech-enabled products, Fabula has a difficult time thriving in this scenario. The elderly already struggle to cover their basic needs and rarely spare portions of their income to purchase technology products that often tackle problems irrelevant to the elderly. There is also a general wariness of these products among the elderly. Nevertheless, Fabula has a place in these circumstances since the elderly who struggle financially also often struggle mentally. Fabula can enable the elderly to reflect and find meaning. Insurance companies become crucial partners because most elderly would not purchase this product themselves. The insurance companies provide Fabula to the elderly to prevent mental illnesses that would otherwise incur

high costs in the future. This provision also remedies the low intention to use; once the elderly get the chance to try out Fabula, they would start seeing its value.



## Fabula

### Challenges

- Customer retention is difficult since the elderly might not want to talk about memories every day, which discourages regular use.
- Customer acquisition costs are high since Fabula's target group is rather technology-averse. Using offline ads for Fabula's target group is relatively expensive.
- Since Fabula relies on interfacing NLP technology, it does not have the best speech detection, especially for older people with potentially strong dialects.
- Data privacy is one of Fabula's biggest concerns since many people are reluctant to share personal information on the internet. Fabula addresses this concern with state-of-the-art encryption and high transparency.
- Currently, less than 45% of 70-plus-year-olds use the internet. This data implies that Fabula can only target half of its potential user group, but this number is likely to increase in the upcoming years, following the trend since the 2000s.

### Outlook

The opportunity to self-reflect makes the elderly's lives happier and more valuable. The older one gets, the more experiences one can share before being forgotten over the following generations. To prevent this loss of information, Fabula enables its users to preserve and access their memories wherever and whenever they need it. The elderly can summarize their most important and life-changing experiences in either a written or an audio format. Therefore, the web app not only acts as a platform for reflection and mental well-being but also provides meaning. The ability to share one's experience with others and leave a legacy motivates the users and leads to high attraction and retention rates. Fabula targets a market without similar competitors. Fabula has the potential to help millions of seniors around the world to know that their most important memories will be protected and shared for many years to come.





# SMART SOLE SOLUTION

The convenient gait rehabilitation assistant for faster recovery

Mobility is an essential factor for the independent living of the elderly. Thus, a fast and full recovery after severe gait affecting surgeries is crucial. Especially elderly need to exercise daily besides their weekly physiotherapy to successfully recover from surgical interventions around the hip and knee area. Physiotherapists observe that patients' willingness to work out at home is low, and the incentives to encourage patients to exercise more actively are missing. Smart Sole Solution (S<sup>3</sup>) is solving this problem by lowering the barrier to exercise at home and monitoring the recovery progress.

S<sup>3</sup> is a sensory insole combined with an app for smartphones and web-browsers. On the one hand, the insole sensors are necessary to monitor, in real-time, walking speed, step frequency, length of one step, and pressure distribution. The app, on the other hand, combines the insole data with

a video gait analysis and hence improves physiotherapists' gait analysis. The physiotherapist can easily record a video of the patient walking, and the app evaluates the gait anomaly by tracking shoulder movements, hip positioning, and knee bending based on the video input and combines this with the insole sensor data. The app displays correction lines along the shoulder, hip, and knee axis in real-time in the video together with arrows pointing out the malalignments causing the gait anomaly. This additional video analysis supports the physiotherapist in expressing the gait anomaly in an easily understandable manner for the elderly patient.

To ensure the active participation of the elderly at home, S<sup>3</sup> lowers the barrier of working out with the help of a homework-assistant (HWA). The HWA demonstrates via video the exercises assigned by the physiotherapist, monitors in real-time via the insoles, and video-analyses the execution of

the exercises and calls out for corrections. Push notifications of the S<sup>3</sup> app remind the patient to exercise daily. The documentation interface of S<sup>3</sup> displays the current stability and rehabilitation score, together with the recovery progress. Combined with the patient's gait videos and visualized graphs of improvements, it has a positive gamification-like effect to encourage the elderly to exercise regularly, thereby significantly enhancing the recovery process.

**Business Model**



### Value Proposition

The core mission of S<sup>3</sup> is to accelerate and facilitate a patient's gait rehabilitation process after an operation.

**Patient:** For the patient this means that by using S<sup>3</sup> during rehabilitation, recovery time can, on average, be reduced by 17%, as estimated by a renowned physiotherapist. Furthermore, the patient can engage in convenient and flexible home exercises, which decrease the need for in-person sessions with a physiotherapist. By creating an environment of awareness through constant feedback, S<sup>3</sup> increases the exercises' positive outcome significantly. This environment also leads to the patients' higher motivation as they can track their progress and see if they execute their exercises correctly. Partly, S<sup>3</sup> implements gamification aspects to increase further the willingness to do one's exercises. Finally, the sensors in the sole can detect if a person falls and immediately call for help.

**Physiotherapist:** For physiotherapists, the value lies within a better working relationship with the patient. First, the patient's communication is eased tremendously by giving the physiotherapist the possibility to show the patient the exercises multiple times, namely in the form of videos on the platform. The physiotherapist can also demonstrate the gait anomalies in an easily understandable way to the patient by using the video analysis function. Second, the patient can reach out to the physiotherapist to clarify questions or overcome problems. Third, with the help of the data gathered by the sole, the therapist can analyze the patient's exercise execution and progress during the in-person session.

**Health insurance:** For health insurances, reduced costs for physiotherapy are the key value proposition. This is possible because of i) a shorter overall gait rehabilitation process and ii) a reduced need for in-person sessions with the physiotherapists. By using S<sup>3</sup>, a patient can also recover from surgery more thoroughly so that there are fewer follow-up costs including pain treatments, appointments with doctors, or an expansion of the physiotherapy.

### Customer Segments

S<sup>3</sup> will address three different customer segments:

**Patients:** In the early stages, the focus customer group of S<sup>3</sup> will be the elderly recovering from hip or knee joint replacement surgeries that require gait rehabilitation. This group is

keen on using the product (i) to reduce their recovery time, (ii) to be more flexible when it comes down to physiotherapy appointments, (iii) to be more motivated to do their exercises, and (iv) to have support in the form of reminders and exercise corrections.

**Physiotherapists and rehabilitation clinics:** This segment wants to use S<sup>3</sup> to offer a better service and more time to focus on the patient. By gathering all the data in a session and at home, they can tailor the exercises to the patient and see which movements still cause problems. Rehabilitation clinics like to implement S<sup>3</sup> to give their patients the best possible rehabilitation process because by doing so, they can take care of more patients over time.

