



SHAPES

Smart and Healthy Ageing
through People Engaging in supportive Systems

D7.1 – SHAPES Market Analysis and Strategy Definition

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Table of Acronyms and Abbreviations

Table 3 - Acronyms and Abbreviations

| Acronym | Full Term |
|----------------|--|
| AI | Artificial Intelligence |
| CAGR | Compound Annual Growth Rate |
| CEN | European Committee for Standardisation |
| DATA | Digital and Assistive Technologies for Ageing |
| EC | European Commission |
| eHealth | Electronic Health |
| EHDS | European Health Data Space |
| ERDF | European Rural Development Fund |
| ESF | European Social Fund |
| EU | European Union |
| FAIR | Findable, Accessible, Interoperable and Reusable |
| GC4HI | Global Consortium for eHealth Interoperability |
| GDP | Gross Domestic Product |
| GDPR | General Data Protection Regulation |
| IA | Innovation Action |
| IETF | International Engineering Task Force |
| ICT | Information and Communication Technologies |
| IoMT | Internet of Medical Things |
| IoT | Internet of Things |
| ISO | International Organisation for Standardisation |
| ITU | International Telecommunication Union |
| MDR | Medical Devices Regulation |
| mHealth | Mobile Health |
| OECD | Organisation for Economic Cooperation and Development |
| PESTEL | Political, Economic, Social, Technological, Environmental and Legal |
| SaaS | System as a Service |
| SDG | Strategic Development Goals |
| SHAPES | Smart and Healthy Ageing through People Engaging in Supportive Systems |
| SMART | Systems Market for Assistive and Related Technologies |
| SME | Small and Medium Enterprises |
| SWOT | Strengths, Weaknesses, Opportunities, and Threats |
| TAM | Technology Acceptance Model |
| TCO | Total Cost of Ownership |

| Acronym | Full Term |
|---------|---------------------------|
| UN | United Nations |
| W3C | World Wide Web Consortium |
| WHO | World Health Organisation |
| WP | Work Package |

Keywords

Market analysis, silver economy, customer segments, competitive advantage, market positioning, integrated care, eHealth, health and long-term care digital solutions and technologies, older adults.

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Executive Summary

This document presents the market analysis and strategy definition for the successful exploitation of SHAPES (Smart and Healthy Ageing through People Engaging in Supportive Systems) Innovation Action (IA), defining how it will be implemented by the SHAPES Consortium as the Action evolves and after its conclusion. Based on SHAPES's Grant Agreement Annex 1 Description of Action, this document is a key reference for the sustainability of a viable commercial exploration of the SHAPES results, upholding an approach that is both market-driven (based on relevant market, technologies, standards and business models analyses) and knowledge-oriented (aiming for new knowledge to unfold and contributing to future research and innovation activities).

Pursuing innovation or new business opportunities has strategic implications: if successful, it improves the competitive position of the SHAPES partners and leads to (business) growth. Still, the success is dependent on a clear understanding of the market, as well as of the competitive positioning of the SHAPES results within that market.

The main principles adopted for the SHAPES's market analysis are:

- Demonstration that SHAPES results do generate competitive advantage for the SHAPES partners and the European active and healthy ageing market, including the digital health and long-term care solutions and services market segment;
- Transfer of SHAPES results to products, solutions and services being offered in the market;
- In-depth market analysis to ensure the best use/application of SHAPES results and for creating new business opportunities;
- Engagement of the commercial/business stakeholders' network of all SHAPES partners to achieve a high-degree of exploitation.

The SHAPES Consortium adheres to the SHAPES's principles in the making of the Action's sustainability strategy and in its pursuit of the broadest array of exploitation activities possible to achieve its proposed goals.

This document hence contributes to the strategy for the SHAPES Action's sustainability, that is, the plan for the actions leading towards sustainable stakeholder involvement and adequate conduct of exploitation measures and activities. Specifically, SHAPES's deliverable D7.1 – SHAPES Market Analysis and Strategy Definition lays the foundation for ensuring the sustainability of the exploitation roadmap applicable to the results being developed by the SHAPES Action, including the sustainability of the SHAPES Ecosystem, and those results' adoption within the active and healthy ageing market. A strategy creating an ecosystem of win-win-win

relationships amongst citizens, care service providers and technology providers has been designed to release the SHAPES's innovation potential, necessary for the adoption of advanced health and long-term care digital solutions and services, the development of the eHealth industry economy, the harnessing of the Silver economy potential, and so enable Europe to effectively provide competitive health and long-term care services in a global economy.

SHAPES's strategy for achieving sustainability thus seeks to develop (SHAPES) community-driven collaborative partnerships, practicing the multiplication and the mainstream exploitation approaches and involving end-users' engagement, stakeholders' consultation and appropriate channels to reach decision- and policy-makers, benefitting from the leverage brought by SHAPES's communication and dissemination strategy and activities.

Stakeholders have indeed an essential and decisive role in the success of the SHAPES's sustainability, for their requirements, interests, motivations and satisfaction are important to understand the market and establish a competitive positioning, beyond the SHAPES IA's timeframe and funding, thus increasing the likelihood of a solid long-lasting impact for the SHAPES Action's outcomes and results.

1 Introduction

This document, named "SHAPES Market Analysis and Strategy Definition", is part of the list of deliverables of the SHAPES Action, dedicated to develop an ecosystem of validated health and long-term care digital solutions to support active and healthy ageing, to reduce the workload of the care workforce and to contribute to the sustainability of health and care systems.

In SHAPES, sustainable exploitation has been a central interest throughout the Action's lifetime, with the ultimate objective of positively impacting the future of the active and healthy market and of the delivery of care services to the ageing population, so that these become genuinely accessible, affordable and available, empowering a more inclusive and participatory engagement of citizens and enhanced efficiency, effectiveness and performance of care services. This will be enabled by SHAPES's innovative technical and technological solutions in the framework of the eHealth market.

These ambitious objectives have been pursued by the SHAPES Consortium, gathering a set of partners with complementary roles and expertise: representatives of the end-user community encompassing healthcare and social care service providers, representatives of the disability community, academia experts in the scientific and technical aspects of active and healthy ageing, and industry players providing electronic health (eHealth) technologies. In this multidisciplinary context, the exploitation of results in SHAPES addresses diverse market sectors.

The "SHAPES Market Analysis and Strategy Definition" presents the SHAPES partners' concentrated effort to understand and analyse the specific context for the scientific and commercial potential of the SHAPES results. In this context, it was important to gather a relevant market analysis to establish the involving structural and conjectural characteristics of the active and healthy ageing sector, to implement a structured profiling of the relevant customer segmentation and to identify the SHAPES's key exploitable results by breaking down the SHAPES's vision into different areas of innovation or value propositions, in which SHAPES holds the potential to create a unique selling point. The SHAPES market strategy is then wrapped up with the clear identification of the SHAPES competitive advantage so as to determine the adequate market positioning and the best approach to define SHAPES's market shaping strategy.

1.1 *Rationale and Purpose of the Deliverable*

This document, named “*SHAPES Market Analysis and Strategy Definition*”, is elaborated as part of Task 7.1 - Market Analysis and Strategy for SHAPES within Work Package 7 and presents a market analysis of the European and global market of digital solutions supporting and extending active ageing and independent living. The work draws upon the knowledge and experience of the SHAPES business-oriented partners, supported by the SHAPES Ecosystem, and comprises a general overview of the market at the European and global levels, a dedicated market assessment concerning SHAPES exploitables as well as market needs, and a competitive positioning analysis of SHAPES, considering the Strengths, Weaknesses, Opportunities, and Threats (SWOT) and the Political, Economic, Social, Technological, Legal and Ethical (PESTEL) tools and prevailing market barriers. A special focus is given to SHAPES’s market shaping strategy, based on the Systems Market for Assistive and Related Technologies (SMART) Thinking Matrix, involving close collaboration of stakeholders to establish well-functioning mechanisms that make the market available, transparent, competitive and affordable, allowing fair and equitable access and fostering economies of scale. Importantly, the SHAPES market analysis and strategy facilitate the deployment and uptake of the innovative SHAPES Platform and digital solutions, fostering the positive impact of SHAPES.

1.1.1 Key Inputs and Outputs

This deliverable considers the results from the work carried out in Work Package (WP) 7 – Market Shaping, Scale-up Business Models and Socio-Economic Impact, as well as the work conducted in WP4 and WP5 concerning the development of the SHAPES Technological Platform and of the SHAPES Digital Solutions, respectively, to build the supplier’s market approach.

In addition, the results of the activities performed in WP2 and WP3, addressing the older persons’ lifeworld and the socio-technical structures of health and social care organisations, have been duly observed to characterise the market’s demand perspective. Further, the SHAPES market analysis reflects the SHAPES’s ethical and legal framework defined as part of WP8.

On its turn, this document delivers valuable outputs to the different tasks within WP7 and to specific project tasks within WP3, associated with the SHAPES’s collaborative governance model and Recommendations, and WP10, concerning SHAPES dissemination and communication efforts. All these different tasks share the same ambition of defining, implementing and promoting the exploitation and long-term sustainability of the SHAPES results.

1.2 Structure of the Document

This report is divided into the following chapters:

- **Chapter 1 – Introduction** – this chapter introduces this document, providing details on its rationale and purpose, including key inputs and outputs. In addition, it delivers a summary of the document's structure and content.
- **Chapter 2 – SHAPES Market Analysis** – this chapter provides a summarised market analysis of the digital solutions and technologies supporting and extending active ageing and independent living, highlighting the market's key political, economic, social, technological, technical, environmental, regulatory and ethical influencing elements and the opportunities of the Silver Economy.
- **Chapter 3 – Customer Segments for SHAPES** – this chapter presents the customer segments for SHAPES Platform and digital solutions, relevant to designing tailored marketing actions to each segment effectively and appropriately, aiming for the long-term sustainability of SHAPES.
- **Chapter 4 – SHAPES Exploitable Results** – this chapter summarises the SHAPES results presenting a high potential to be exploited, that is, to be deployed, adopted and upscaled in the market, deriving benefits and fostering the value and impact of the SHAPES innovation activity.
- **Chapter 5 – SHAPES Competitive Advantage** – this chapter introduces the set of differentiating attributes allowing the SHAPES results to outperform its competitors, attracting wider audiences and building brand loyalty.
- **Chapter 6 – SHAPES Market Positioning** – this chapter is focused on the shaping of customers' perception concerning the SHAPES vision, concept and results, by applying the SMART Thinking Strategy.
- **Chapter 7 – SHAPES Market Deployment: Challenges and Opportunities** – this chapter enunciates the challenges and opportunities involving the market deployment and scaling-up of SHAPES results.
- **Chapter 8 – Conclusion** – this chapter provides a summary of the document, making broad statements that highlight the most important insights of the work performed within Task 7.1 in Work Package 7.
- **Chapter 9 – Ethical Requirements Check** – this chapter identifies the verification of the relevant ethical requirements/topics applicable to the document.

2 SHAPES Market Analysis

Market analysis provides a comprehensive overview of the current market, encompassing the demand and supply perspectives (including a summary of the industry-related economic aspects) and a summary of the external environment that impact or affect the market. The SHAPES partners conducted this analysis for the market applicable to SHAPES in order to better shape its exploitation activities.

Europe's active and healthy ageing market is characterised by a **proliferation of different healthcare and social care organisational structures** that rely on digital health and long-term care solutions and services to ensure daily operations. Digital health and long-term care solutions and services encompass a **broad scope of technologies**, including mobile health Apps, connected wearables and devices, games, communication aids, assistive robots, telemedicine and AI-based solutions. Currently, the increasing number of older individuals and the **reduced healthcare and long-term care workforce** have compelled public health and social care authorities to enforce more integrated care policies and measures, to adopt flexible and robust digital health and care solutions and technologies and to encourage health and care organisations to adopt and deploy improved capabilities, a factor that is primarily driving the growth of the digital health solutions and services market segment. In addition, the **ubiquitous use of the Internet, smartphones and tablets**, as well as the shift towards a healthier lifestyle and a better sense of wellbeing are estimated to be a driving force for the market's growth. The COVID-19 pandemic has been contributing significantly to this trend. In fact, the increasing requirement for integrating advanced, innovative, inclusive and accessible digital solutions and services is anticipated to make more prominent business opportunities in the coming years.

Specifically, the European region is expected to witness relevant growth in the active and healthy ageing market. **Increasing ageing populace** in the European Union and an expanding number of individuals living longer with chronic diseases and debilitating physical and cognitive conditions bring about higher concentrations of individuals and resources in specific urban zones. This, in turn, is expected to prompt **additional pressure on the performance of healthcare and social care systems**, already strained by heavy budget constraints, that are likely to support the growth of the European active and healthy ageing market. Different funding schemes are likely to be defined and adopted across Europe to enable the adoption and upscale of affordable, accessible and available digital solutions. At the same time, healthcare and social care systems benefit significantly of today's society tendency towards the **adoption of preventative behaviours and more active and healthier lifestyles**, including the ongoing presence of older adults in the work market beyond their retirement age, facilitating the promotion of health and digital literacy and of active and healthy ageing policies.

In addition, it is worth noting that also the **informal care networks** are changing over time: in the last decades, it is more and more frequent for family members to be geographically disperse. In this context, specific health and long-term social care technologies can assist the delivery of informal care, for example through the remote monitoring of the old people's wellbeing by family members living far.

Concerning the market's supply perspective, the European medical technology market is estimated at about €150 billion in 2021, being the top five biggest markets Germany, France, the United Kingdom, Italy and Spain. Based upon manufacturer prices, the European medical technology market is estimated to represent 27.3% of the world market, that is, the second largest medical device market after the US (43.5%) [1]. The healthcare industry has typical **high barriers to entry** in the form of high research and development expenditures, regulatory restrictions and legal obstacles. Smaller manufacturers, particularly small and medium enterprises (SMEs), have difficulties competing with larger healthcare supply manufacturers due to various factors, such as purchasing power, sales forces, and advertising expenses. And yet, SMEs comprise 95% of the market, revealing the agility required to explore innovation and new technological breakthroughs and bring a truly disruptive offer that is affordable, accessible and available. As a result, **the digital health and long-term care solutions and services market segment is expected to be the fastest growing segment**, including all technology devices, Apps and Artificial Intelligence (AI) tools that support health and long-term care organisations with the delivery of integrated care to the ageing population. The digital health and long-term care market segment also includes the provision of **consulting services**, design and integration services, training and education services and support and maintenance services. Among these services, the **training and education services** segment is expected to be growing at the highest rate. The training and education services are provided to health and long-term care service providers' workforce, as well as to specific community groups (informal caregivers, volunteers), to raise the level of **digital and health literacy** and care delivery capability.

Overall, the digital health and long-term care market represent an **innovation-friendly ecosystem**, characterised by significant competitiveness and a strong focus on **gerontechnology**, fuelled not only by the uptake of information and communication technologies (ICT), robotics and the Internet of Things (IoT), but also by important advances in the application of AI-enabled health data analytics. Most market analysts agree to the valuation of €38-40 billions of Europe's total digital health market with an annual growth of around 20%, bolstered by the COVID-19 pandemics effect¹. According to Grand View Research, **Europe's digital health market was valued at USD 39.3 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 27.1% from 2022 to 2030** [2].

¹ <https://cifs.health/backgrounds/european-digital-health-in-brief-background-landscape-stakeholders/>.

Market growth is driven by the rising ageing population (associated with the current demographic changes), the increasing prevalence of chronic diseases and the reduction of the care workforce, as well as by the advancement of digital technologies, improved Internet connectivity and growing demand for digital health and care services also are among the major factors anticipated to accelerate the growth. In addition, the COVID-19 pandemic catalysed the adoption of digital health and long-term care solutions, technologies and services.