**Health insurances:** As financial resources are limited, health insurances have an inherent interest in cutting their costs as long as it is not to customers' disadvantage. By using S<sup>3</sup>, the gait rehabilitation process can be shortened by 17%, which cuts the hours of physiotherapist sessions needed.

### Customer Relationships

Managing good customer relationships must be an essential quality of S<sup>3</sup>. This is because there are three different types of customers who are highly related to each other.

**Patient:** The relationship with the patient is mostly managed and developed via the platform. The recovery progress overview builds up trust in the product, keeps the elderly motivated, and ensures further app usage. Apart from the platform, a hotline helps in case of technical difficulties and gives the possibility to always reach out to someone to clarify questions.

**Physiotherapist:** As the success of S<sup>3</sup> is dependent on the physiotherapists' willingness to use the product, they are supported in the appliance at every stage. The initial phase of getting to know the product and its functions is supported by S<sup>3</sup>'s own staff. Furthermore, continuous support is offered



## Smart Sole Solution

by giving training and workshops to integrate the product even better into their therapy and get to know new features.

**Health insurance:** Relationship building is key for winning health insurances as valuable partners and getting first-hand insights into their demands. The sales process will not consist of cold calling and making sales appointments but will instead represent an ongoing relationship that needs to be taken care of at every point in time.



### Channels

To address the three different types of parties, S<sup>3</sup> uses targeted channels for each one of them:

**Patient:** The first and foremost channel to reach patients is the doctors' prescriptions. After having an operation that is affecting the gait and therefore requires a rehabilitation process, doctors need to prescribe S<sup>3</sup> in addition to traditional physiotherapy. Hence, for the success of S<sup>3</sup>, it is important to maintain good relationships with doctors and make sure that they know about our solution. Besides doctors, the physiotherapy sessions themselves are another channel by which patients can be reached as it might be that the original doctor does not know about our solution yet, but the physiotherapist does. In this case, the physiotherapist can tell the patient to ask his doctor for a prescription of our solution.

Another channel to reach the patients are health magazines and platforms because most of the elderly use traditional media sources as their primary source of information. Therefore, patients have to be made aware of S<sup>3</sup> so they can proactively ask their doctor to benefit from it.

**Physiotherapist:** The main channel for reaching the physiotherapists are the insurances which encourage them to use our product. Significant cost savings incentivize physiotherapists and health insurances alike to adopt our product. Furthermore, S<sup>3</sup> will be showcasing at fairs and conferences to increase its reach and engage in direct dialogue with physiotherapists.

**Health insurance:** Health insurance companies will be targeted in a tailored marketing and sales process. Especially in the latter, a close relationship has to be maintained from day one onwards to address their needs and gain their backing.



### Key Activities

Key activities of S<sup>3</sup> focus on the continuous improvement of the product and its services to achieve maximum value for patients, physiotherapists, and thereby insurances in the last instance.

**Continuous product development:** After developing the first commercialized version, S<sup>3</sup> pursues a continuous development cycle. This approach ensures that state-of-the-art technology is used, and new findings in medicine, especially among our key partners, are integrated. Thereby, the best possible experience in the rehabilitation process is offered to the elderly.

**Therapy conception and regular content updates on the platform:** The initial therapy conception and a constant expansion and update of the content offered on our platform is crucial to supplement the ongoing development of our product. Physiotherapists shall be able to integrate their own exercises. Thereby, they play a vital role in shaping our platform and introducing new content.

**Marketing and sales:** Especially in the environment of S<sup>3</sup>, it will be crucial to target the right people from the very beginning. Sales will not only focus on insurances but also on physiotherapists directly, which can then reach out to the insurances to increase the product awareness. Furthermore, S<sup>3</sup> targets doctors to make them aware of the possibility of prescribing S<sup>3</sup> to significantly reduce their patients' rehabilitation process. Hence, for these groups, S<sup>3</sup> pursues a push-marketing approach. In contrast, a pull-marketing strategy will be adopted for the patients since they will not buy our product at the beginning of their rehab directly but get it via their physiotherapists.

**Data analysis:** One core feature of our product is gathering a vast quantity of gait specific data. This includes the pressure maps with gait lines, foot orientation and pronation, gait cycles, and balance analysis. Insights from this data will be used to improve the gait during home training sessions. In addition, the home training can be recorded and serve as valuable input for the session with the physiotherapist. Finally, the data will be used to continuously evaluate the effectiveness of the exercises offered on the platform.



 Key Resources

The key resources needed to make S<sup>3</sup> successful consist of three categories: (i) Know-how, which will mostly be provided by the employees, (ii) necessary funding, and (iii) partners involved in the development process as co-creators.

**Technical hardware know-how:** The sole represents a highly complex product involving miniature sensors operated under pressure and constant movement. In addition, safety and energy efficiency aspects have to be integrated. To realize that, technical know-how about the hardware must be given. Questions such as which hardware should be used and how it should be placed and operated must be answered.

**Medical know-how:** Obtaining the classification of a medical device requires sophisticated medical know-how. This need for know-how applies to the field of regulation and the design as well as to the development of the product and its surrounding platform. Having this know-how ensures a smooth launch and a frictionless introduction of future improvements.

**Patents:** Patents will be relevant in two ways: i) S<sup>3</sup> needs to

obtain the license to use certain technologies to develop the product in the first place, ii) S<sup>3</sup> has to establish its patents to demonstrate traction with investors and to secure intellectual properties.

**Human capital:** The aforementioned know-how will come into the company in the form of talented and motivated employees of various disciplines who are willing to work together to integrate all different subparts into one functioning offering.

**Funding:** Although it should be reasonably cheap to come up with a first prototype, the design and manufacturing of a sophisticated product, as well as the development of the ICT platform is cost-intensive. Adhering to current regulations and the surrounding marketing and sales processes will require further investment.

**Physiotherapists and elderly persons as co-creators:** During the product development as well as its continuous improvement, physiotherapists and patients shall be involved in the whole process as co-creators to ensure a user-centric approach.

 Key Partners

To ensure a triumphant market entrance, S<sup>3</sup> seeks to cooperate with various partners along the development lifecycle. Renowned doctors and therapists: At the beginning of the development, the frequent exchange with renowned surgical orthopedists and physiotherapists is important. Close conversations ensure that their expertise can be leveraged from the early stages of designing the smart sole and developing the software.

**Health insurances:** As health insurances are the ultimate financing party and determine whether S<sup>3</sup> is a success, winning them as partners right from the beginning is essential. S<sup>3</sup> aims to start a dialogue as soon as possible to identify their priorities and to be able to continuously align with them if S<sup>3</sup> is tackling their needs. Furthermore, in cooperation with insurances, it has to be determined how the product is distributed to the different rehabilitation clinics and physiotherapists.

**Manufacturers and suppliers:** At least at the beginning, the production of the sole needs to be outsourced, which stresses the importance of having a good relationship with a trusted manufacturer. Furthermore, as S<sup>3</sup> is acting in a highly regulated environment, the highest quality levels are indispensable for its success. These quality requirements do not only apply to the manufacturing process but also the integrated components.

**Rehabilitation clinics:** Rehabilitation clinics are crucial partners to reach multiple physiotherapists at once. Private companies often own these, so winning them as partners is a powerful lever to attain high market penetration. Integrating their demands during the development and the continuous improvement of the product sets the base for fruitful long-term partnerships

 Revenue Streams

The primary revenue source for S<sup>3</sup> is the money received from insurances when doctors prescribe the product to their patients. In Germany, 441,560 patients have a knee or hip joint replacement every year. This figure represents the total addressable market. Out of these, 400,000 people are elderly, which is the serviceable addressable market. The market size for this group amounts to 200m EUR every year. Besides the prescription, other fields of revenue can be tapped into:

**Insurance:** In the default case, a patient gets S<sup>3</sup> prescribed





## Smart Sole Solution

in addition to his usual gait rehabilitation plan. The costs are then covered by the insurance, which pays S<sup>3</sup> to distribute the product to the physiotherapists.

**Patients:** Once a patient has finished their rehabilitation, they might still be interested in using S<sup>3</sup> for further improvement and for maintaining their progress. In this case, the sole is sold directly to the patient at the end of the rehab instead of being disinfected and used again. In this case, a subscription to our platform must be obtained to be able to access current and upcoming content.

**Third parties:** S<sup>3</sup> gathers various data that can be used in an anonymized form by multiple parties. Research institutes might be interested in acquiring the data to gain further insights. Insurances can analyze their customers' behavior and develop incentive schemes to support the optimal rehab process. Sole manufacturers can use the data to further improve their products by using individual, highly specific data.

### Cost Structure

To develop the sole and establish the surrounding platform, S<sup>3</sup> has to front initial investment costs. After having developed the first version and having set up the platform, further fixed and variable costs will occur:

**Initial investments:** In order (i) to create a first version of the sole, (ii) to develop the platform with its analysis functionality, (iii) and to provide initial content, a substantial investment is needed. Furthermore, as S<sup>3</sup> seeks to operate as a medical device, legal advice must ensure compliance with the current regulations.

**Fixed costs:** The biggest fixed cost block is the salaries for S<sup>3</sup> employees. To develop the hardware and software, a variety of talented employees and medical and legal experts are needed. The highest fixed costs consist of the office space's rent and the maintenance of the IT infrastructure.

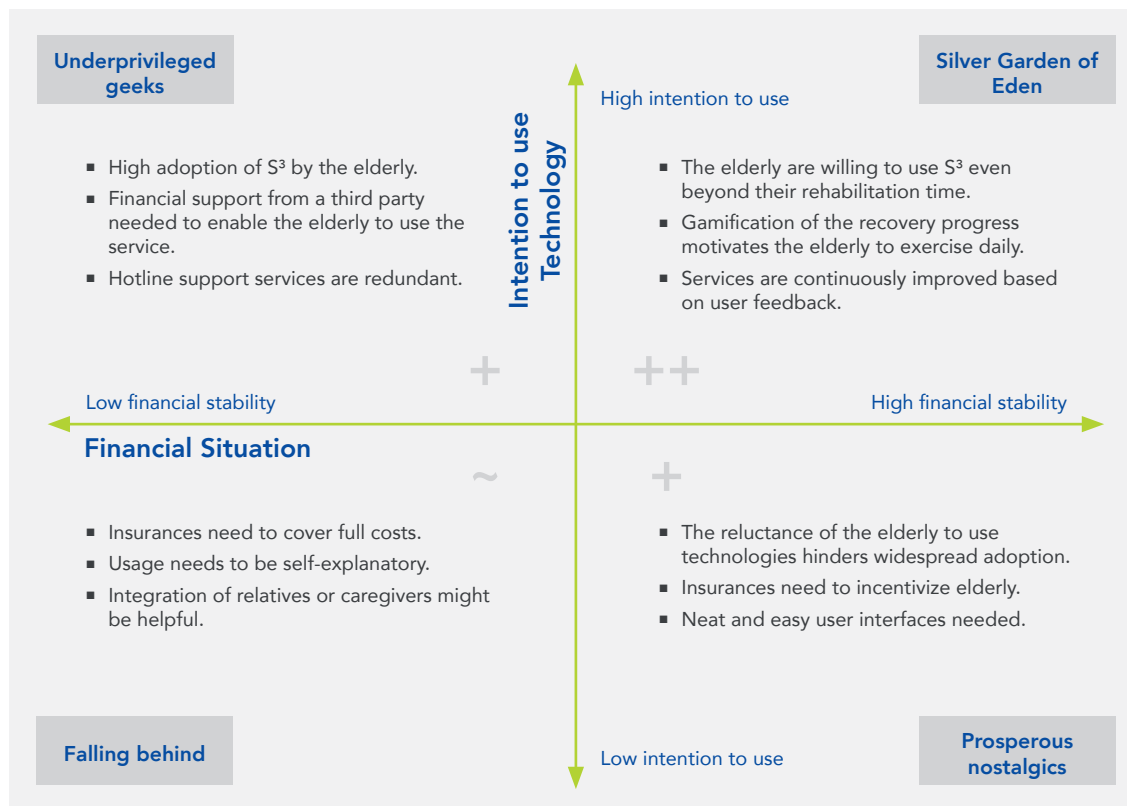
**Variable costs:** R&D costs differ depending on the stage of the development cycle. When launching a new version - either of the sole or the platform and when doing a significant content update - these costs may be higher. The same applies to costs for marketing and sales. Especially at the beginning, where winning key partners is crucial, acquisition costs can be high. Later on, they might increase even further when launching in other countries or trying to win major rehabilitation clinics as customers. The costs for customer support depend on the number of users.

## Scenario Fit

**Underprivileged Geeks:** In this scenario, the elderly being interested in disruptive technologies and being digitally literate will positively affect the usage of S<sup>3</sup> during post-surgery rehabilitation. To overcome the poor financial situation of the elderly, insurances will need to cover the full costs of S<sup>3</sup> usage to enable the elderly to integrate the service into their recovery journey. Since the elderly will be willing to include technologies into their daily routine, S<sup>3</sup> insoles and the HWA will be used every day during rehabilitation time. These additional home exercises will significantly impact the elderly's rehabilitation and shorten the recovery time significantly. The

HWA will be self-explanatory for the elderly hence hotline services will not be commonly used.