According to the World Health Organisation (WHO), *Mobile wireless technologies for public health, referred to as “mHealth”, have been shown to increase access to health information, services and skills, as well as promote positive changes in health behaviours to prevent the onset of acute and chronic diseases* [3]. In order to realise these gains, European Union (EU) Member States are seeking to identify standardised approaches for applying mobile health (mHealth) in health systems and services.

The **mHealth** segment held the highest revenue share of 34.4% in 2021, attributable to the increase in the number of mHealth apps for medical, health and wellness applications and the growing number of smartphone users. Increasing adoption of mobile healthcare applications for disease management, remote patient monitoring, medication management, patient tracking, women's health, fitness and wellness, and personal health record management is expected to continue to drive the segment's growth. Telehealthcare is expected to register the fastest CAGR over the forecast years, due to the growing adoption of telecare and telehealth platforms for **remote patient monitoring and treatment**. Indeed, market forecasts indicate that remote patient monitoring was worth €1046 million in 2019 and is estimated to grow at a CAGR of 13,5% to reach €1972 million by 2024². The services segment accounted for the highest revenue share of 63.7% in 2021, driven by the growing demand **for maintenance, training, staffing, resource allocation and optimisation services**, which in turn contribute to reinforce the market players' position. However, it is also important to note that the absence of reimbursement of health digital solutions from medical insurance companies in most European countries restrains the growth of this European market. A specific market that is also growing exponentially is the **AI healthcare market**, expected to reach €36.1 billion by 2025, at a CAGR of 50.2% from 2018 to 2025³. Growing data complexity, rise in availability of data and expedite progress of data analytics in healthcare will further drive the use of artificial intelligence in healthcare. Moreover, implementing artificial intelligence tools in the diagnosis, treatment, prediction, and prognosis evaluation of major disease areas, such as cardiology, cancer, and neurology, might further benefit the European healthcare AI market expansion. Overall, innovative eHealth technologies (connected devices, mobile eHealth Apps and remote patient monitoring systems), supported by AI and Big Data analytics, are a major factor driving the market, essential to build sustainable health systems. Technological innovation is indeed one of the key features of the

² <https://www.marketdataforecast.com/market-reports/europe-remote-patient-monitoring-market>.

³ <https://www.marketsandmarkets.com/market-reports/artificial-intelligence-healthcare-market-54679303.html>.

Silver Economy, and its market estimates shine a bright light onto the long-term exploitation and sustainability of the SHAPES results, as presented next.

2.1 The Silver Economy

In 2018, the EU published a comprehensive report by the technopolis group and Oxford Economics addressing *The Silver Economy* [4], representing over €4.2 trillion in Gross Domestic Product (GDP) and over 78 million jobs. Given the increased life expectancy (+100 years) and ageing of the European population, it is forecasted that this economic sector will grow by approximately 5% per year up to 2025 to €6.4 trillion, representing 88 million jobs (37.8% of the EU employment) and 31.5% of EU GDP. It is the birth of a new industry addressing the business of longevity [5]. More specifically, the Silver Economy is a major consumer of health services accounting for over 53% of all health expenditure across the EU and this perspective remains unchanged until 2025, when the Silver Economy's share of health spending is forecast to increase to 60%, totalling three-quarters of all health spending and being worth €465 billion (11.4% of all government spending).

SHAPES ambitions to become a reference in developing a Silver Economy strategy for Europe, by which economic growth in Europe is focused on technological and labour markets relevant to older individuals and exploits opportunities by tackling the societal challenge of the ageing population and demographic change.

SHAPES digital solutions touch several markets in the Silver Economy, from connected integrated care services and health platforms to robotics and gaming Apps, to intelligent living platforms, to mindfulness Apps and health-related silver tourism. Currently, the size of these markets is close to €350 billion⁴, representing an opportunity that the SHAPES Consortium attentively considers. Hence, based on the Report, the SHAPES Consortium identified the market sectors displaying more economic value to be addressed by SHAPES results, being clear SHAPES's perfect alignment with the market needs and its high potential to attain sustainable business operations.

2.1.1 Integrated Care Services and Monitoring at Home

Integrated care services and improved connectivity, including the integration of ICT for healthcare monitoring at home that are user-friendly for older individuals, help overcome social isolation and improve efficiencies in the health and care sector.

Integrated care services for older individuals look after their needs and include different facilities, including home care, hospice care, residential care, health care,

⁴ <http://pwc-megatrends.co.uk/mylifeconnected/health.html>; <https://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/merrill.pdf>; <http://www.bccresearch.com/market-research/healthcare/telemedicine-technologies-global-markets-report-hlc014h.html>; <http://www.forbes.com/sites/freddiedawson/2015/09/30/smart-home-sector-could-be-worth-hundreds-of-billions-in-next-five-years/#172f499499ca>; <http://www.idtechex.com/research/reports/wearable-technology-2016-2026-000483.asp>.

assisted living, and adult day care, that provide a mix of medical care and social care so that the ageing society may live with dignity with adequate medical and daily activities assistance.

The rapidly growing ageing population and the medically underserved (especially rural) population are fuelling the development of this market, with an increasing demand for home care services, particularly monitoring at home. In this context, the technological progress and advances made in rendering monitoring technologies less intrusive have accelerated also the demand. Leveraging digital health technologies, such as telemedicine, wearables and connected medical devices, is key to enable better access to care and improve patient outcomes. Assistive technologies, monitoring sensors and connected medical devices are emerging in the market, contributing to the market's growth. Further, the scarcity of skilled professionals presses the demand for technology to support the delivery of integrated care.

Market size: the global elderly care services market is expected to reach USD 2.74 billion by 2030, at a CAGR of 8.1% during the forecast period 2022 to 2030. Over the forecast period, the institutional care segment is expected to grow at the fastest CAGR of 10.3%. Europe emerges as the largest market for the global care services for older individuals, with a 36.8% share of the market revenue in 2021⁵. The global market for monitoring at home using telemedicine technologies is estimated to increase from \$72.4 billion in 2022 to reach \$173.3 billion by 2027, with a CAGR of 19.1% from 2022 through 2027⁶. In addition, the global home healthcare market was estimated to be worth \$226 billion of revenue in 2022 and is poised to grow at a CAGR of 8.5% from 2022 to 2027⁷.

SHAPES exploitable results: CCS Telehealth System; CH ROSA; EDGE eCare Platform; FNOL Medimonitor; GNO eHealthPass; MedSyn Video Call Solution; OMN DigiRoom; OMN eCtouch and VICOM Safe Digital Assistant and NLP.

2.1.2 mHealth

Connected health, or the market of mobile health (mHealth) devices, such as neurological, cardiac, and apnoea and sleep monitors, and mHealth services. A subset of mHealth is also referred to, in the literature, as Internet of Medical Things (IoMT). **mHealth** aims at the prevention, diagnosis, monitoring and wellbeing, with a view to better understand the person's condition, better prescription of medicines and other interventions, along with a decrease of adverse drug reactions and enhanced ability to address other health needs of older individuals.

⁵ <https://www.thebrainyinsights.com/report/elderly-care-services-market-12772>.

⁶ <https://www.bccresearch.com/market-research/healthcare/global-markets-for-telemedicine-technologies.html>.

⁷ <https://www.marketsandmarkets.com/Market-Reports/home-healthcare-equipment-market-696.html>.

The rising focus on improving personal health and fitness using smart devices and wearables is the major factor currently accelerating mHealth market growth. Also, the widespread use of the Internet and smartphones and the growing adoption of mHealth technology and platforms by physicians and patients are also anticipated to propel market growth. Furthermore, the expansion of digital services for remote patient monitoring is also increasing the demand for mobile health Apps, which in turn is expected to propel market growth over the forecast years.

In 2021, the **Apps** segment dominated the global mHealth market, garnering a market share of over 86%. This is attributed to the increasing number of mHealth start-ups and their aggressive marketing through digital channels. However, the wearable segment is expected to gain rapid traction in the forthcoming years, considering the rising adoption of wearable devices among the population for fitness and health goals.

Market size: the market's value was close to €58.7 billion in 2020, with €1.9 billion for the online prescriptions market, €13.5 billion for the mHealth devices market and €43.3 billion for the mHealth services market⁸. In 2021, Precedence Research valued the global market at \$54.25 billion, expecting it to reach over \$243.57 billion by 2030 with a registered CAGR of 18.2% during the forecast period 2022 to 2030⁹.

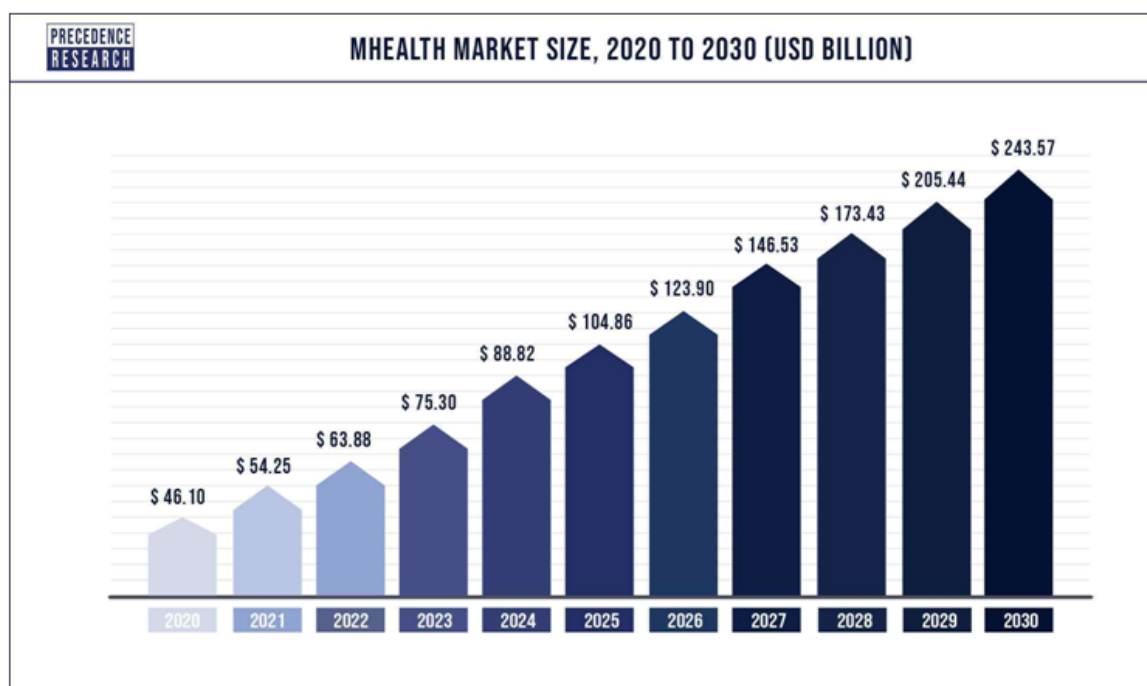


Figure 1 - mHealth Market Size 2020-2030

SHAPES exploitable results: EDGE eCare Platform; FNOL Medimonitor; GNO eHealthPass; MedSyn IT Health Care Platform; VICOM Visual Analytics; VICOM Decision Support System; VICOM Gait Analysis; and VICOM Wellbeing Assessment.

⁸ <http://pwc-megatrends.co.uk/mylifeconnected/health.html>.

⁹ <https://www.precedenceresearch.com/mhealth-market>.

2.1.3 Data Analytics Apps and Wearables

Knowledge for an active and healthy lifestyle consisting of **tools/Apps for data analytics** that support healthy and active lifestyles, as well as **wearable technologies** (e.g., smartwatches, fitness trackers, smart eyewear) and **personalised nutrition and preventative medicine**.

In recent years, there has been a constantly increasing demand for solutions offering effective analytical tools. This trend is also noticeable in the analysis of large volumes of data (Big Data). Healthcare management worldwide has changed from a disease-centred model to a patient-centred model, highlighting a paradigm shift towards value-based care delivery models [6]. In order to meet the requirements of this model and provide effective patient-centred care, it is necessary to manage and analyse healthcare **Big Data analytics**. Current Big Data analytics' expansion is supported by increased data volumes, advanced algorithms and improvements in computing power and storage.

Data analytics is a statistical strategy for evaluating and looking at a lot of data to get value from it. Insightful knowledge that can aid in corporate growth can be gained from the data processed in this way, which can be gleaned from historical trends. The introduction of Big Data analytics in healthcare allows using new technologies in patient treatments and health management.

Key factors driving the **healthcare analytics** market growth include the increasing need to reduce healthcare expenditure, namely the cost associated with medical product flaws and hospital workflow inefficiencies. Other key factors involve the optimisation of provider networks and the curtail of fraud claims. As a result, descriptive analytics dominated the healthcare analytics market, with a share of 36.1% in 2022. This is attributable to the growing usage of these systems for process optimisation and administrative activities.

To adapt the healthcare sector to the growing data analytics challenges, it is necessary to implement systems that will be able to learn quickly about the data generated by people within clinical care and everyday life. This will enable data-driven decision-making, receiving better personalised predictions about prognosis and responses to treatments, a deeper understanding of the complex factors and their interactions that influence health at the patient level, the health system and society, enhanced approaches to detecting safety problems with drugs and devices, as well as more effective methods of comparing prevention, diagnostic, and treatment options [7].

In terms of segments [8], in the healthcare sector, data analytics streams consist of various types of data, including:

- **clinical data**, i.e. data obtained from electronic medical records, data from hospital information systems, image centres, laboratories, pharmacies and

other organisations providing health services, patient-generated health data, clinician's free-text notes, genomic data, physiological monitoring data [9];

- **biometric data** provided from various types of devices that monitor weight, pressure, glucose level;
- **financial data**, constituting a full record of economic operations reflecting the conducted activity;
- **data from scientific research activities**, i.e. results of research, including drug research, design of medical devices and new methods of treatment;
- **data provided by patients**, including a description of preferences, demographic data, level of satisfaction, information from systems for self-monitoring of their activity: exercises, sleep, meals consumed;
- data from **social media**.

Because of the development of mobile technology, such as smartphones or tablets, and advancements in mobile networks and Wi-Fi, both data generation and consumption are constantly rising. The amount of data created, stored, duplicated, and used worldwide increased by almost 5,000% between 2010 and 2020, going from 1.2 trillion GB to 59 trillion GB. The data analytics industry is essential for improving business operations and minimising data loss. The four key components of this service are volume, diversity, and velocity. Data analytics gives firms leverage by creating greater insight through unstructured data and finding data that might support business ideas. The use of analytical tools may give business analysts as well as other corporate users a competitive advantage and generate company value.