**Silver Garden of Eden:** The financially stable situation of the elderly, paired with being highly digitally literate, will unleash the full potential of S<sup>3</sup>. The elderly will be willing to use S<sup>3</sup> during their rehabilitation time and actively ask for the service at their rehabilitation clinics or physiotherapists. Since the elderly are financially well off, they will cover the costs themselves if insurances are not covering it. Based on the daily integration of S<sup>3</sup> insoles and the HWA, the elderly will be able to recover significantly faster from severe surgeries. Many elderly will enjoy the HWA and thus voluntarily utilize



## Smart Sole Solution

S<sup>3</sup> even after their rehabilitation. The elderly will regularly give feedback on S<sup>3</sup> services via the app, which improves the UX even further.

**Prosperous Nostalgics:** Overcoming the elderly's reluctance to use technologies daily will be a significant challenge for S<sup>3</sup> in this scenario. Relatives and insurance companies will need to encourage the elderly to integrate the technology into their everyday routine actively. The recovery time after surgery can be reduced by 17%. Together with the pain point of immobility, these benefits will push the elderly to overcome their aversion to technologies. To lower the technology usage barrier even further, it will be crucial for the S<sup>3</sup> application to have a patient user-interface as easily understandable and convenient as possible. Service hotlines will be extended to improve the customer relationship.

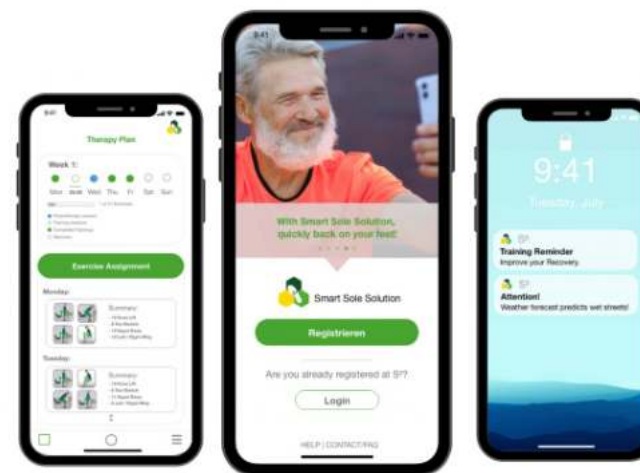
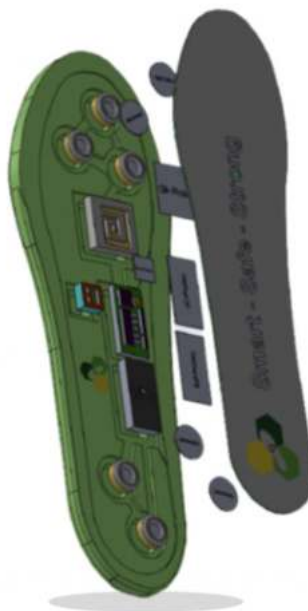
**Falling Behind:** The aversion to technologies paired with the financially unstable situation of the elderly will make this scenario the most challenging one for S<sup>3</sup>. To provide the elderly with S<sup>3</sup> after severe surgeries, insurances need to cover the full cost of the usage and incentivize the elderly to use the sensory insoles and the app for home workouts. It will be crucial for S<sup>3</sup> to have a user-interface as neat and easy to use as possible to overcome the elderly's reluctance to use technologies. An additional feature involving relatives or caregivers in the daily exercises might further encourage the elderly to use S<sup>3</sup> during their rehabilitation. Furthermore, it will be essential to extend the hotline services to improve the customer relationship.

### Challenges

- Overcoming the reluctance of the elderly to use smartphones for home-workouts.
- Engaging insurances to cover the full cost of S<sup>3</sup> usage for physiotherapy.
- Incentivizing patients to exercise daily.
- Proving that S<sup>3</sup> usage enhances the physiotherapy significantly.
- Receiving the medical product certification.
- Becoming the standard app for physiotherapists.
- Protecting patients from data misuse by insurances.
- Needing a convenient and easily understandable usage to lower the barrier of S<sup>3</sup> use by the elderly.
- Charging of the insole batteries needs to be as convenient as possible.

### Outlook

In the future, S<sup>3</sup> could become the most popular and successful app complementing physiotherapy globally. S<sup>3</sup> will further develop and improve the algorithms monitoring body posture and the insole sensors to facilitate the usage for other rehabilitation purposes. One crucial step to reach this goal is to develop a more modular sensor that is independent of the insole. The gamification of the recovery process and the neat and easy UI will also be appealing for other age-groups. Based on the HWA's positive health impact, S<sup>3</sup> will shift the focus towards health prevention in the future. To further improve the monitoring and impact of home workouts, S<sup>3</sup> will reach the next level by integrating electrical muscle stimulation (EMS) training and smart mirrors into the patient journey. The data analysis advancements and long battery life that S<sup>3</sup> will offer could make it attractive for athletes to monitor their physical abilities conveniently and daily.



# desir.ed

## DESIR.ED

Educational platform to help the elderly enjoy a fulfilled sex life

The elderly often do not live out their sexuality. Despite the proven health benefits of sex [463], elderly sexuality is a tabooed topic. This taboo results in a lack of public discourse on the subject and often causes the elderly to lack the understanding, knowledge, and role models to adapt to changes in their bodies and sexuality. Without the right guidance, it becomes nearly impossible to return to a fulfilled sex life after long stressful periods or illnesses and injuries. Because this topic is usually a taboo during doctor visits and with friends or family, the only remaining alternatives are disputable online resources, such as blog articles.

Desir.ed addresses each of these issues and enables a fulfilled sex life at an age believed to be the "golden age of sexuality." As an online education platform, desir.ed guides its users through their customized "sexual journey." With high-quality content adapted to individual preferences, needs, physical

abilities, and personal expert consultation, desir.ed serves one of the most pressing needs of the elderly. The user journey begins with a candid and straightforward onboarding process, where desir.ed learns about the preferences, needs, and impairments of the user. Desir.ed's smart recommendation engine then proposes "learning paths" and "curiosity paths" based on the user's inputs. Along the learning paths, topics on sexual health and other factors affecting personal sex life are tackled, such as dealing with a hip impairment. Curiosity paths address the users' need to explore and give them the confidence to experiment by guiding them through uncharted sexual territory. The learning and curiosity paths add up to a personal sexual journey bringing back confidence and fulfillment into the user's sex life.

Quality, trust, and inclusion form the basis of desir.ed's core values. Throughout the entire journey, users are guided

through a mix of high-quality educational content and offered consultation sessions with certified professionals. Desir.ed aims to ensure value provision to people of all genders and sexual identities.

Our mission is to educate and inspire everyone to enjoy a fulfilled sex life all the way into old age.

**Business Model**

 **Key Partners**

- Doctors and therapists specialized in elderly sexuality
- Health insurances
- Experienced individual content creators
- Public ambassadors

 **Key Activities**

- Creating high-quality educational content
- Web and application development
- Establishing external partnerships
- Breaking the social stigma

 **Value Proposition**

- Help people enjoy a fulfilled sex life into old age
- High-quality educational content and advice about elderly sexuality
- Normalize the social discourse around old-age sexuality

 **Customer Relationships**

- Automated self-service
- Dedicated personal assistance

 **Customer Segments**

- Senior people with certain disabilities/ailments
- Senior people free of any significant disabilities/ailments
- LGBTQ community

 **Key Resources**

- Product development team and infrastructure
- Core team of domain experts
- Core team of content creators
- Legal expertise

 **Channels**

- Insurance
- Newspaper, TV
- Doctors and therapists
- Guerilla marketing

 **Cost Structure**

**Initial investments**

- Technical platform
- Smart recommendation engine
- Initial content creation

**Fixed Costs**

- Office space and further work equipment
- IT infrastructure

**Variable Costs**

- Educational content
- Customer acquisition
- Advertisement

 **Revenue Streams**

- Pay-per-Path
- Subscription fee
- Commission
- Health insurances



## Value Proposition

**Help people enjoy a fulfilled sex life into old age:** Aging changes peoples' habits, bodies, and sexuality. A lack of sexual confidence and discomfort with one's appearance often accompanies these changes. To add to the elderly's woes, the stigma associated with old-age sexuality prevents them from discussing their challenges with most people, including their doctors. Often the challenges feel too personal or too complex to discuss even with one's partner, which leaves a void in which people lack someone they can consult. Desir.ed fills this void and lowers the barrier to access professional guidance, advice, and inspiration. Thus, desir.ed empowers its users to turn their old-age into the golden age of sexuality and foster the resulting health benefits.

**Quality and personalization:** Desir.ed works with experts to provide high-quality content and individualized private consultation. During its user onboarding process, desir.ed's smart recommendation engine makes sure to learn all the necessary details about the user's needs, preferences, and impairments. With this information analysis, the platform suggests tailored learning and curiosity paths that add to each user's own sexual journey.

**Normalize the social discourse around old-age sexuality:** A crucial factor for a fulfilled sex life is talking about it and understanding individual differences. Current societal trends widely suppress such discourse about sexuality in one's old age. This suppression is mainly attributed to the fact that sex is commonly associated with youthfulness and rarely with the elderly. The situation is even worse for the elderly belonging to the LGBTQ community. The prevalence of these stigmas creates frustration, fear, and insecurities. Desir.ed aims to launch public awareness campaigns to eradicate the stigma and make elderly sexuality a part of the mainstream social discourse.



## Customer Segments

Desir.ed's targeted customer segments include people who want to continue embracing their sexuality into old age. Overall, desir.ed is committed to being an inclusive platform and strives to ensure that its offering is valuable to all genders and sexual orientations.

**Aged people with specific disabilities/ailments:** Desir.ed designs its products around physiological and psychological challenges associated with elderly sexuality. One of the

target customer segments presents people who wish to educate themselves on how their sex lives can proceed after recovering from injuries, surgeries, and also in the light of chronic diseases such as diabetes and arthritis. The learning paths and expert consultation sessions offered on desir.ed's platform provide meaningful value to such customers.

**Aged people free of any major disabilities/ailments:** Research surveys indicate that people over 50 years of age often engage in sexual activity contrary to popular belief. Not being comfortable with one's appearance and lacking sexual confidence in old-age are widely stated reasons for the absence of a fulfilled sex life. People would be keen to discuss age-related changes in sexual experience; however, the associated stigma prevents such discourse from happening. Desir.ed offers a platform for the elderly to learn more about the subject and confidently rekindle their sex lives with our curiosity paths and ask any questions that still stay unaddressed during one-to-one sessions with experts.

**LGBTQ community:** The LGBTQ community represents a sub-community whose sexual needs are equally marginalized. People's old-age challenges become more severe when their sexual preferences do not conform to "traditional expectations". This causes them to have even fewer people to talk to about topics around sexuality. Upholding its core values of trust and inclusion, desir.ed works to ensure that the content and advice on its platform do not exclude any sub-community while continuing to be mindful of the user's data privacy concerns.



## Customer Relationships

**Automated self-service:** One's sexuality is a deeply personal topic and deserves to be treated like one. On its platform, desir.ed's customers can choose from various educational content that the users can view without any shame and complete privacy. The content on the platform is structured into learning and curiosity paths. Learning paths tackle specific age-related challenges to sexuality, and the curiosity paths allow the users to gain new inspiration and confidently venture into unexplored territory. Information about the users' interests and physical impairments gathered during the onboarding process provides relevant recommendations for new content. Building and maintaining the trust of its customers is one of desir.ed's highest priorities. Personal data concerning the customer's sexual journey is highly sensitive, but it also enables desir.ed to provide relevant educational content. With more data available along the journey, the

content becomes more tailored to each user's needs and interests.

**Dedicated personal assistance:** Some topics along the user's journey to a fulfilled sex life require individual and personal advice by human experts in the respective field. To meet this need, desir.ed offers expert consultation sessions as an integral part of the user's personalized sexual journey. Customers can book sessions through the application, either in addition to a path they are currently pursuing or as a stand-alone consultation about a specific topic. To ensure transparency, desir.ed clearly explains to its users how the smart recommendation engine proposes a shortlist of suitable experts based on the customer's needs and journey so far. The users have complete control over what private information they wish to share with the experts they speak to.



## Channels

**Insurances:** Living a fulfilled sex life comes with numerous proven advantages for personal health and well-being. Desir.ed helps its customers to live healthier lives and thus, enables substantial cost reductions for insurances. Owing to this, desir.ed expects to build strong and lasting partnerships with health insurances. These partnerships would not only expand desir.ed's user base due to the reimbursements offered by the health insurance, but also serve as channels to advertise desir.ed and its value proposition.

**Newspaper, TV:** Not all of desir.ed's potential customers are active social media and internet users. With elegant yet enlightening TV commercials and newspaper advertisements, desir.ed will attract potential customers' attention. Commercials featuring desir.ed's brand ambassadors will help break the societal taboo regarding old-age sexuality and combat the elderly's inhibition in using desir.ed's platform.