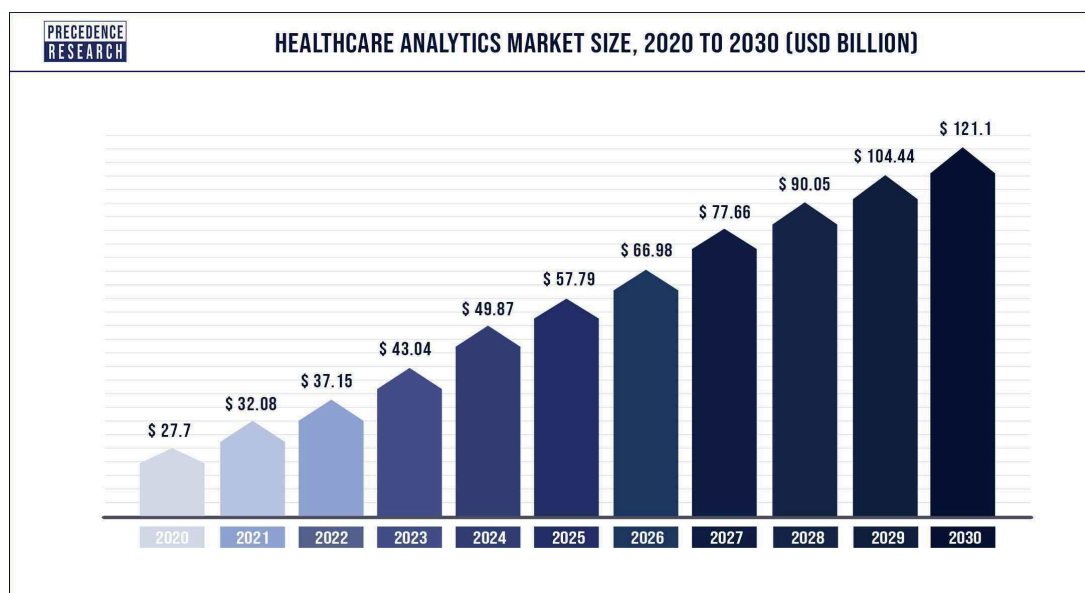


Figure 2 - Healthcare Analytics Market Size 2020-2030

Market size: the market is estimated to be over €96.2 billion by 2023 and €144.3 billion by 2026¹⁰. The global healthcare data analytics market size was exhibited at

¹⁰ <http://www.idtechex.com/research/reports/wearable-technology-2016-2026-000483.asp>.

\$32.08 billion in 2021 and is projected to surpass around \$121.1 billion by 2030, poised to grow at a projected CAGR of 15.9% during the forecast period 2022 to 2030¹¹.

SHAPES exploitable results: AUTH LLM Care; AUTH Virtual Patient Scenarios; EDGE eCare Platform; GNO eHealthPass; MedSyn Patient Survey System; TREE Sentiment Analysis; TREE People Detection and Tracking; TREE User Engagement; TREE Vitals Control; TREE Fall Detection; TREE Anomaly Detection; TREE Sleep Quality and Physical Intensity Level; UCML Physical Activity Monitoring; UCLM PHYX.IO; UAVR DanceMove for Psycho-Social Environments; VICOM OROFACE; and VICOM FACECOG.

2.1.4 Age-Friendly Environments and Smart Home

Development of age-friendly environments, including smart home solutions, comprising new build and retrofit home environments to empower older individuals to live more independent and connected lives with dignity and autonomy.

The importance of monitoring homes in remote locations and the need for energy-saving solutions are responsible for driving the market growth. **Smart homes** are designed to automate household appliances, offering residents convenience, efficiency safety and security. This technology is increasingly perceived as affordable, with the integration of IoT and connectivity in smart homes opening new value propositions. Whereas environmental control (thermostats, ventilators, lighting systems, kitchen appliances) provides occupants with comfort, safety and security devices (cameras, door locks, motion sensors, smoke detectors) to deliver security and prevent mishaps. In EU's strategic energy technology plan [10], smart homes are one of the ten key areas. The European Commission (EC) ambition is to help consumers and governments to improve their energy use and to benefit from a balance between home building and sustainable environments.

Market size: the smart home market is projected to be €111.20 billion in 2022 worldwide, in Europe it is €27.04 billion, showing a CAGR of 11,5% from 2022 to 2027¹². As of 2020, Europe has about 50 million homes with smart home technology¹³, which represents a market penetration of about 21%. The number of homes with smart technology is forecasted to pass 100 million homes by 2024, increasing the market penetration in Europe to 42% [11].

¹¹ <https://www.precedenceresearch.com/healthcare-analytics-market>.

¹² Statista. *Smart Home – Worldwide*. Statista Market Forecast. March 2023. <https://www.statista.com/outlook/dmo/smart-home/worldwide>.

¹³ Strategy Analytics, see <http://www.forbes.com/sites/freddiedawson/2015/09/30/smart-home-sector-could-be-worth-hundreds-of-billions-in-next-five-years/#172f499499ca> and <http://www.forbes.com/sites/freddiedawson/2015/09/30/smarter-entrepreneurs-finding-smaller-sector-opportunities-from-smart-homes/#7112e0fc2c36>.

SHAPES exploitable results: AELTD Access Earth Platform; FINT FINOT Platform; OMN NOTiFY.

2.1.5 Robotics and Games

Robotics and games help unburden the jobs of caregivers and assist older individuals and more frail population and integrate robotics with the gaming sector to allow the 50+ to interact with robotics in a fun and interactive way.

Healthcare assistive robots are used in clinical settings to support healthcare professionals and improve patient care. These robots may clean and prepare patient rooms, reducing person-to-person interaction in infectious disease wards. These robots may even carry out specific tasks fully on their own, including giving out water, blankets and medicine. As a result, physicians, nurses, and other healthcare professionals will have more time to spend in directly patient care. The factors driving this market's growth reflects improved health awareness, rising disposable incomes and the increased use of assistive robots in rehabilitation therapies.

The prevalence of chronic diseases and the growing acceptance by physicians of gamified models are expected to drive the **healthcare gamification** market growth, since the healthcare sector embraced the development of digital and mobile technologies for the treatment of chronic illnesses. For example, gamification helps in the management of diabetic care by rewarding patients upon the correct monitoring of blood glucose, insulin and food intake, which renders the treatment more cost-effective and efficient. Still, it is known that the gaming features and design strategies mostly lead to short-term behavioural changes and lack interoperability features. It is expected that the growing interest and use of serious games in healthcare can spark the surpassing of those barriers and investment in patients' long-term engagement through awareness, education, training and performance evaluation programmes.

Market size: the global healthcare assistive robot market size was valued at \$8.3 billion in 2021, and is projected to reach \$38.4 billion by 2031, growing at a CAGR of 16.5% from 2022 to 2031¹⁴. The healthcare gamification market size is valued at more than \$10 billion in 2022 and is projected to have a 10.5% CAGR from 2023 to 2032, reaching \$27.5 billion¹⁵.

SHAPES exploitable results: KOM Kompai-3; PAL ARI; PAL TIAGo; SciFY Talk and Play; SciFY ICSee; SciFY DiAnoia; SciFY Memor-I Studio; and SciFY NewSum Application.

¹⁴ <https://www.alliedmarketresearch.com/healthcare-assistive-robot-market-A10981>.

¹⁵ <https://www.gminsights.com/industry-analysis/healthcare-gamification-market>.

2.1.6 Silver Tourism

Silver tourism, with European tourists aged 65+ spending on average €53 per day and €66 billion per year, 16% of total tourism expenditure in the EU28¹⁶. Globally, the 50+ population spend €109 billion per year on sectors directly related to tourism, close to 3% of GDP, and contributing to 100 thousand jobs and inducing further economic growth in other sectors of the economy¹⁷. This market is likely to grow with the improvement of the EU tourism offer to the needs of the 50+ population, offering more comprehensive tourism packages, including mHealth and promoting off-season tourism.

Every year, over 14 million individuals travel to other nations for medical treatment, according to the Medical Tourism Association. The global medical tourism market size was estimated at \$115.6 billion in 2022 and it is expected to reach around \$346.1 billion by 2032, poised to grow at a CAGR of 11.59% during the forecast period 2023 to 2032¹⁸.



Figure 3 - Medical Tourism Market Size 2023-2032

The medical tourism market is experiencing significant growth, propelled by the rising burden of chronic diseases and the availability of advanced medical technologies for the treatment of various chronic disorders in other countries. Therefore, to attain fast medical attention and affordable medical treatment, there is a tendency towards medical tourism. Favourable government policies, rising investments on air transportation and government initiatives to promote medical tourism are the major factors that contribute in the development of the market. Moreover, the readily available information regarding treatments of various diseases, cost, and best

¹⁶ <http://ec.europa.eu/eurostat/documents/2995521/7664325/4-26092016-AP-EN.pdf/59bc5872-a0e0-4666-99b3-073a82672e71>.

¹⁷ <https://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/merrill.pdf>.

¹⁸ <https://www.precedenceresearch.com/medical-tourism-market>.

destinations for the treatment plays a major role in spreading awareness regarding medical tourism.

SHAPES exploitable results: The SHAPES Platform follows the EU interoperability standards and offers solutions that benefit from the cross-border exchange of health and care related data and information, which supports mobility use cases for silver health and wellness tourism.

2.2 AI Healthcare Market

A major contribution to healthcare delivery can come from **increased use of data**, supported by increasing democratisation of access to healthcare. Greater access to and availability of health data, such as electronic health records, genomics data and data from patient registries, may help improve diagnostic timelines and facilitate remote monitoring to ease the management of chronic conditions. It can also be the basis for analysis to help further the development of personalised medicine and precision treatments. This could lead to better use of resources through predictive techniques that help prioritise hospital activities. And algorithms could reduce the administrative burden by extracting relevant information from patient data. This would let healthcare professionals spend more time working with patients, who would have a better quality of life and could self-manage their conditions via integrated health data systems.

Artificial intelligence (AI) can be defined as the science and engineering adopted to design intelligent machines, especially intelligent computer programs. AI is an intelligent system that applies various human intelligence-based functions such as reasoning, learning, and problem-solving skills in different disciplines such as biology, computer science, mathematics, linguistics, psychology, and engineering. AI is widely applicable in medication management, treatment plans, and drug discovery.

A study by MarketsandMarkets determined that the huge availability of big data (growing number of datasets of patient health digital information), the high-demand for personalised medicine, the increasing number of cross-industry partnerships and the growing imbalance between healthcare workforce and patients are fuelling the growth of the AI in the healthcare market¹⁹. According to the authors of Healthcare Artificial Intelligence Market Share Growth Report 2019-25, the European healthcare AI market should witness 41.8% growth throughout the forecast period [12], with the market's growth driven by the adoption of AI in research areas and the EU undertakings designed to stimulate the use of healthcare AI systems in strengthening the eHealth sector.

Nevertheless, AI is a complex system, requiring a specific set of skills, and integrating AI solutions into existing systems is challenging due to the need for extensive data

¹⁹ <https://www.marketsandmarkets.com/Market-Reports/artificial-intelligence-healthcare-market-54679303.html>.

computing and the absence of professional standards to restrain the growth of AI. The performance of AI algorithms depends on data quality and availability; therefore, limited access to data in healthcare is still a barrier to AI in the healthcare market.

The AI in healthcare market is expected to continue to grow rapidly in the coming years, driven by the need to improve healthcare outcomes and reduce costs. New AI technologies and more available healthcare data will allow to address the challenges associated with data privacy and security, regulatory frameworks and patient and physician acceptance of AI technology.

Market size: The AI healthcare market is expected to grow from \$14.6 billion in 2023 to reach \$102.7 billion by 2028, at a CAGR of 47.6% during the forecast period²⁰.

SHAPES exploitable results: TREE COPD Hospitalisation Prediction; and VICOM Heart Failure Decompensation Predictive Module.

2.3 The COVID-19 Response Market

In 2020 and 2021, the SHAPES ecosystem of digital solutions was enriched with a set of COVID-19 response digital solutions proposed by the SHAPES partners to support the COVID-19 pandemic response. Existing market analysis reports and assessments have identified the testing and diagnostic market sectors but they have not clearly distinguished the market of eHealth applications for COVID-19 response from the traditional digital healthcare or eHealth markets. As a result, it is not possible to present associated market size figures. For all market analysis purposes, the SHAPES partners will consider the traditional digital healthcare or eHealth market information when considering commercial activity associated with their COVID-19 response digital solutions.

SHAPES exploitable results: AELTD Access Earth; EDGE ONE System; GNO COVIDShield; KOM Robotics for COVID-19 Support; PAL Robotics; VICOM RAPID; and ULS Symptom Checker.

As detailed in the sections 2.1, 2.2 and 2.3, the **SHAPES Platform** offers a set of sustainable technology-based solutions for older individuals. Deployed and validated in a large-scale piloting campaign across Europe, the **SHAPES digital solutions and technologies** aim to produce a significant body of knowledge and evidence that further **promotes the opportunities for the Silver Economy and the eHealth market**. The SHAPES Marketplace builds on this approach, providing reliable and trusted knowledge as a valued tool to support healthier lifestyle choices and creating an interactive dynamic platform connecting the demand and supply sides to develop

²⁰ <https://www.marketsandmarkets.com/Market-Reports/artificial-intelligence-healthcare-market-54679303.html>.

new solutions capable of sustaining healthy ageing and the independent living of older individuals, benefiting from viable business and financing models. Large-scale piloting increases market access and allows to rapidly bridge the gap between product development and European-wide market access. Overall, the SHAPES Platform is a European-led multi-stakeholder network supporting intergenerational learning and representing a new and more inclusive way forward to build an integrated, inclusive and healthy society.

Within the medical technology market, **eHealth** is still an emerging market with considerable potential to bring greater benefits to citizens, governments, and companies in the future. The COVID-19 pandemic has positively accelerated growth in the eHealth market by making healthcare and self-monitoring of health conditions more accessible to public. With a clear demand established worldwide, digital health solutions and services are slowly becoming mainstream with regulatory approvals and reimbursement routes addressed, this market is estimated to significantly grow in the coming years.

2.4 PESTEL Analysis

The **PESTEL Framework** [13] provides a strategic macro-level analysis of a set of factors influencing the market. Those factors are of Political, Economic, Social, Technological, Environmental and Legal nature. Considering the external environment involving the digital health solutions and services' domain, it is important to identify key elements that influence the market:

- Political** – The implementation of ageing-related policies and the promotion of healthy ageing are high priorities in the political agenda. Active ageing was the concept developed, adopted and promoted by WHO since 2002. In 2015, the concept of active ageing was replaced by the idea of healthy ageing, the process of developing and maintaining a functional ability that enables well-being in older age, constituting a policy framework until 2030 [14]. In December 2018, the United Nations (UN) published the *Ageing Related Policies and Priorities in the Implementation of the 2030 Agenda for Sustainable Development* [15], a document providing an overview of ageing related trends, policies and priorities associated with the Strategic Development Goals' (SDG) implementation²¹, specifically acknowledging that science, technology and innovation serve as enablers for SDG implementation and help countries deal with ageing-related challenges. In fact, on December 14th 2020, the UN endorsed the Decade of Healthy Ageing 2021-2030, leveraging an ambitious Action Plan [16]: 1) **combatting ageism** and changing how one thinks, feels and acts towards age and ageing; 2) **developing age-friendly environments**

²¹ The SDG implementation refers to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

in ways that foster the abilities of older people; 3) **delivering person-centred integrated care** tailored to older people; and 4) **providing older people access to long-term care**. Further, in 2020, under its Global Cooperation on Assistive Technology programme, WHO launched the Digital and Assistive Technologies for Ageing or DATA initiative to encourage the development and access to assistive technologies for people with impairment or decline in physical or mental capacity, with a particular focus on older people. The European Commission, the European Parliament and the Council of the European Union also created a number of initiatives stimulating Member States to undertake policies and programmes towards active ageing, including the European Innovation Partnership on Active and Healthy Ageing, aiming to foster an environment supportive of social and economic participation and enabling EU citizens to lead healthy, active, and – as long as possible – independent lives. In March 2021, the European Commission published an Action Plan on the implementation of the EU Pillar of Social Rights, advocating ageing policies and broader access to services. Active and healthy ageing was also highlighted in the EC's Green Paper on Ageing, which posits that, while healthy and active ageing policies fall under the domain of the Member States, the EU may play a significant supportive role, assisting in the development of ageing policies at the national, regional and local levels. In 2021, the European Parliament adopted a resolution entitled *Old continent growing older – possibilities and challenges related to ageing policy post-2020*²² (European Parliament, 2021c). The resolution states that the EU should motivate Member States to make more use of EU funds, such as European Social Fund + (ESF+) and European Rural Development Fund (ERDF), to address the challenges of population ageing, for example, by adjusting infrastructure and public spaces to the needs of older people. The report also highlights the need to combat loneliness among the older and strengthen intergenerational bonds, for example, by promoting mentoring and volunteering activities and organising day care centres for the older. Also, the report proposes a European Year for Dignified Ageing meant to target loneliness and support intergenerational ties. It also draws attention to territorial disparities in ageing and the need for strengthening the sense of security of older people by promoting the use of digital technology. Central piece of the EU Care Strategy, the recommendation on access to affordable high-quality long-term care was adopted on 8 December 2022 by the European Council²³. While not legally binding, the recommendation establishes an ambitious framework towards adopting timely, comprehensive and affordable long-term care services, continuously aligning to different care needs, and supporting freedom of choice and participation in decision-making. The focus is also placed in the better use of digital technologies, solutions and services in health and long-term care. Indeed,

²² https://www.europarl.europa.eu/doceo/document/A-9-2021-0194_EN.html.

²³ <https://data.consilium.europa.eu/doc/document/ST-13948-2022-INIT/en/pdf>

among the measures to increase the well-being of older individuals, prevent loneliness and social isolation, improve coordination and quality of integrated care, as well as contain the costs related to integrated care delivery, technology-based interventions were found to be an essential component of active and healthy ageing, particularly useful during the COVID-19 pandemic. SHAPES explores the benefits of digital health technologies, solutions and services to create better integrated care policies supporting *ageing in place* and to transform integrated care delivery in Europe, at substantial savings and improved outcomes.

- Economic** – In 2020, the average healthcare spending of European countries was 8% of the GDP²⁴ and the Organisation for Economic Cooperation and Development (OECD) predicts that, by 2060, expenditures for long-term care will increase to between 10-14% of GDP [17]. Considering the European economic-financial constraints addressing the ageing phenomenon and transforming the delivery of health and long-term care to the older population, it is unfeasible to advance solutions for integrated care delivery for older people that would require significant investment. Further, it is acknowledged that current macroeconomic conditions reinforce global inflationary pressures, which threaten the recovery and growth tendency experienced post-COVID. In fact, high energy prices, the erosion of households' purchasing power, a weaker external environment and tighter financing conditions are expected to tip the EU and most Member States into recession in the last quarter of 2022. The first quarter of 2023 will continue to witness the contraction of economic activity. Slowly, growth is expected to return to Europe, as inflation gradually subdues and, by 2024, economic growth is forecast to progressively regain traction, averaging 1.6% in the EU²⁵. It is in this challenging and uncertain economic landscape that policy-makers and government authorities need to address some of the deep-rooted systemic issues affecting the delivery of health and long-term care and the ageing population and industry and users tap into the potential of the Silver Economy. Consequently, SHAPES proposes to overcome existing limitations of integrated care services for older individuals by offering the affordable SHAPES digital solutions, designed to support and extend healthy and independent living, meeting older individuals' needs, as well as the needs of their informal caregivers and care professionals. Also, it is relevant to consider that SHAPES's improved digital capabilities do translate into an increased resource efficiency for care service providers while delivering high-quality integrated care services (for example, the use of remote monitoring solutions allows to send to the point-of-care relevant information of the individuals' health and wellbeing, enabling care professionals to early detect abnormal situations and promptly intervene, reducing the need for unnecessary

²⁴ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Government_expenditure_on_health_-_Expenditure_on_health

²⁵ https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6782

consults or travel and even preventing hospitalisation). Moreover, there is a strong investment in the European health industry sector and its competitiveness. SHAPES is a reference implementation of an open ecosystem of digital solutions supporting and extending healthy and independent living of older population, clearly showcasing the potential to outperform the existing market offer, and having the capability to build economies of scale and contribute to create highly qualified jobs.

- Social and Societal** – The adoption of the SHAPES Platform will have mid- and long-term direct and indirect impacts on how older individuals, and citizens in general, interact with local, regional and national integrated care services across Europe. In the process, SHAPES contributes to improve older individuals' and citizens' health literacy rates, by allowing them to understand their responsibilities with respect to their health and care, to participate in the decision-making process of their own care, from prevention to treatment, to better navigate the complexity of health and social care systems and to improve patient safety. While SHAPES enables the sharing and scaling-up of best practices in prevention and early intervention across Europe, it also empowers older individuals and citizens to reduce health risks, improve quality of life and better prevent or manage chronic diseases. This means that SHAPES upholds the understanding that citizens, including older individuals, must be the custodians of their own health, an empowerment requiring joint action from stakeholders, including the public sector, health and care providers, civil society, media, the healthcare industry and academia to build momentum and capacity in communities. In 2021, the European Union opened a wide debate on the **ageing trend** with the publication of the Green Paper on Ageing²⁶, highlighting the challenges and opportunities throughout the lifecycle. Specifically, with people living longer lives, the demand for healthcare and long-term care in the EU is increasing: the number of people potentially in need of long-term care is expected to increase from 19.5 million in 2016 to 23.6 million in 2030 and 30.5 million in 2050 (EU-27). Thus, ensuring access, affordability, and quality as well as adequate workforce will be a common European challenge, requiring immediate and concerted action. Also, in 2022, the European Care Strategy for care receivers and caregivers was presented by the European Commission, supporting Principle 18: Long-term care of the European Pillar of Social Rights, advocating investments in the care sector and setting an agenda to ensure quality, affordable and accessible care services with better working conditions, gender equality and work-life balance of carers. SHAPES acknowledges these challenges and opportunities and delivers a sound vision of digitally-enabled integrated care solutions for care receivers and carers that are available, affordable, accessible and of high-quality,

²⁶ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12722-Demographic-change-in-Europe-green-paper-on-ageing_en

increasing the existing market offer and focusing on a balanced mix of long-term care solutions for home, community-based, residential and primary care.

- Technological** – Europe maintains a competitive position in the digital technologies market, based on the assumption that adequate standardisation of the national markets at the European level is being stimulated to strengthen digital sovereignty with a clear focus on data and infrastructure. In this context, as an open ecosystem of digital solutions for integrated care, harnessing the benefits of IoT technologies and mobile and secure connectivity, SHAPES contributes to strengthening Europe's leading position, further supported by SHAPES's part on the common pan-European standardisation effort on the European data strategy, the European Health Data Space (EHDS) and artificial intelligence in healthcare. Further, SHAPES contributes to the European healthcare interoperability effort on next generation health and long-term care systems. SHAPES's exploitation of eHealth applications, smart living platforms, robotics and assistive technologies and connected smart sensors and devices will also contribute to build European excellence in the eHealth technologies markets, balancing today's non-European solutions (patents, products, services), and strengthen Europe's ambition to build a European Health Union, sustaining a leading position in digital solutions for the next generation of integrated care delivery in home and community-based settings. In recent years, the concept of Smart Safe and Secure Cities gained significance, especially at the policy level. The EU devoted substantial effort to the evolution of cities in a smart way, that is cities that attain excellence levels of performance in the fields of economy, citizenship, safety, mobility, livelihood, environment and governance. SHAPES's success relies on the new eHealth technologies and assisted living platforms prevalent in Smart Cities. The SHAPES solution to one of the most pressing shortcomings of health and care delivery – equal access to health and social care – leverages on another relevant trend of the last decades: the ubiquitous presence of mobile smartphones and tablets in all facets of modern life, exploring mobile Internet connectivity. With smartphones and tablets offering the platform of choice for mobile eHealth Apps, with appealing, intuitive and accessible user interfaces and the capability to empower older individuals as custodians of their own care, a fast increase of penetration rates for advanced digital solutions supporting and extending autonomy and independence of older individuals can be achieved. In addition, SHAPES's exploitation of assistive technologies, associated with the Internet of Things, smart sensors and wearables, implies that the revolution of the traditional health and care services delivery will continue, as more and more information is produced and consumed by devices, communicating between themselves to improve the quality of life. For the upcoming future, the broad adoption of smart living platforms and eHealth applications and the non-invasive collection and analysis of real-world health and wellbeing data, as

advocated by the SHAPES Platform, will be key differentiators for the delivery of affordable, accessible, and available high-quality integrated care services.

- Environmental** – Current health and social care systems considerably impact the environment, contributing to greenhouse gas emissions and climate change, as a result of direct energy use in health and long-term care facilities, through patient and staff travel and via procured goods and services. Further, health and social care systems release ecologically toxic substances into the environment, produce large volumes of waste material and contribute to the depletion of natural resources such as drinking-water. SHAPES fosters environmental sustainability in health and social care systems, contributing to reduce the negative environmental impacts and strengthen the positive environmental impacts of health and social care system activities. Aside from a more efficient use of energy and other resources, the use of digital solutions to support and extend the autonomy and independence of older individuals promote active and healthy lifestyles that help to reduce the burden of non-communicable diseases, reduce the need for patient travel, and benefit the care workforce by reducing workload and achieving higher levels of employee engagement. Bringing higher effectiveness and efficiency to the health and social care system as a whole and to the specific interventions provided within, SHAPES reinforces interventions delivering improved health, wellbeing and quality of life outcomes, promotes ageing in place and the reduction of unnecessary patient travel and advocates a governance model with improved communication, shared decision-making and coordination avoiding duplication of efforts and reinforcing the quality of care.
- Legal** – As EU's legislation is based on minimum standard directives, national regulatory activities are quite relevant to implement European obligations, such as the Ageing Policy²⁷ and the EU Directive on the Application of Patients' Rights in Cross-Border Healthcare, under a harmonisation umbrella. Another relevant initiative is the European Care Strategy, consisting of a European Commission Communication accompanied by a proposal for a European Council Recommendation on Long-term care and a proposal for a European Council Recommendation on the revision of the Barcelona targets on early childhood education and care. The European Care Strategy recognises the economic and societal impact of care and specifies the need to increase the offer and provide a balanced mix of long-term care services in all care settings like home, community-based and residential care and to roll-out affordable, accessible and available digital solutions in the provision of care services. These are core principles in SHAPES and next generation healthcare and long-term care services. SHAPES fully adheres to the European regulatory framework for health and long-term care in what respects access, affordability and availability and, as a result, the SHAPES results have been developed in

²⁷ https://ec.europa.eu/employment_social/soc-prot/ageing/intro_en.htm.

a regulatory-compliant environment. SHAPES will also continue to advocate for adapted regulatory strategies for high-quality integrated care governance models, policies and measures that are accessible and affordable for everyone. Moreover, SHAPES supports transparency and accountability in integrated care policies and measures, envisaging adequate balance between health and long-term care delivery in-home and community-based settings and privacy, contributing to build Europe as an area of universal, affordable and accessible access to health and social care services.

- Legal - Ethical** – The SHAPES Consortium fully respects the applicable ethical principles and fundamental rights reflected in the EU Charter of Fundamental Rights, the EU General Data Protection Regulation (GDPR), Biomedical Ethics and the Ethics of Care. SHAPES has been thoroughly attentive to issues of privacy, data protection, secondary use of data, expressed user consent, artificial intelligence, data management, openness and transparency, but also of the potential incidental findings of SHAPES. Concerns of data privacy and (cyber)security face all major innovations and the loss of trust may hamper the uptake of digital solutions supporting healthcare and long-term care services, as they rely on Internet-enabled technologies. SHAPES establishes a clear data management and security framework, upheld the SHAPES Research Protocol to properly manage the participation of volunteers in the SHAPES large-scale piloting campaign and all SHAPES partners follow the SHAPES Code of Conduct, fostering a culture of ethically-sound research and innovation activities, that facilitates the execution of SHAPES in full compliance with EU and Horizon 2020 ethical standards and guidelines.
- Legal - Standardisation** – SHAPES proposed to contribute to European standardisation efforts on eHealth and assistive technologies, by introducing to international standardisation bodies – the International Organisation for Standardisation (ISO), the European Committee for Standardisation (CEN), the International Engineering Task Force (IETF), the International Telecommunication Union (ITU), the Global Consortium for eHealth Interoperability (GC4HI), the World Wide Web Consortium (W3C) – the SHAPES's results with respect to eHealth interoperability, health data, secondary use of health data, connected smart devices, assistive technologies and user interface design. Indeed, SHAPES actively supports the development of a new ISO standard framework, ISO 25553, relating to the design, creation, operation and maintenance of 'Neighbourhoods that Care', and aiming to normalise the creation of smart multigenerational neighbourhoods. Moreover, SHAPES embodies prevailing standards in health data exchange, the sharing of IoT data and interoperability among smart living platforms, as well as the guidelines and best practices in user interface design, accessibility and usability.

In conclusion, the overall external context involving SHAPES is well-fitted to accommodate and boost SHAPES's ambitious objective of establishing unique positioning in the European digital eHealth industry and health and long-term care services market.

3 Customer Segments for SHAPES

Since health and long-term care digital solutions and services for supporting and extending healthy and independent living for older individuals still struggle with a number of issues that are hindering their acceptance on the part of older individuals and of health and long-term care professionals, the uptake appears to be restricted to specific customer segments in Europe. Based on the knowledge built as part of SHAPES, it is acknowledged that, today, the major restrictions to the wide adoption and scale-up of health and long-term care digital solutions and services are the perceived high initial investment, change anxiety, low awareness, low trust in AI for clinical decision-making, lack of access to healthcare data and insufficient regulation to support the adoption of digital solutions supporting and extending healthy and independent living for older individuals who are facing permanently or temporarily reduced functionality and capabilities.

The SHAPES results embody the vision of high-quality integrated care delivery for older individuals but they may be decomposed into different complementary solutions that support different new capabilities to improve the service provided by health and long-term care service providers. In addition, because the organisation and implementation of public healthcare and social care policies and systems is an exclusive responsibility of the Member States, there are different types of organisational structures across Europe and the delivery of high-quality health and social care can either be provided by public or private entities or even through public-private partnerships. As a result, the SHAPES partners need to develop market-driven tactics suited to reach and involve each customer segment.

The SHAPES results, therefore, target different customer segments within Europe: older people, informal caregivers, health and long-term care professionals, health and long-term care service providers, health and social care authorities (decision-makers), health and social care policy-makers and regulators, eHealth industry, researchers and academia, civil society organisations and the general public.

3.1 Older People

Older people are the customer segment that would be the primary users of the SHAPES digital solutions ecosystem, but also reluctant adopters of new technologies (for example, due to the lack of familiarity and privacy concerns) and, at the same time, the holder of high expectations towards the delivery of high-quality accessible, affordable and available healthcare and long-term care services (as a result of the massive advances in healthcare and long-term care in the past decades). An older person is an individual of above 65 years old²⁸. This group of individuals has developed its own consumer behaviour: in Europe, the Silver Consumer represents a

²⁸ <https://data.oecd.org/pop/elderly-population.htm>.

prospect *market* of over 200 million people with specific needs and concerns, with each individual upholding a global average gross income of €12,247 [18]. Importantly, older individuals form a heterogeneous group of people with different backgrounds, skills, interests and capabilities, concerning technological proficiency and digital literacy. The friendly user-centred digital solutions brought forth by SHAPES aim to facilitate long-term healthy and active ageing and the maintenance of a high-quality standard of life, significantly improving the participation of older people in the management of their own health and care, as well as the social communication dynamics between the older person, the care workforce and the health and long-term care services' providers, while upholding equal access to those services. The engagement of older people with the SHAPES's integrated care vision and digital solutions is expected to positively influence the healthcare and long-term care services' providers and the decision-makers towards a faster adoption of SHAPES advanced digital capabilities to support and extend ageing in place.