**Doctors and therapists:** Desir.ed closely cooperates with doctors and therapists to ensure publishing only the highest-quality content on its platform. These partnerships further help to acquire new users, especially in desir.ed's growth stages. Partners will advertise desir.ed to their existing patients and clients. Advertising measures include, in this case, both word of mouth and the distribution of pamphlets and brochures.

**Guerrilla marketing:** Desir.ed also aims to integrate taboo-breaking into its marketing strategy. This serves the company's goals by advertising its product and drives the normalization of old-age sex as a topic in society. Possible examples include unapologetically bold billboards, public events, and merchandise.

## Key Activities

**Creating high-quality educational content:** Using the learning and curiosity paths that are customized to the users' needs and preferences, desir.ed's goal is to educate and inspire the users of its platform. To do so, desir.ed needs to create high-quality educational content. This content is generated by an expert content creation team, which works closely with external key partners like doctors and sex therapists to ensure the highest quality standards. This content is then packaged into the many different paths and published on the web and mobile applications.

**Web and application development:** For desir.ed's educational content to be easily accessible, it provides both a web and mobile application. Developing these platforms is a crucial activity and includes usability testing to ensure that the application features are easy to use for desir.ed's target user groups. The fact that a majority of desir.ed's user base is not necessarily tech-savvy, further emphasizes how the adoption of desir.ed's web and mobile applications depends strongly on their intuitive design.

**Establishing external partnerships:** To lower the bar of getting in touch with a consultant for sexual advice, desir.ed aims to build a pool of external partners familiar with critical topics around the issue of sexuality in old-age. This pool includes experts such as urologists and sex therapists, as well as individuals speaking from their own experience. Additionally, desir.ed will establish partnerships with health insurance providers to enable the users to receive reimbursements for using its platform.

**Breaking the social stigma:** A primary goal of desir.ed is to eradicate the stigma around old-age sexuality and educate society in this regard. Therefore, another key activity is to advocate desir.ed and its content in the public sphere by conducting events, guerilla marketing campaigns, and television advertisements.

## Key Resources

**Product development team and infrastructure:** Desir.ed engages its customers through a web application and a mobile application. These are the two most essential touchpoints for the platform. With a skilled product development team and the right hosting infrastructure, desir.ed offers a seamless and intuitive UX, ensures that the users' data is secure at all times, and recommends content suitable and adaptive towards their needs and impairments.

**Core team of domain experts:** In addition to the experts and therapists that desir.ed partners with, it builds a dedicated core team of domain experts to decide the topics covered along the sexual journey, author content for the learning and curiosity paths, and screen content from non-expert contributors. Some of the domain experts also leverage the in-depth knowledge that they have about desir.ed's users to contribute to the product design.

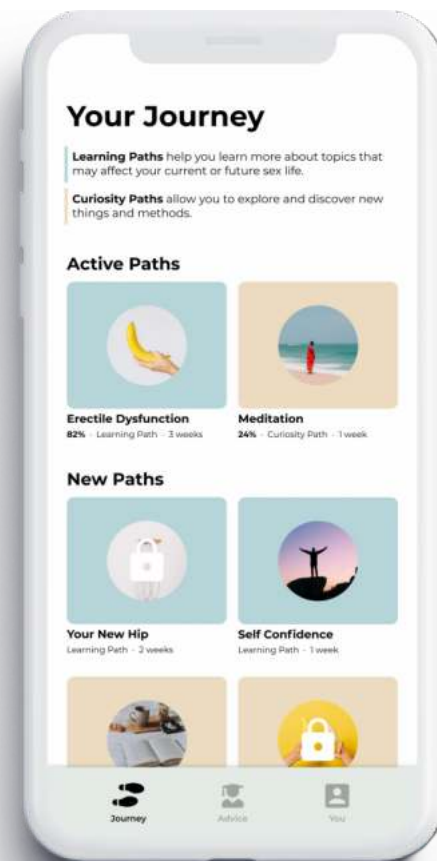
**Core team of content creators:** Having high-quality expert inputs and experiential content does not suffice - this content has to be presented and visualized in a way that allows users to derive the maximum value from it. To achieve a wholesome educational experience, a team of content creators drafts the content, creates visual representations, and chooses the appropriate media formats. The content creators understand the elderly's needs, are sensitive to their insecurities, and have a deep sense of empathy for the users.

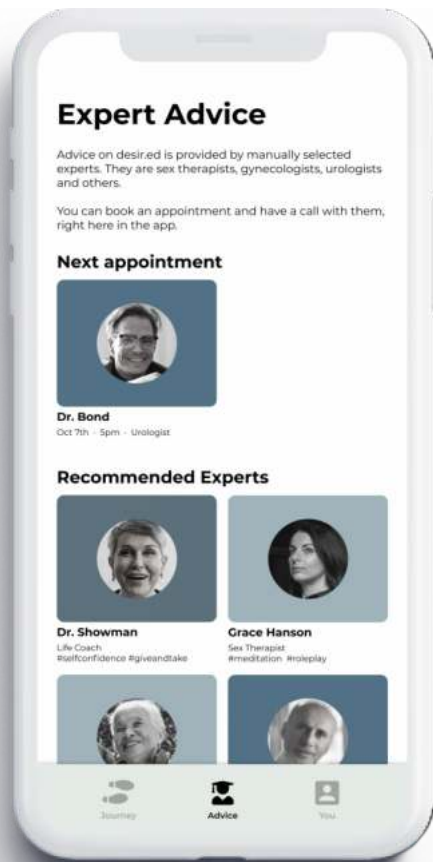
**Legal expertise:** Building a successful business in the public health sector requires constant legal verification of day-to-day decisions. Furthermore, legal expertise is necessary to understand the very transient rules of certifications, such as the DiGA compliance and partnering with health insurance providers.

## Key Partners

**Doctors and therapists specialized in elderly sexuality:** To provide its users with high-quality content and consultation, desir.ed partners with urologists, gynecologists, and other medical experts in nutrition, psychology, and physiotherapy. All the content published on desir.ed's platform is authored and vetted by the relevant experts. In addition to this, partnering with professionals also allows desir.ed to offer personal consultation sessions to its users. Any topic in the realm of sexuality can be discussed.

**Health insurances:** The scientific community agrees that a fulfilled sex life in old-age has several health benefits [LIU2016], [TOW2017]. Desir.ed uses the overwhelming scientific evidence for these benefits as a basis to form partnerships with insurance companies to reimburse a percentage of the membership costs for its users. Insurance companies benefit from the potential reduction in health insurance claims. This partnership also bolsters their public relations agendas. In turn, desir.ed earns the trust of its users by being endorsed by their health insurance providers. This trust, along with the partial reimbursement of membership fees by





insurance companies, encourages user adoption, and reduces desir.ed's customer acquisition cost.