3.2 Informal Caregivers

A key customer segment in SHAPES is the informal caregivers, that is, the persons that provide unpaid care (more than twice a week) to one or more family member, neighbour or friend with a disability or an illness [19]. Informal caregivers can provide simple assistance, such as companionship and transportation, or a more specialised help, like helping to set up doctor's appointments or managing medications, but often they combine these care responsibilities with a work employment. Currently, in Europe, 80% of care is provided by informal carers, representing 44 million people, with the majority being female and middle-aged [20]. Informal caregivers endure significant physical and mental health problems because of the high level of physical (e.g., lifting and moving people) and emotional (e.g., handling daily emotionally disturbing situations while hiding their own feelings) demands. In addition, as medicine evolves, these carers must deliver more sophisticated levels of care and miss training and skills development support²⁹. Already in 2014, more than 34% of the population in twenty European countries were informal caregivers, with 7.6% providing care for at least 11 hours a week (intensive caregivers) [21]. And yet, only in recent years, has the formalisation of informal care been on the agenda of different EU Member States, in terms of the introduction of payment or subventions and associated social security benefits (pension and health insurance), to training/certification of skills and to legislation, with the recognition of status and rights to being assessed as a carer. SHAPES's digital solutions and services also aim to assist informal caregivers, by understanding and responding to their specific needs, by allowing them to gain better and more detailed insights into the health and wellbeing status of their loved ones, and by providing guiding information and knowledge on the delivery of care.

²⁹ <https://eurocarers.org/about-carers/>.

3.3 Health and Social Care Professionals

A customer segment that is responsible for providing health and social care and has not only the required knowledge to understand the inherent benefits of the SHAPES results with respect to improving their workload and performance but also the responsibility to endorse the early and broader adoption of the new SHAPES capabilities. In the EU27, about 6.3 million people work in long-term care, representing an expansion of about one-third (33.5%) in size in the last decade, with four-fifths (81%) of the workforce being female and more than one-third (37.9%) of the workforce aged 50 years or over³⁰. The latest information from Eurostat (July 2022) indicate that healthcare personnel (nursing and caring professionals providing services directly to patients) amount to 7.6 million, a number that indicates a shortage of nursing and caring professionals in the EU, which may become exacerbated as the population continues to age and a relatively high proportion of nurses and caring professionals move from employment into retirement³¹. Overall, SHAPES's digital solutions and services assist health and social care professionals, by understanding and responding to their specific needs, by allowing them to gain better and more detailed insights into the health and wellbeing status of their patients, and by providing guiding information and knowledge on the novel pathways of integrated care delivery.

3.4 Health and Long-term Care Service Providers

Health and long-term care service providers constitute a customer segment that is responsible for organising the care response, managing the care professionals' resources and providing assistance at the point of care (hospitals, clinics, medicalised residences, nursing homes) or/and at home settings. Statista indicates that there are 24.2 thousand hospitals in Europe, which provide approximately 4.6 million beds across Europe³². The European Ageing Network presents more than 10 thousand long-term care providers across Europe³³ and Eurostat indicates that, in 2020, there were approximately 3.4 million long-term care beds in nursing and residential care facilities in EU Member States³⁴. This large customer segment is one of the key beneficiaries of the SHAPES digital solutions and services, being well-informed of the current shortcomings in the delivery of high-quality integrated care services and of the actions required to ensure that care professionals have adequate digital resources and training to ensure a smooth adoption of the SHAPES results. Further, these organisations acknowledge that the SHAPES digital solutions and services will

³⁰ Eurofound (2020), *Long-term care workforce: Employment and working conditions*, Publications Office of the European Union, Luxembourg, <https://www.eurofound.europa.eu/publications/customised-report/2020/long-term-care-workforce-employment-and-working-conditions>.

³¹ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_personnel_statistics_-_nursing_and_caring_professionals_-_Healthcare_personnel.

³² <https://www.statista.com/topics/8361/hospitals-in-europe/>.

³³ <https://www.ean.care/en>.

³⁴ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_resource_statistics_-_beds&oldid=567775#Long-term_care_beds_in_nursing_and_residential_care_facilities.

broaden their care services' portfolio, becoming an additional source of sustainable income and exerting a positive impact in ensuring that the effectiveness, reliability and efficiency of high-quality care delivery continue to improve, to the benefit of citizens. Particularly, rural hospitals, clinics, medicalised residences and nursing homes may benefit from the participation to a platform such as SHAPES because it fosters access to relevant digital health and long-term care solutions supporting the geographical divide, such as remote services for their patients and users.

3.5 Health and Social Care Authorities

The health and social care authorities are the customer segment responsible for implementing the national legislation associated with the delivery of high-quality health and social care services, for establishing the strategy for the national healthcare and social care systems and for making available the budgetary resources required to fund the acquisition of new and improved capabilities for the public healthcare and long-term care systems. As decision-makers on the governance and policies associated with high-quality integrated care delivery, health and social care authorities acknowledge that significant value may be provided by the SHAPES results, namely the SHAPES digital solutions ecosystem, as they hold highest the citizens' health, wellbeing and safety outcomes, while also addressing concerns with the socio-economic and financial sustainability of health and social care systems. In this context, SHAPES provides also an in-depth knowledge to address structural reforms associated with integrated care, emphasising economic growth, a resilient labour market, and equal access to affordable and available health and long-term care services as part of the construction of economically and socially resilient communities.

3.6 Health and Social Care Policy-makers and Regulatory Bodies

Health and social care policy-makers at the EU, national and local levels are responsible for formulating or amending health and social care policy to be carried out by executive institutions, addressing the demographic and ageing challenges, while protecting the sustainability of health and social care systems. Health and social care regulatory bodies at the EU, national and local levels are responsible for enacting the regulatory pathways to improve the delivery of sustainable health and social care and for overseeing the adherence of executive institutions to those laws and regulations. This customer segment sees in SHAPES the potential to build a novel ecological concept capable of truly advancing the delivery of high-quality, affordable, accessible and available integrated care to support active and healthy ageing in-place. SHAPES delivers the knowledge to shed an understanding of the policy and regulatory environments in which older people, carers, and care service providers live and work across Europe, including their detrimental and facilitating effects to foster improved care delivery. In addition, health and social care policy-makers and regulatory bodies accept the positive potential of SHAPES digital solutions to implement scalable and effective integrated care interventions across the care continuum, ranging from health

promotion and disease prevention policies to long-term care. In this context, policy-makers and regulators are also responsible for setting the legal, economic, financial and commercial frameworks for nurturing and paving the way to the uptake of SHAPES digital care innovations in support of active and healthy ageing.

3.7 eHealth Industry

The eHealth industry is a growing customer segment in SHAPES in the perspective that SHAPES offers its results – technologies, know-how and knowledge – to reinforce the industry players' and new entrants' solutions and services portfolio and to establish a new market landscape that is based on transparency and open competitiveness, on synergies and critical mass, to bring forth an affordable, accessible and available market offer. The total number of healthcare companies in Europe is 2.765.830³⁵ and SMEs make up around 95% of the medical technology industry, the majority of which employ less than 50 people (small and micro-sized companies) [22]. According to Speedinvest, Europe's health tech industry is growing fast, with 626 funded digital health companies active in Europe, mostly in the sectors of enabling tech for providers, screening and diagnostics and consumer health, bringing in \$2.3 billion in the third quarter of 2020³⁶. In fact, the revenue in the healthcare segment in Europe is projected to reach \$12.15 billion in 2023 and \$18.83 billion by 2027, at an annual growth rate of 11.58%³⁷. According to MedTech Europe, there are more than 500 thousand medical technologies available in hospitals, community care settings and at home³⁸. Leveraging on the SHAPES Marketplace and Open Calls initiatives, the SHAPES partners engage eHealth companies to jointly benefit from compelling business advantages, exploring common business opportunities and giving fruition to a valuable and trusted channel capable of providing reach to larger markets, namely to new entrants and innovative SMEs.

3.8 Researchers and Academia

SHAPES views researchers and academia as a relevant customer segment of SHAPES results, particularly those associated with the ethnographic studies on the lifeworld of older individuals, the development of the ecological model of health and social care systems across Europe and the abundant real-world data and data analysis stemming from the SHAPES large-scale piloting activities. This knowledge and data are expected to support relevant research and innovation projects in a broad range of scientific disciplines, as well as to foster a new generation of highly qualified researchers in top EU academic institutions. Further, SHAPES aims to foster interdisciplinary networks of scientific excellence to disseminate novel educational and

³⁵ <https://bolddata.nl/en/companies/europe/healthcare-companies-europe/>.

³⁶ <https://sifted.eu/articles/europes-healthtech-industry-2020/>.

³⁷ <https://www.statista.com/outlook/dmo/ecommerce/beauty-health-personal-household-care/health-care/europe>.

³⁸ The European Medical Technology Industry in Figures 2022, MedTech Europe, 2022, <https://www.medtecheurope.org/wp-content/uploads/2022/09/the-european-medical-technology-industry-in-figures-2022.pdf>.

training contents (digital and soft skills, eHealth literacy) targeting the existing and future care workforce so that informal caregivers and care professionals may acquire the right skillset to benefit the most from the SHAPES digital solutions, reduce their workload and attain higher levels of efficiency and job satisfaction.

3.9 Civil Society Organisations

Civil society organisations, including networks representing older people, associations supporting persons with disabilities or specific medical conditions, health and social care professionals' unions or associations representing informal carers, as well as voluntary groups active in different active and healthy ageing fields, may become a customer segment to SHAPES results as they acquire and use the knowledge, information and datasets produced by SHAPES to support their associates, users or supporters. Aside from endorsing SHAPES's digital solutions, highlighting their particular added-value, civil society organisations may see in SHAPES digital solutions the opportunity to modernise their own technologies or even enhance their traditional offer by adding new added-value care services to the community, delivering them in a more coordinated, organised and safer way.

3.10 General Public

The general public is an important customer segment for SHAPES as the project aims to build improved health literacy, contribute to prevent diseases and self-manage medical conditions and promote better health, wellbeing and quality of life outcomes in society. By actively promoting SHAPES digital solutions and knowledge, the general public will stimulate the transformation of health and social care systems towards the adoption of integrated care digital solutions that are affordable, accessible and available and contribute to the sustainability of health and social care systems across Europe.

4 SHAPES Exploitable Results

As an Innovation Action, **SHAPES adapted and matured beyond state-of-the-art knowledge and solutions with a superior market potential**. Depending on the nature of SHAPES's exploitable results, a strategy is formulated to secure continuation and uptake in the market through two alternative sustainability and exploitation strategies: scientific exploitation and commercial exploitation, for the SHAPES Consortium exhibits real talent to exploit the SHAPES IA's results, easily reach customers and open business opportunities.

The **knowledge-oriented exploitation strategy** aims at continuing the research and innovation work leveraged with the SHAPES IA, opening future research opportunities in the fields of advanced digital solutions supporting and extending healthy and independent living for older individuals. The SHAPES partners that are part of academia (NUIM, NUIM, FhG, LAUREA, AUTH, UP, HMU, UCLM, UAVR, UPORTO, UCC, UNRF, ULS and VICOMTECH) will exploit the novel know-how brought forward by SHAPES to identify new research, development and innovation programmes related with age-friendly neighbourhoods and communities, new governance models for the delivery of high-quality health and long-term care, as well for new funding projects to transfer the acquired knowledge to other research areas.

The **market-driven exploitation strategy** aims to leverage more than thirty SHAPES innovative results to enhance the products, solutions and services portfolio of the SHAPES partners that are industry-related (AELTD, EDGE, FINT, GNO, ICOM, KOM, MedSyn, OMN, PAL, SciFY and TREE) and assist them in bolstering their own commercialisation activity. From the technological perspective, the SHAPES results achieved significant health and social care advances. These advances were focused on the Action's two technological pillars: the SHAPES Technological Platform and the SHAPES Digital Solutions.

Instrumental in SHAPES is also the role of the end-user partners (AGE, AIAS, CCS, CH, EUD, FNOL, gewi, NHSCT, DYPE5, SAL, AAA and WFDB) that, acting as early adopters and advocates of the SHAPES results, benefit first-hand from the benefits of the SHAPES Platform and digital solutions supporting smart healthy living at home, upholding European regulations, ethical principles and standardised approaches. The SHAPES end-users also leverage on SHAPES's knowledge on the feasibility, impact, sustainability and potential of integrated care and ageing well pathways to improve their services to the community and to better prepare own procurement processes. Finally, these SHAPES partners are very influential, helping to build and raise awareness to the SHAPES innovation towards health and long-term care services that are inclusive, affordable, accessible and available.

The outcomes of the SHAPES IA activities are the key SHAPES exploitable results:

- The SHAPES Integrated Care Platform;
- The SHAPES Digital Solutions Ecosystem;
- The SHAPES Marketplace;
- The SHAPES Capability Services;
- The SHAPES Consultancy Services.

These results are explained below.

4.1 The SHAPES Integrated Care Platform

The SHAPES Integrated Care Platform is an open, EU-standardised platform based on four factors: “home” (the house space and the sense of belonging to a community), “behaviour” (the capability to take action towards ageing in place), “governance” (the model advocating good practices that engage relevant stakeholders to transform integrated care delivery) and “market” (the set of affordable, accessible and available digital solutions, technologies and services that support active and healthy ageing). The SHAPES Platform hence delivers: (1) the **SHAPES Knowledge base**, with relevant data, information and knowledge on the “home” and “behaviour” aspects of active and healthy ageing, ranging from the SHAPES recommendations to contents on the older people’s lifeworld and age-friendly neighbourhoods, to the SHAPES educational and training materials, to relevant socio-economic sustainability analyses and to the datasets produced by the SHAPES large-scale piloting activities; (2) the **SHAPES Governance model**, supporting the interoperability of data, procedures and processes associated with the delivery of high-quality, affordable and accessible integrated care in Europe; and (3) the **SHAPES Technological Platform**, facilitating the integration and interoperability of devices, systems, applications and data, **and the Digital Solutions Ecosystem**, delivering a set of user-centred and personalised integrated care solutions that support and extend the independence and autonomy of older people.

4.2 The SHAPES Digital Solutions Ecosystem

SHAPES enabled the development of an open ecosystem of more than thirty interoperable technological, organisational, clinical, educational and societal solutions to enable and facilitate active, independent, and healthy ageing at home. Intelligent and personalised digital solutions, including **assisted living platforms, online communication and accessibility tools, cognitive stimulation and rehabilitation programmes, conversational assistants and chatbots, assistive robots, telehealth and remote monitoring platforms**, and data analysis solutions in the domains of **decision support, risk assessment, prediction systems, anomaly detection and wellbeing assessment**, are integrated through a core platform to solutions empower older people to optimise their health, mental and physical wellbeing

and participate in civic life, while maintaining a degree of independence as they age. In the process, older people may continue to enjoy healthy, productive, independent and dignified lives at home and delay or prevent the need for long-term institutionalised care.

4.3 The SHAPES Marketplace

The SHAPES Marketplace is a platform that connects the demand and supply sides of health and long-term care delivery, acting as a **one-stop-shop** that presents a dynamic catalogue of digital solutions and services targeting the smart and healthy ageing and independent living markets and tailored for the silver economy. The SHAPES Marketplace aims to facilitate access to affordable, accessible, and available solutions that have demonstrated their effectiveness and trustworthiness in SHAPES piloting campaign to support active and healthy ageing and independent living, easily integrated in actual practices. Foremost, the SHAPES Marketplace allows for an open and transparent expansion of the existing market offer, while preventing vendor lock and enhancing the competitiveness of the EU health and care industry. In addition, the SHAPES Marketplace also serves as the main access way to the de-identified and aggregated data captured during the SHAPES large-scale pilots, informational resources, best practices, tutorials and educational material, aiming to nurture the community in general and the health and social care service providers in particular, with respect to the most optimal settings, models and policies involving integrated care in Europe and the process of ageing in place.

4.4 The SHAPES Capability Services

SHAPES delivers not only an ecosystem of interoperable digital solutions addressing different aspects of health and long-term care delivery and capturing a diverse set of health and wellbeing data but also advanced big data analytics and artificial intelligence techniques capable of analysing the older individuals' health, environmental and lifestyle information. As a result, SHAPES exhibits as exploitable results specific capability services for individual guidance on healthy lifestyle and disease prevention, based on personalised models formed upon the exploration of the gathered monitoring data of health and wellbeing parameters by the Platform's digital solutions. In this context, SHAPES develops the **Healthy Lifestyle Management and Wellbeing Assessment**, based on personalised models that gather the monitoring data of multiple health and fitness parameters, using the Platform's wearables, home sensors, social activity apps, emotion analytics, vital signs readers and nutrition recorders and incorporating the Platform's intelligent data processing for the recognition of behavioural trends and specific services for individual guidance on healthy lifestyle and disease prevention. Also, SHAPES provides the **Risk Assessment and Prediction Module**, based on supervised and unsupervised classification methods that allow for the Platform's intelligence engine to assess the risk of deterioration of an individual's wellbeing condition and to build accurate

predictive models that are capable of assessing the need to adjust, alter or increase the level of care at home to safely postpone the need for institutionalisation. Moreover, SHAPES produces **User Profiles**, derived from the processing and analysis of large datasets using big data analytics and AI techniques to extract commonalities, specificities, patterns and trends that allow the creation of user stereotypes, in which specific health and care conditions or settings are associated with appropriate care pathways, treatment plans and medicine prescriptions (best matching profile). The offer of SHAPES Capability Services function as a true enabler of the transformation of health and long-term care services across Europe, allowing relevant stakeholders to determine the pace of the change and select the specific capabilities that will bring them the edge required to improve their high-quality care service offer, to the benefit of their own professionals and of society.

4.5 The SHAPES Consultancy Services

The novel knowledge, competences and skillsets generated through the implementation of the SHAPES Action, and particularly emphasised in the SHAPES Recommendations, provides to the SHAPES partners a superior expertise that is exploitable to the offer of **specialist advice, guidance and consultancy services** to health and social care service stakeholders across Europe with respect to the transformation into next generation health and long-term care services. These consultancy services may take the form of best practice tutorials, organisation change assessments or coordination of digital innovation processes and will support either the engagement of decision-makers to support the organisational benefits brought forth by the adoption of SHAPES capabilities or the involvement of collaborators to build a positive work culture towards change, as health and social care services evolve.

5 SHAPES Competitive Advantage

Competitive advantage is an attribute that allows an organisation to outperform its competitors. In SHAPES's context, competitive advantage refers to the set of factors that allow the SHAPES Platform to deliver more affordable or higher quality services. As the Innovation Action that developed the first EU-open and standardised ecosystem of stakeholders, knowledge and technologies dedicated to health and long-term care for older individuals based on the scientific evidence captured in EU-wide large-scale piloting activities, SHAPES is uniquely positioned to provide a competitive advantage to its adopters/customers. This competitive advantage is reflected in new communication dynamics and participatory mechanisms, the improved understanding of older people's lifeworld and needs, a sustainable integrated care adoption and scale-up model, the enhanced ethical framework supporting older people's rights and care services' delivery and affordable, accessible and available digital solutions and technologies to support older people's independence, autonomy and ageing at place. Overall, the new knowledge, technologies, digital solutions and services that deliver true transformation of health and long-term care systems, positively impacting their effectiveness, efficiency and long-term sustainability.

Amongst the different tools enabling the understanding of competitive advantage, the **SWOT analysis**³⁹ allows SHAPES partners to assess the internal (strengths and weaknesses) and external (opportunities and threats) factors that influence a better use of resources and help the definition of a successful business strategy for the SHAPES Platform. The goal is to emphasise the Platform's strengths and mitigate its weaknesses (so as not to be explored by competitors), while being aware of existing threats and leveraging on actionable opportunities.

In this context, a major **strength** offered by the SHAPES Platform is its **ability to deliver a broad range of affordable, accessible and available digital solutions** that can help older people manage their health, maintain their social connections, and stay engaged in their communities. Importantly, these solutions have been **co-created with and co-validated by the end-users**, ensuring that the solutions truly meet the users' needs and are user-centred, easy to use and friendly, as well as reliable and trustworthy. Rejecting the paradigm of *one solution fits all*, the Platform's integration of technological, organisational, clinical, educational, and societal solutions in a single **Marketplace** delivers a **unique resource** that facilitates the easy and timely access to a range of tools that help older adults to stay healthy, active, connected, and engaged. For example, SHAPES offers health monitoring digital solutions allowing older adults to track their vital signs, monitor their wellbeing and communicate with their care providers remotely, as well as social networking and communication platforms that allow them to stay connected with friends and family. SHAPES's

³⁹ The SWOT framework is credit to Albert Humphrey, who developed the approach to the business and marketing domain at the Stanford Research Institute in the 1960s and early 1970s.

strength is also embedded in the delivery of **multiple informational resources**, explaining in simple and understandable terms the different aspects of older adults' care needs, the specificities of current health and social care systems across Europe, the implementation of integrated care pathways and the value of participatory models in health and long-term care decision-making. Further, SHAPES makes available **aggregated datasets** stemming from the SHAPES piloting activities. The **wealth of knowledge on the available information, best practices, innovative technologies and unprecedented real-world data** involving the lifeworld of older people is a unique resource that SHAPES brings forth to benefit society.

There is also **strength** in numbers: the SHAPES effort to build and expand the **SHAPES Community**, continuously involving diverse stakeholders with interest in matters of active and healthy ageing, of ageing in place and of integrated care is a strong indication that SHAPES supports the role of **social capital**, valuing each community member's contribution and offering a sense of connectedness, kinship, empathy and purpose that strengthens the overall community. SHAPES gathers a large number of skilled expert partners that are building a **network of networks**, welcoming opportunities to learn, share experiences and gain knowledge, through diversity, critical thinking and innovative ideas that contribute to the transformation of health and long-term care delivery across Europe and bring about **social change**. This context is directly created by the SHAPES **ethos**, the SHAPES's set of shared beliefs and values that uphold SHAPES's uniqueness in what concerns the delivery of high-quality affordable, accessible and available integrated care digital solutions and services, co-created with users and upholding the absolute respect for older people's and care workforce's fundamental rights and dignity, for care ethics and for a humane society. Importantly, SHAPES also engages the participatory processes of its community into performing its due diligence on the assessment of its results' **social impact**, focusing on enhancing the benefits for involved users and stakeholders and minimising harm, in a framework that protects fundamental rights.

The SHAPES Platform's strengths allow it to perform well, and in a differentiating manner, its role in supporting active and healthy ageing and extending the autonomy and independence of older adults at home settings. Further, the advocacy towards the adoption of SHAPES digital solutions, technologies and services also unleashes the potential to reduce health and long-term care costs, hospitalisations, and the need for institutional care. By providing older adults with the resources and support they need to manage their health and maintain their independence in their own homes, SHAPES contributes to reduce the burden on healthcare and social care systems and the need for costly hospitalisations and institutional care. This not only benefits older adults, by allowing them to safely stay in their own homes and communities, but it also benefits healthcare and social care systems by reducing the demand for costly inpatient and institutional care. On another token, by offering a range of digital solutions allowing older adults to participate in activities and connect with others, SHAPES helps to combat social isolation and promote intergenerational connection, a benefit

particularly important for older adults who experience isolation due to mobility issues or other barriers, and see in SHAPES the opportunity to stay connected and engaged with their communities from the comfort of their own homes.

Notwithstanding, SHAPES is attentive to its intrinsic **weaknesses**, and is actively mitigating them by: 1) pursuing novel avenues to continue strengthening the **expansion of its Community**, aiming for a wider European geographical coverage that brings about transformation to the different healthcare and social care systems across Europe; 2) being always relevant and engaged, **continuously providing up-to-date and important informational resources and contents** that present real answers and actionable solutions to meet the needs and expectations of its community of users and practitioners; and 3) continuing to **grow its Marketplace's offer** of affordable, accessible and available digital solutions, technologies and services that abide to SHAPES's ethos and code of conduct, qualifying to be reliable and trustworthy. Overall, this effort will support increased market dynamics, marked by new entrants, a continuous innovative drive, transparency and competitiveness and the creation and sustainment of highly qualified full-time jobs in health and social care sectors.

Concerning the identified **threats** in the situational assessment of SHAPES, the SHAPES partners accompany the ongoing efforts to build secure electronic health records and health data spaces, which still denote a rather **siloed perspective on data flow and exchange, ownership and access**, despite the applicable provisions of the GDPR, of the Data Governance Act, the Data Act and the EHDS Proposal. In this context, and following the mandatory data privacy and protection regulation, the SHAPES Platform only uses aggregated non-identifiable data on health and wellbeing parameters and will make it accessible to all, abiding to the Findable, Accessible, Interoperable and Reusable (FAIR) principles of research data. Access authorisation and authentication processes are implemented to ensure that only authorised users are able to access the data, ensuing the SHAPES's data access policies. In addition, SHAPES is aware of the threat posed by the **need for digital solutions to fit to the specific constraints of different healthcare and social care systems** across Europe, making it difficult, particularly for SMEs, to scale-up their solutions and have a presence in different national markets. The SHAPES Platform will not only support digital health companies to shape their solutions into modular and system-agnostic settings to facilitate their application to different healthcare and social care systems, but also provide a Marketplace to enlarge the reach of the SHAPES digital offer to a wide European market. Further, SHAPES fully acknowledges the **difficulties for integrated care digital solutions, technologies and services to attain user acceptance**, being it provided by older adults or by the care workforce or by health and social care service providers. SHAPES faces this threat by insisting on the co-creation and co-validation of digital solutions with relevant end-users, so as to ensure adequate suitability of those solutions to the users' needs and expectations, including with respect to safety issues. In addition, SHAPES is committed to combat medical

misinformation, improving the levels of health and digital literacy and the competence and skills amongst its Community (older adults and care workforce), and to establish a trusting framework for users' interaction with the SHAPES digital offer, in order to facilitate the adoption and use of integrated care digital solutions, to the benefit of all involved. This trusting environment is also instrumental to surpass the threat of **ethical and security concerns surrounding the gathering of personal health data and the adoption of digital solutions, robotics and AI technologies in the delivery of care**. Aside from upholding ethically-sound values and principles, fundamental rights and a code of conduct associated with the ethics of care, to which it also holds all third-parties in the Marketplace accountable and responsible for, SHAPES treats its users as valuable stakeholders and not just as data sources, implementing robust security measures to protect the users' privacy, as well as ensuring that its AI technologies are transparent, understandable, explainable and fair. As much as standardisation and regulation are important to ensure user acceptance and the scalability of digital solutions across Europe, SHAPES will **remain vigilant to the influence these determinants may exert in constraining the flow of innovation** into emerging and future integrated care digital solutions. To ensure wider adaption, SHAPES advocates the next generation of digital solutions and technologies should support innovative concepts and engage users in such a way that fosters equality and inclusivity, resulting in improved integrated care digital solutions for all. In this process, SHAPES recognises that innovation continues to flourish as **new competing entrants**, with advanced and innovative digital solutions, technologies and services for the Silver Consumer, are constantly emerging in the market. SHAPES will endeavour to attract these new players to the Marketplace, turning them into a revenue source in exchange for delivering a new privileged channel to the market.

Based on the PESTEL analysis conducted, the SHAPES partners identify a set of **opportunities**, building on the **positive political and policy-related environment** towards the adoption of integrated care and healthy ageing practices, including the implementation of incentive mechanisms to enable older adults to continue to provide paid or unpaid work beyond official retirement and continue to instil positive benefits to the economy and contribute meaningfully to society. The market growth estimates for the **Silver Economy** are also highly encouraging, reflecting a very dynamic market characterised by a new customer base with high consuming power and by a large number of businesses, namely innovative SMEs, that are pursuing innovative gerontechnologies and embedding *ageing* as a key strategic driver of their commercial goals and are capitalising on the knowledge and skills of an ageing workforce. In turn, these highlight the increasing social trend towards healthy and active lifestyles, including the adoption of preventative behaviours even by older adults. In tandem, and benefitting from a **significant investment of the EU and national governments in digital infrastructures and Internet-enabled connectivity**, citizens are using more and more digital solutions and smart IoT devices that allow them to support their active lives and to be socially connected and engaged, an environment that revealed itself fundamental during the COVID-19 pandemic to combat isolation and mobility and

travel restrictions. As digital solutions and smart connected devices become mainstream, it is also interesting to observe the **increased regulatory and ethical scrutiny on the use and adoption of these technologies**, namely in health and long-term care settings, to the benefit of patients' or users' satisfaction, safety and trust.

SHAPES is uniquely tailored to leverage on the prevailing opportunities to promote the transformation of healthcare and social care systems, as well as of integrated care delivery across Europe. By promoting its uniqueness, mitigating its weaknesses, being aware of potential threats and leveraging on existing and future opportunities, the SHAPES Platform is and will continue to be a powerful instrument at the service of older adults wanting to live healthy and active lives in their own communities.

Table 4 - SWOT Analysis of SHAPES Results

| Strengths | Opportunities |
|---|--|
| <ul style="list-style-type: none"> • Easy access to friendly user-centred affordable, accessible and available digital solutions supporting healthy and active ageing and ageing in place; • Delivery of simple and easy to understand informational resources on healthy and active ageing and ageing in place, as well as of unprecedented real-world data on the lifeworld of older adults; • Creation of the SHAPES Community, a network of networks, as a force multiplier to promote true social change; • Uphold of an ethos and code of conduct that provides guidance to the SHAPES Platform's activities, while respecting the fundamental rights of older individuals. • Creation of the SHAPES Marketplace for validated health and long-term care digital solutions fitted to older individuals' needs. | <ul style="list-style-type: none"> • Positive political environment and policy provision encouraging integrated care and healthy ageing; • Sufficient incentives for older adults to remain economically active and socially engaged; • Robust market growth estimates on Silver Economy to attract investments and sustain healthy economic activity; • Dynamic market with suitable cohort of SMEs to develop products and services; • Solid innovation drive with a focus on gerontechnology; • Significant EU investment in digital infrastructure and Internet connectivity; • Strong social tendency towards healthy and active lifestyles and the use of smart IoT devices; • Increased regulatory and ethical scrutiny on the application of digital solutions to health and long-term care sectors. |
| Weaknesses | Threats |
| <ul style="list-style-type: none"> • SHAPES Community needs a wider European geographical coverage; • SHAPES's informational resources and real-world data require constant updating to maintain relevance and attract interest; • SHAPES Marketplace has to grow, being open to third-parties' digital solutions supporting healthy and active ageing and ageing in place. | <ul style="list-style-type: none"> • Tendency to concentrate health data in specific repository silos with excessive bureaucratic access policies; • Need to operate within different healthcare and social care system constraints; • Stringent national regulations affect the adoption of digital solutions; • Lack of user acceptance due to lack of suitability and safety and to low levels of health and digital literacy and training skills; • Ethical and security concerns about the collection of health data and the adoption of |

| | |
|--|--|
| | <p>digital solutions, robotics and AI technologies in the delivery of care;</p> <ul style="list-style-type: none"> • Standardisation and regulation limit the breadth of innovative developments; • Access of new entrants to the market with advanced and innovative digital solutions. |
|--|--|

Furthermore, to better understand the competitive landscape that SHAPES faces and to assist in positioning SHAPES's digital health solutions, technologies and services within it, the SHAPES partners applied **Porter's Five Forces Model** [23] to the digital health market, aware that the collective strength of these five threat forces – threat of new entrants, threat of substitutes, bargaining power of buyers, bargaining power of suppliers and rivalry of existing competition – determines the attractiveness of the digital health market and the potential for SHAPES to attain superior financial performance, by influencing prices, costs and investments.