**Experienced individuals:** In addition to receiving scientific advice from medical experts, desir.ed provides its users with experiential content consisting of various stories from people they can strongly relate to. To do so, desir.ed partners with people who have experienced and overcome old-age related challenges to eventually live fulfilled sex lives. These individuals contribute content to desir.ed, which is then carefully reviewed by medical experts for scientific consistency before being published on the platform.

**Public ambassadors:** The masses look up to artists, movie actors, and sportspersons as role models. Desir.ed collaborates with these public figures to launch a widespread awareness campaign about the importance of sexuality among the elderly. This partnership aims at combating the stigma around old-age sexuality and serves as an endorsement of desir.ed's platform.

### Revenue Streams

**Pay-per-Path:** Some users are only interested in specific learning or curiosity paths on the platform. Lifetime access to these paths can be purchased for a one-time fee. Based on certain paths' popularity and content, desir.ed may choose to differentiate the prices to bolster revenue.

**Subscription fee:** Some introductory paths in the journey are free of cost as they give the users a glimpse into the platform and help demonstrate desir.ed's value proposition. By paying a monthly subscription fee, premium users receive access to all of the content in these paths during the subscription cycle. Additionally, they are also able to pay for consultation sessions at a discounted hourly consultation fee.

**Commission:** Users may request consultation sessions during which desir.ed connects them with experts in elderly sexuality. The users are charged a flat hourly rate, and they are free to specify the duration of the sessions. Desir.ed earns a commission, which is a percentage of the total amount charged for the consultation.

**Health insurances:** As the scientific community agrees that a fulfilled sex life is beneficial for various aspects of health, it encourages desir.ed to form partnerships with health insurances to reimburse membership costs for users. From desir.ed's perspective there are at least two benefits for health insurance companies: desir.ed has the potential to reduce health insurance claims for the subscribers of the platform

and partnering with desir.ed bolsters public relations agendas of health insurance providers.

### Cost Structure

**Initial investment cost:** An upfront investment is required to build the technical platform and develop desir.ed's smart recommendation engine for educational content. Desir.ed needs qualified software developers and data scientists, whose salaries are a significant cost driver. Besides the technical infrastructure, an integral part of desir.ed's product offering is its educational content. The initial scientific and experiential content needs to be created by desir.ed's core content creation and curation team, which is composed of domain experts with a clear understanding of the science behind elderly sexuality. Their salaries plus recruiting and training expenditures will make up a significant part of desir.ed's initial investment cost structure.

**Fixed costs:** Desir.ed faces some fixed costs that are mostly independent of the number of customers. These include a team of in-house product designers, product managers, web and mobile application developers, and data scientists that improve and maintain the platform infrastructure and recommendation engine. In addition to this, the content creation team will consistently research elderly sexuality and associated topics to create content for the platform and devise methods for communicating it effectively. The salaries for this workforce, along with the operational expenses, equipment costs, cloud-hosting costs, and the financing costs arising from initial investments, would constitute the company's fixed costs.

**Variable costs:** The creation of educational content together with desir.ed's external experts contribute the most to the company's variable costs. In the growth phase, desir.ed faces substantial variable customer acquisition costs. Offline advertising through newspapers and TV will be used together with ambassador and guerilla marketing campaigns to attract and acquire customers.

Scenario Fit

**Underprivileged Geeks:** In this scenario, the users have a high intention to use technology but their financial situation is relatively unstable. For desir.ed this would mean offering a more affordable pricing model. From a business strategy standpoint, this demands a reduction in recurring fixed costs, such as salaries. Desir.ed would then focus its energies on automating parts of the content creation activities using NLP. Similarly, the implementation of chatbots would support customer care operations. Automations like these would be accepted by the elderly, who are adept at interacting with technology. Developing machine-learning algorithms that ensure a personal touch would become an important activity for product development teams. The dire financial situation of the elderly, albeit challenging, would not be a deal-breaker for desir.ed. In this scenario, desir.ed would depend more on the reimbursement schemes of health insurances to attract users. To ensure that the product meets the compliance requirements for these reimbursement schemes, desir.ed will work very closely with health insurance providers.

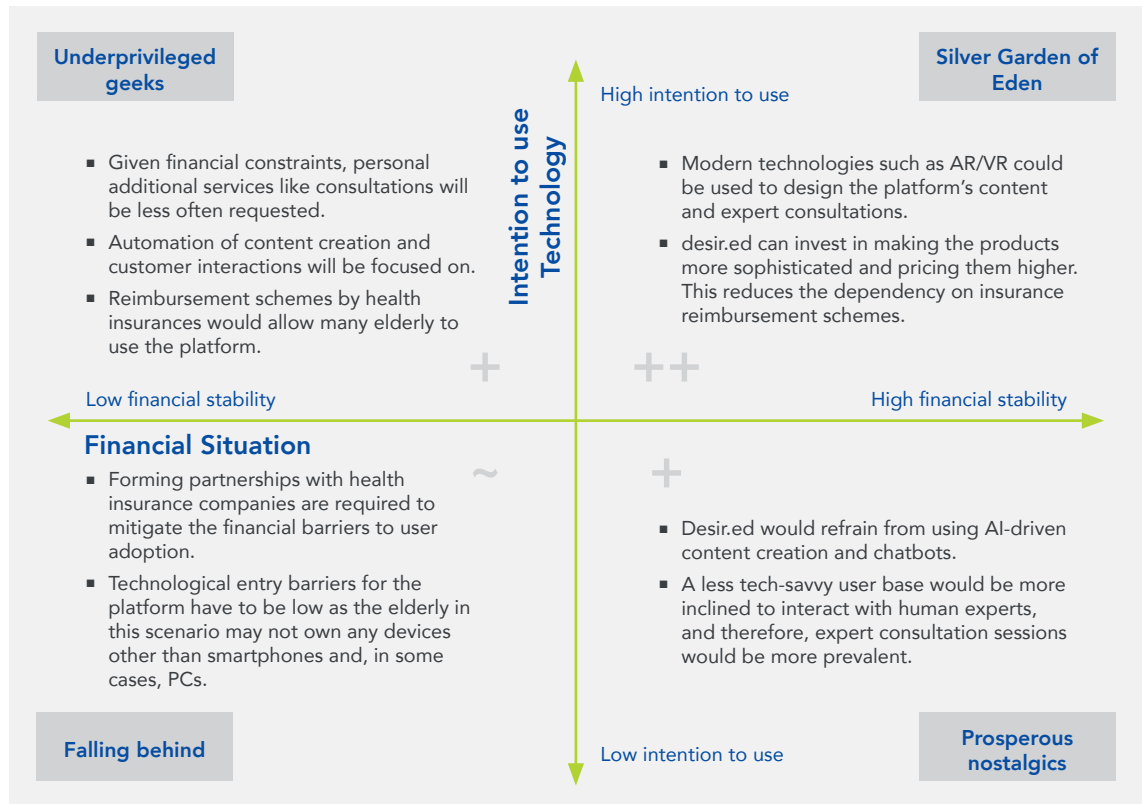
**Silver Garden of Eden:** In this scenario, desir.ed’s customers have the money and the willingness to use high-tech products. For desir.ed, this means that modern technologies such as AR and VR could be used to design the platform’s content and for the expert consultations. The stable financial situation of the elderly permits desir.ed to invest in making the products more sophisticated and pricing them higher. This helps with revenue generation and makes desir.ed capable of operating without heavily relying on insurance reimbursement schemes. In addition to this, the company would also be able to offer its customers costlier services such as a dedicated customer service hotline. A scenario in which its users enjoy financial stability complements desir.ed’s strong focus on high-quality content and offering reliable expert consultation.