Any **new entrant in the market** strips away the potential market share of SHAPES. This threat is directly related with one factor: the barriers to entry into the market. The health and care market is characterised by relatively high entry barriers, associated with a significant regulatory framework on medical devices for safety and security purposes, the long lead times to market and the required high level of investment in research, innovation and marketing. The traditional mistrust towards new players also derives from their usual absence of relevant knowledge and know-how to understand the market's culture and how to operate within the sector (high learning curve). SHAPES leverages this specific knowledge, reinforced by the delivery of digital solutions, technologies and consultancy services, to counter the threat of new entrants and strengthen its influence, both through the implementation of fidelity programmes and the establishment of partnership strategies involving key stakeholders. These partnerships also aim to empower the SHAPES partners' networks and serve as a multiplier effect to bolster SHAPES's presence in the market. Overall, the threat effect of new entrants in the market represent a **low force** level.

In order to be a viable **substitute**, an offer needs to fulfil the same function as the offer which it is replacing. Hence, substitute offers face the same barriers for entry as the SHAPES Platform, particularly with respect to security concerns regarding user data, long lead times to market and initial high investment requirements. These barriers do make the emergence of substitutes gradual and represent a **low threat force**, considering existing barriers to entry and the ongoing strong demand for the SHAPES offer. Forged in the delivery of unprecedented expert capacities associated with a full co-creation process orchestrated with end-users, SHAPES's uniqueness also makes it more difficult to replace in the hearts and minds of the consumers, especially the silver consumer that is known for a fierce loyalty to trusted brands. Nevertheless, to ensure continued protection against substitutes, SHAPES needs to be always up-to-date, providing the newest and more relevant knowledge and presenting, through the Marketplace, new digital solutions and technologies that are effective and cost-

efficient. This means that SHAPES will need to define the processes to attract new suppliers, while attentive to the emerging needs of the ageing population for health and long-term care; the ability of SHAPES to develop and offer specific packages of care-associated data, knowledge, solutions, technologies and services will certainly influence its competitive position.

Buyers of SHAPES's exploitable results are mainly the healthcare and social care service providers, research institutes and the eHealth industry, rather than the older individuals and the public. Overall, the prevailing **buyer bargaining power** may be described as a **moderate threat**, for this market usually involves large amounts of investment and capital (high acquisition power) and is increasingly becoming more consolidated in the industry, especially as reimbursement or funding policies are evolving. If the highly fragmented industry supports the buyers' bargaining power, since buyers represent a significant portion of their suppliers' revenues, the absence of buyer concentration limits their power as price setters. As a result, the political and regulatory external factors play a fundamental role in the market, also influencing SHAPES's business options and decision-making. Without an obligation or mandatory requirement to adopt and use the SHAPES results, SHAPES partners will need to understand how their buyers' bargaining power functions and clearly identify the knowledge required to operate effectively in the market. It will be important to invest in brand loyalty and the quality of services provided in order to ensure the buyers' trust and long-term commitment.

The suppliers of SHAPES's exploitable results are the manufacturing companies, research and technology institutes and academia departments providing their digital solutions, technologies and services through the SHAPES Platform. It is a large and diverse group of entities and their **supplier bargaining power** is **high** by nature for, despite the high cost of healthcare and long-term care services, demand is high and growing. In addition, specific digital solutions and applications and information technologies may be hard to replace, concerning invested costs and high switching costs, the difficulty of backward integration and the buyers' price sensitivity. Other factors limiting the replacement of suppliers would be the differentiated products and the availability of substitute offers. SHAPES is aware that a lower buyer bargaining power would make the SHAPES Platform more attractive, increasing the profit potential. By gathering a large number of suppliers in the Marketplace, SHAPES aims to set more favourable terms and conditions in the market, reinforcing the suppliers' power, stimulating the buyers' loyalty and contributing to the existing market dynamics with a triple win strategy (for suppliers, buyers and the overall market). To ensure this competitive advantageous position, SHAPES partners will have to be willing to make adjustments in suppliers' recruitment and networking, so as to reduce operational costs, while maintaining unique valuable knowledge and offering differentiating digital solutions, technologies and services that are affordable, accessible and available.

The **competitive rivalry** is usually the largest force to consider in the strategic competition analysis. Concerning the SHAPES Platform as a whole, competition is scarce and scattered, so the underlying effect of competition is low. However, the exact opposite context occurs when considering primarily the SHAPES's health and long-term care digital solutions, technologies and services. Indeed, more than two million of health technology companies in Europe, the large majority SMEs, bring forth a **high competition threat level**, mostly because of reduced product differentiation, of low switching costs for buyers and the regulatory changes associated with reimbursement and funding models. Changes in ownership are also a clear indication of how rivalry operates in the healthcare industry: in the last five years, significant changes in ownership affected the market, with the number of mergers and acquisitions multiplying, the availability of risk capital decreasing (heavy impact on start-up companies) and the large companies consolidating and expanding their market presence, supported by investors attracted by innovation and growth prospects.

The EU competition policy contributed to influence some ownership changes in the healthcare market, often calling for the sale of a national division of a company to ensure competition is maintained between member states. In fact, EU pressure and different public health crises have been influencing market integration and compliance within national healthcare systems and, as a result, the competition in the healthcare market. Today, a large number of major players in the digital health market are focusing on alliances and partnerships and on the use of marketing techniques to enhance their client base and revenue share in the market. This rapidly consolidating market contributes to increase rivalry amongst existing players, as significant economies of scale benefit mostly larger players. Still, concentration is low, for no player has a dominant position, which also results in high competition for market share among existing players. With each market player investing heavily to attain and maintain its market share, the competition process intensifies, particularly in what relates to pricing. In this respect, the gathering of suppliers to attain relevant economies of scale and the transparency brought by SHAPES are deemed to establish a good foundation for fair competition, while also bringing additional insight to the pricing schemes underlying the end-users' (public) procurement processes. Overall, it is noted that SHAPES's business strategy is the most important asset against the rivalry of competitors.

In a nutshell, Digital Health is a growing market providing many opportunities for business and investment. However, entry to the industry is difficult, due to the large capital needed to invest, as well as the threat of strong competition from the large companies operating in the market. There is a vast number of suppliers to select from and buyers have a large number of digital solutions, technologies and services to choose from. And the prospects of future technological advances will increase the attractiveness of this industry as well as the profit potential of the players involved in it. Still, as security concerns regarding patient safety and data protection may refrain

the industry demand, there is also room for possible substitutes to arise. Globally speaking, the digital health industry can be considered to have a moderate average of profitability.

Being aware of the main sources of competition at place allows SHAPES partners to shape the way these forces perform, interact and compete, to adjust their competitive strategy decision-making and superiorly exploit SHAPES's success potential in the market.

5.1 Fostering SHAPES's Competitive Advantage

When the offer is as beyond state-of-the-practice as the one encapsulated in SHAPES, even more so when the technology is yet to be fully embraced, its early adoption also brings risks that may pose constraints to the exploitable results' market penetration and uptake. Consequently, as part of the SHAPES exploitation approach, a number of activities were defined and implemented with the purpose of mitigating apparent risks and augmenting the user and social acceptance and the trust level in SHAPES and its digital solutions ecosystem, to foster their widespread adoption in the future.

In this context, one of the first activities undertaken has been **Community Building**. The development of the SHAPES Action started off with the engagement of all SHAPES partners in the recruiting of valuable members to the SHAPES Community, including end-users, medical and social care practitioners, health and social care authorities, policy-makers, civil society organisations, industry and academia. As the SHAPES Community grew, so did the interest generated by the project, allowing the SHAPES partners to gather relevant feedback on end-users' needs and expectations. This Community also established a set of early adopters that would willingly validate the SHAPES results and contribute to market penetration and uptake. Indeed, actively involved with the SHAPES large-scale pilots, the SHAPES end-user community recorded the improvement of SHAPES innovations, using and reviewing the knowledge and technologies, indicating potential optimisations and eliminating vulnerabilities and shortcomings. As a result, SHAPES was able to establish scientific advancements, best practice in service supported by educational and training materials and technological prototypes that ensure novel technologies take root in the organisations that are part of the SHAPES Community, planting the seed for future communities of practice (in this sense, the SHAPES Action was also able to identify new directions for research).

Another activity that has been key to foster the competitive advantage of SHAPES's propositions is **Technology and Knowledge Transfer**. The ecosystem of end-users and customers is changing rapidly, with technological evolution and digitalisation dictating the fast pace of change. Aside from the traditional communication and dissemination activities with a strong market drive, including participation in events,

publication of articles and the use of online media, the SHAPES partners developed specific initiatives such as the SHAPES Dialogue Workshops (involving all SHAPES stakeholders), the SHAPES Open Calls (targeting technology providers, including developers of eHealth digital solutions), the large-scale SHAPES Pilots (addressing specific end-users and practitioners) and the participation in meetings with key stakeholders to the SHAPES Action (government authorities, policy-makers and standardisation bodies). All these dissemination activities have proven invaluable in making potential customers aware of the SHAPES results' availability and quality.

Thirdly, the SHAPES Action invested heavily in its own **Sustainability**, by promoting targeted involvements with standardisation efforts and by exploring not only a preliminary economic impact but also a socio-economic sustainability analysis of SHAPES results (this avenue is addressed in detail in Deliverable D7.2 – SHAPES Socio-economic Sustainability). From the start of the Action, the SHAPES partners thoroughly performed the analysis and research of applicable regulatory aspects issued by the European Parliament and the EU Members States, as well as of the extensive standardisation work performed by ISO, IETF, CEN, ITU, GC4HI and W3C in the last decades to build age-friendly neighbourhoods and eHealth technologies and digital solutions, to assess of their adequacy and application within the health and long-term care services domain and to identify the best practices for building transforming health and social care systems in Europe. As an ecosystem of people, organisations and technologies supporting integrated care solutions for active and healthy ageing in place, SHAPES privileged the adoption of a wide variety of well-known and recognised standards in the domains of health data exchange, the secondary use of health data, the sharing of IoT data and interoperability among smart living platforms, and user interface design, accessibility and usability. Simultaneously, SHAPES partners, such as AAA, EUD, GNO and WFDB, contributed to ongoing and new standardisation efforts seeking to ensure age-friendliness, accessibility, inclusion and eHealth data exchange specificities are met.

Community Building, Technology and Knowledge Transfer and **Sustainability** are therefore key exploitation activities undertaken by the SHAPES Consortium to highlight the SHAPES's added-value and potential to relevant stakeholders and adequately prepare the market to the future entry of the exploitable SHAPES results as they become market-ready.

6 SHAPES Market Positioning

Sustainability, at its most basic definition, is the ability to continue. Before the SHAPES partners decide how to proceed after the SHAPES Action, they need to first determine what they want to sustain. Which are the key SHAPES elements to continue beyond the end of the Action? The answer to this question involved two major aspects, as follows.

The question of generating value is encapsulated in the **value proposition of SHAPES**. In this Action, the sustainability work is responsible for determining the initial value proposition of the next generation of integrated care services, and the way it may be operationalised to provide value. SHAPES's innovation activities already delivered value to the SHAPES stakeholders, in that they provided relevant knowledge and digital solutions and technologies that were tested and validated by users/customers in operational environments. The SHAPES partners needed then to understand what value SHAPES delivers atop, both to them and to the users/customers. The actual value depends on the nature of the SHAPES business models to be thoroughly addressed in Deliverable D7.3 – SHAPES Business Plan.

Across the European market for health and long-term care digital solutions and services, investors are faced with high diversity. The adoption of different technologies, solutions or strategies lead to different business approaches on the implementation of digital technologies in support of the delivery of high-quality health and long-term care services that, ultimately, do render the adoption of improved integrated care services in Europe a more complex and long-term task, requiring the address of systemic issues and tackling simultaneously technical, organisational and regulatory challenges.

The SHAPES Action aimed at achieving a breakthrough in the introduction of eHealth digital solutions to support and extend the independence and autonomy of older individuals, by proposing an open implementation that considers different types of structures, processes and technologies for integrated health and long-term care services.

In this context, it is helpful to adopt a systems' thinking perspective. The **Systems Market for Assistive and Related Technologies (SMART) Thinking Matrix** [24] is a fundamental element of SHAPES's market strategy, as it allows to better understand the market's services, providers and users, advocating the implementation of market shaping activities that aim to establish fairness and transparency in a balanced market that encourages the involvement and agency of local stakeholders and services' users.

SHAPES proposed to identify and reach prospective users, understand their needs and provide an offer that sets a distinctive and sustainable competitive advantage,

promoted across a wide range of channels, to effectively transform those users into satisfied customers. The SHAPES **marketing strategy** therefore connects the SHAPES Platform and digital solutions with customers, upholding four different impact axis that bring about innovation, competitiveness, growth and value.

Nevertheless, introducing new digital and assistive technologies in the European market, in particular implementing improved integrated care solutions and services, requires considerable investments from various stakeholders. In order to decide on an investment, investors (payable customers or decision-makers) expect viable business models, often developed on the basis of an economic impact analysis. The SHAPES partners therefore performed a **preliminary economic impact analysis**, here-in presented, as well as a socio-economic sustainability analysis based on the outcomes of the SHAPES pilot validation process, to be presented in Deliverable D7.2 – SHAPES Socio-economic Sustainability. Still, it is acknowledged that, as the SHAPES partners proceed towards the product market-ready phase, it will be important to conduct a thorough business study for the SHAPES exploitable results.

The knowledge on the economic impact of SHAPES is relevant for the successful adoption of the SHAPES digital solutions, technologies and services in the EU Member States. The associated investment is more feasible if it pays-off within a reasonable timeframe. This is possible through improved response to health and long-term care needs, enhanced resource management of the care workforce and positive effects in the older individuals' health, wellbeing and quality of life. The SHAPES preliminary economic impact considers those effects by identifying the resulting societal costs. In order to receive the most immediate feedback on SHAPES and its possible economic impact from the stakeholders that have the highest impact on market introduction, the SHAPES partners involved them in the validation process of the SHAPES results. Representatives from those stakeholders were part of the SHAPES Advisory Board and, aside from their involvement, the SHAPES partners reached out to other stakeholders.

Overall, the focus is on the creation of customer value, affected by external technological, market and regulatory frames and benefitting from internal technological, financial and organisational arrangements to implement improved integrated care pathways, digital solutions and services that are valued by the customer, thus generating the envisaged provider value.

6.1 The SMART Thinking Strategy

In order to consider how different aspects of service provision and the market interact with the various factors described above, it is helpful to adopt a **systems-thinking perspective**. Such a perspective embraces *Forest Thinking*, focusing on the wider forest rather than individual trees; *Dynamic Thinking* by which, rather than focusing on single events, the focus is on patterns of behaviour that change across time and

contexts; *Loop Thinking* where cause and effect are often bi-directional rather than one-off events; and *System-as-Cause-Thinking* where changing one aspect may affect other – not directly connected — aspects of the system [25, 26].

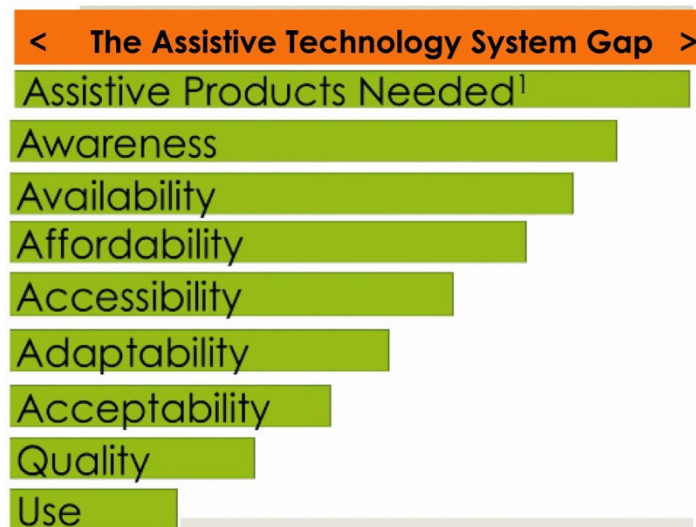


Figure 4 - The Assistive Technology System Gap

Figure 4 [27] above illustrates different elements that may contribute to an **assistive technology system gap**, where the need for (or required benefit from) digital and assistive products may not be aligned with the demand for (consumers seeking and willing and able to purchase) these products, nor the supply of them into such markets. Each step in the above diagram represents a part of the chain between the need for and use of products where the link can be broken or diminished. People must be aware of the existence of a product that suits their needs, that product must be available to them, and affordable for them (either personally or through some type of social insurance scheme). The product should also be accessible in terms of information about it and the skills required to use it, and it should be possible to adapt it to the particular needs of particular users. The product should also be one which people like, it is acceptable to them and seen as *adding to them* rather than detracting from their image, confidence or how others respond to them. If the digital or assistive product is not of sufficient quality, it may simply be rejected, malfunction or need too high a level of maintenance. If all of the above steps are achieved to a sufficient degree then – and only then – may the product be used by the person who can benefit from its use. It is their experience of use that stimulates further demand both from themselves and from others they may interact with or influence. This therefore is the **demand-side of the market**, but the ability of the SHAPES results to address the steps to use will support the functioning of the market for digital solutions and assistive technologies. One approach to achieving this is adopting a system-thinking approach to these issues.

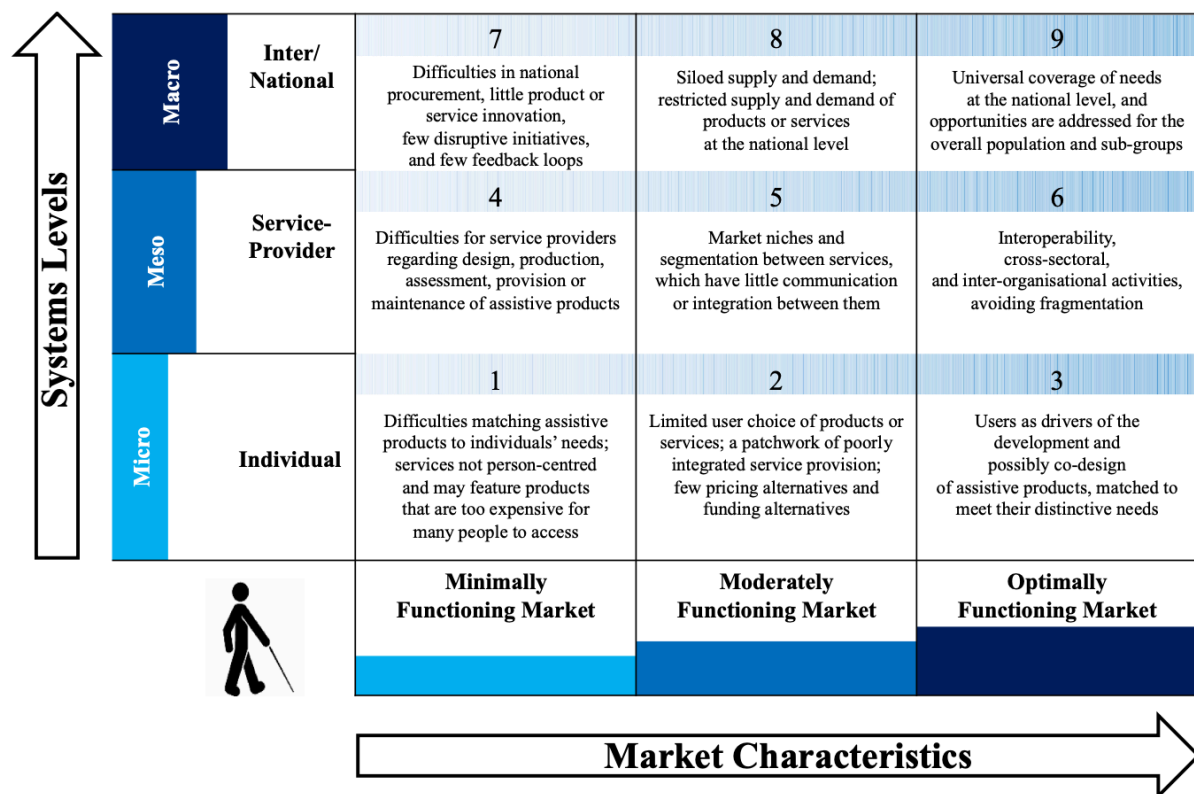


Figure 5 - The SMART Thinking Strategy

Holloway et al. [28] stress the importance of systems strengthening. They state “*The link between market characteristics and systems level of AT provision demonstrates the need for strengthening at each level. Understanding the market characteristics of a sector is key to being able to diagnose what type of support is best needed.*” (p.10). The same systems-thinking issues apply to assistive digital technologies more broadly, as to digital and assistive technologies in particular [29]. Throughout Europe, there is a vast range of market types and differing degrees of market penetration from digital and assistive technologies. Figure 5 illustrates the interaction between different levels of service provision: individual (micro), service provider organisations (meso) and the society (macro) level which is influenced by both national and international policy and laws. Figure 5 also illustrates how at each of these levels the market can be considered to be functioning minimally, moderately or optimally. This **SMART Thinking Matrix**, developed through categorising the results of a systematic review of literature, allows to think through what improvements in service development are required to **move the market further to the right in the matrix**. It is noteworthy that what constitutes an optimally functioning market for the individual, service provider, or nation-state may be quite different. In different countries, cultures and economic systems there may be a focus on one level more strongly than on other levels. **The matrix does not seek to be prescriptive, but rather to make service planners aware of the different priorities of different stakeholders**, and the often-necessary compromises or decisions needed to address these. Notwithstanding the above, SHAPES does not believe that there is anything incompatible with the achievement of the optimal market at each level (cells 3, 6 and 9 in the matrix), although the journey

along the way may proceed more quickly along some levels than along other levels. Again, the SHAPES market may focus more in one country on progressing along one of these levels than it does in another country. The SMART Thinking Matrix can therefore be used to help countries strategically plan their approach to adopting the SHAPES results.

6.2 SHAPES Marketing Strategy

The sustained exploitation of the SHAPES results requires the definition and development of an appropriate marketing strategy to ensure the Action's maximum impact and value generation capability. The SHAPES partners consider that the SHAPES Action involve four major impact axes:

- **Technology** - related to the Action's proposed digital solutions' and technologies' **innovation** for health and long-term care services (next generation integrated care services);
- **Knowledge** - referring to the acquisition and transfer of new knowledge, expertise and capabilities, also linking with other technical or scientific projects and communities and contributing to strengthen Europe's **competitiveness** at research and industrial levels;
- **Business** - proposing the identification of emergent (business) opportunities to deploy the SHAPES results, either considering the whole SHAPES Platform and Digital Solutions ecosystem or different combinations of SHAPES digital solutions, and foster business **growth** benefitting from the know-how, skills and competence of the wide SHAPES community;
- **Societal** - considering SHAPES results' **value** for older individuals, informal caregivers, care workforce and public health and social care services in what regards the contribution to enhance the quality of life, the safety and security and the well-being of the older people.

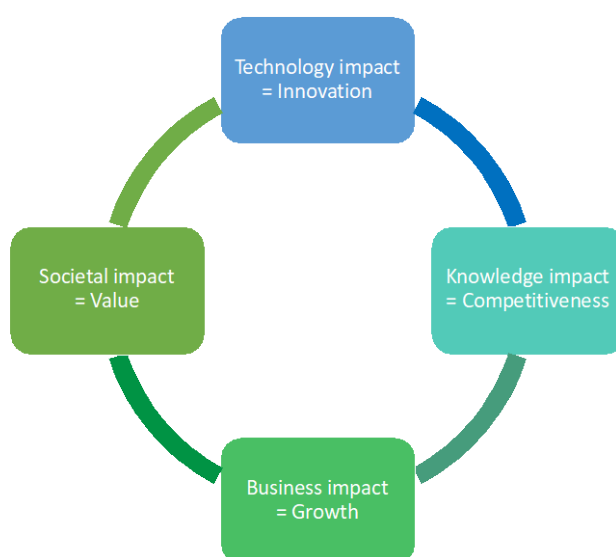


Figure 6 - SHAPES Impact Axes

The four interdependent impact axes are reflected in SHAPES's long-term exploitation plan, of which the marketing strategy is a relevant part. As preparatory steps towards designing the marketing strategy, the SHAPES partners considered the identification of the SHAPES exploitable results, the assessment of the market's characteristics and the establishment of the SHAPES's potential, based on competitive advantage and viable market positioning. These in turn are critical to define the SHAPES business models, identify exploitation plans and establish the roadmap for the broad adoption and uptake of SHAPES results across Europe (these features are addressed in deliverable D7.3 – SHAPES Business Plan to be submitted on month 48 or October 2023).

An adequate marketing strategy increases the business-related opportunities that support the SHAPES's exploitation activities and future commercialisation effort. Nowadays, the health and long-term care digital solutions sector is comprised of multiple providers offering many different technologies, so it is necessary to position correctly the SHAPES offer on the market, in order to achieve good exploitation results and foster significant market penetration and uptake.

To achieve this proper positioning, the SHAPES partners determined a marketing strategy that is held on three axes:

- Competitive price;
- Distribution strategy;
- Sales strategy.

To determine the best possible marketing strategy for SHAPES, the SHAPES partners reviewed Bowman's strategic clock model [30], which classifies the possible strategies by a joint function of two variables: the perceived added-value and the perceived price of the offer. This model was viewed as exceeding the traditional model established by Porter (cost leadership, product differentiation or market segmentation)⁴⁰ and opening new perspectives for competitiveness, considering both quality (perceived added-value) and price.

Following Bowman's model, the SHAPES partners deemed that the SHAPES exploitable results would primarily benefit from a **Hybrid Strategy**, characterised by affordable pricing and superior product quality, based on differentiating added-value features. Considering that SHAPES is attentive to the paced transformation of health and social care services and built its solutions modularly and using broadly adopted Internet-enabled technologies, open components and relevant standards, this marketing strategy is adequate to introduce new digital solutions to the market and to satisfy specific customer needs (customer solution). Further, to sustain higher margins

⁴⁰ Porter, M. E., *How Competitive Forces Shape Strategy*, May 1979, Vol. 59, No. 2, pp. 137-145.

and maintain affordable prices, the SHAPES partners will seek greater market share, an objective well-aligned with the ageing demographics and the silver economy.

SHAPES meets these eligibility conditions, since it brings forth new advanced capabilities to the health and long-term care digital solutions market that already in their pre-market stage showcase superior potential. And as a true customer solution, SHAPES deeply involved end-users in the co-creation of innovative solutions that offer its customers a unique capacity to truly meet their needs and expectations, either by being the front-runner to the market and by combining multiple advanced functionalities in an integrated extended portfolio. In addition, considering that current macroeconomic conditions are characterised by a large degree of uncertainty and the estimate of *lacklustre growth*⁴¹, it is expected that SHAPES's paying customers, namely public health and social care authorities and health and long-term care service providers, would have greater scope to address the deep-rooted systemic issues affecting health and long-term care systems, while protecting the high level of service required by society.

In regard to the **competitive pricing of SHAPES**, affordability is key to ensure leadership in price, that is, to guarantee that the SHAPES exploitable results are priced adequately considering the superior quality of the digital solutions/services, while reflecting the incorporation of standards and open technologies. It is envisaged that SHAPES innovations will assure high profitability for the SHAPES partners, upon SHAPES's market readiness.

With respect to the **distribution strategy**, involving the decision on how to deliver the SHAPES digital solutions or services to its customers, the SHAPES partners agreed that, based on their experience, the best option is to combine direct sale activities and sales through intermediaries, in a complementary manner. Direct sales secure the SHAPES partners' control of the entire distribution chain and elimination of transaction costs (transaction, negotiation and monitoring costs) by eliminating intermediaries, and transforming the final price paid by customers into net income, thereby increasing associated profitability.

Highly important, the use of **direct sale channels** contribute to protect the SHAPES technology, a critical success factor in the transformation of the health and long-term care digital solutions market, for it avoids the opportunity for competitors to copy or emulate the technological features (which seriously reduces profitability margins and damages the reputation of the provider). But it is also important to consider that direct sales do augment the pressure on SHAPES partners to be present in all market geographies, which represents a significant investment. Furthermore, as an additional

⁴¹ European Commission (2022), *Autumn 2022 Economic Forecast: The EU economy at a turning point*, November 2022, https://economy-finance.ec.europa.eu/system/files/2023-01/ip187_en.pdf.

disadvantage, it is noted that the use of this channel, in very specific situations, may be perceived as prone to selling rivalry amongst the SHAPES partners.

Selling through intermediaries has the immediate advantage of committing reduced resources and reaching a wider market, including specific markets characterised by heavy entry barriers (the local players act as buffers and facilitate the market penetration of new entrants). In addition, the commitment of limited resources does provide increased flexibility to the organisation to adjust business, marketing and sales strategies, as needed. Being relevant players in the market, the industry-driven SHAPES partners already have an installed network of partners, distributors or sale representatives. To those that are now essaying to grow their market share or advance to new markets, this sale strategy is also appropriate for a company who does not own the required logistics and infrastructure to support direct sales. However, it is relevant to note that selling through intermediaries may carry a significant disadvantage with respect to profitability (shared with the intermediary).

This advantage is significantly lowered if SHAPES's industry partners line-up with SHAPES's end-user partners as solution/service advocates and early adopters in the market. And, given the geographical implementation of SHAPES, this is often the case. Indeed, as the SHAPES digital solutions and services evolve to become market-ready, the SHAPES partners may consider including in their distribution strategy the option to create an inter-partner network, so as to obtain enhanced selling flexibility. In this option, each partner would maintain its independence but their collaboration, under a rigorous Level of Service Agreement, would enable additional benefits, through the joint exploitation of business opportunities with complementary solutions, envisaging the customers' full satisfaction. This option reinforces the competitiveness of the SHAPES partners in the market and, in applicable cases, would outrank potential profitability loss (compared to direct sales, for example).

SHAPES partners intend to approach potential customers by upholding a sales strategy that is primarily **customer-focused**. The SHAPES outcomes are, foremost, the result of the intensive relation cultivated between the SHAPES partners and the SHAPES end-user community. It is therefore natural for the SHAPES exploitation activities (and future business commercial operations) to continue loyal to the user/customer-centric drive. Currently, as the SHAPES solutions and services are still in the process of becoming market-ready, the pitch or *sales* message refers to the added-value of SHAPES digital solutions and technologies and their unmatched capability to cost-effectively satisfy the user/customer needs, rendering the decision-makers (payable customers) aware of SHAPES competitive advantage. Moreover, implementing outstanding customer service is determinant to achieve customer loyalty and retention. Adequate tools to establish prime customer service will be addressed by the SHAPES partners, as the SHAPES results enter the market and partners strive to increase market share.

The magnitude of user/customer needs for health and long-term services, the care workforce and citizens and the diversity of specific organisational structures and processes of potential customers are such that the SHAPES partners cannot operate according to a single exploitation model. Considering its vision, SHAPES partners need to have the agility and flexibility to provide appropriate responses to user/customer needs, without compromising ethics, security and the quality of service required. As part of an innovative endeavour, the SHAPES partners are willing to engage in original exploitation approaches towards the target customers, portfolio expansion or business models, to assess their feasibility and impact. Their capacity to explore innovation, whilst carefully assessing risks, makes the SHAPES Action an incubator of research and innovation solutions for next generation integrated care services.

6.3 SHAPES