**Prosperous Nostalgics:** In this scenario, while the users are financially stable, they are unwilling to adopt new technologies. Desir.ed would, therefore, refrain from using AI-driven content creation and chatbots. The users’ financial stability implies that a platform with a promising value proposition would enjoy higher revenues. In this scenario, desir.ed would ensure high-quality content authored by leading medical experts and curated by an editing team capable of empathizing with the end-user. A less tech-savvy user base would be more inclined to interact with human

experts, and therefore, expert consultation sessions would be more prevalent in this scenario. This would require desir.ed to invest time in partnering with experts in a wide range of fields concerning elderly sexuality. While desir.ed would be discouraged from developing solutions using futuristic technologies like AR and VR, a reluctance to adopt new technologies would not hurt desir.ed’s business model and its feasibility as a platform.

**Falling Behind:** This scenario entails the most challenging business environment for desir.ed. Many potential users would face financial hardships and would not be able to, or in

some cases, willing to spare money for educational content on sexual health. The content and expert advice provided by desir.ed would still be highly valuable, as a fulfilled sex life mitigates many long-term health problems. In this scenario, desir.ed’s strategy would be to form partnerships with health insurance companies and negotiate the best deals for its customers to mitigate the financial barriers to user adoption. Technological entry barriers for desir.ed’s content have to be low as the elderly in this scenario may not own any devices other than smartphones and, in some cases, PCs - in most cases, the hardware and the firmware of these devices may also be quite outdated.





## Challenges

- Insurance reimbursement: To enable its users to receive health insurance reimbursements, desir.ed will make considerable efforts to substantiate the fact that using its platform has measurable health benefits. Receiving DiGA compliance certifications would be a long and costly undertaking. Therefore, desir.ed is also considering partnering with major health insurance providers directly.
- Breaking the taboo: One of desir.ed's main goals also happens to be an obstacle in its way. Sexuality among the elderly is taboo and customers might be too self-conscious to use a sex education platform. To tackle this challenge, the emphasis is placed on creating high-quality content presented in a way that does not overwhelm the users.
- GDPR and data security: Desir.ed handles highly sensitive personal data and has to comply with all applicable regulatory legislation.

## Outlook

Desir.ed aspires to be the high-quality one-stop solution for people's sexual needs into old age. To accomplish this lofty target, we would establish a vast network of medical experts and sex therapists as partners. The users of desir.ed's platform can discuss all kinds of challenges with these experts and benefit from the cutting-edge content that the experts would contribute to the platform.

Desir.ed aims to improve its partnerships with insurance companies to offer extensive reimbursements for its users. As the health benefits of a fulfilled sex life become increasingly acknowledged by insurers, desir.ed would be able to extend the DiGA conformity to a majority of the platform's offering. Desir.ed wants to increasingly engage in social discourse and open up the discussion around sexuality in old age. Enabling the elderly to discuss this topic freely, desir.ed would aim to break the existing taboos and eliminate society's inhibitions regarding the subject.

Lastly, the team at desir.ed is convinced of the universal nature of the problem we are trying to address and aims to expand to other European countries after establishing a strong foothold in the German market.



# LIST OF CONTRIBUTORS



**Ana Garcia de Gortari**  
Management



**Florian Schepp**  
Informatics



**Lisa Thiergart**  
Informatics



**Sergej Lotz**  
Media, Management and  
Digital Technologies



**Antonia Glatzel**  
Management & Technology



**Henrik Petersen**  
Management & Technology



**Lisa Sophie Oberaigner**  
Management & Technology



**Srajit Sakhuja**  
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# INDEPENDENT LIVING OF THE ELDERLY

Increasing innovations in the healthcare industry have continuously increased life expectancy. Similarly, technology has revolutionized how we connect with one another and lead our daily lives. However, the elderly population still faces significant challenges in dignified aging, and few advancements have been made in that field. Ranging from health issues, housing, financial security to social isolation, the elderly often remain dependent on relatives and the healthcare industry. Older people seek independence – but many struggle due to the problems they face.

How can we better empower aging and older people? What can we innovate to enable independent living? What

are the solutions towards creating more connectedness with their loved ones and society in an age of individualism and changing family models? How can individuals change their lifestyles now to better prepare for an independent and fulfilled aging later?

To answer these questions, we first need to understand the cornerstones of elderly living. What brings happiness and fulfillment in old age? What are the social determinants of health, and how does this affect elderly living? How can supporting environments be designed to enrich health and happiness, and what preventative measures can be implemented to shift the focus towards independent, healthy living?

This report identifies current trends (political, economic, social, technological, environmental, and legal) that affect the future of both aging and the elderly. It derives four future scenarios, as well as five related business ideas. The generated business concepts range from a noise-canceling pillow, a smart sole for gait analysis, an elderly-led community gardening concept, a family memory storytelling platform, to an education platform for elderly sexuality.



The Center for Digital Technology and Management (CDTM) is a joint interdisciplinary institution of education, research, and entrepreneurship of the Ludwig-Maximilians-University (LMU) and the Technical University of Munich (TUM).

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**E-mail** [info@cdtm.de](mailto:info@cdtm.de)  
**Internet** [www.cdtm.de](http://www.cdtm.de)

Philipp Hofsommer · Anna-Sophie Liebender-Luc

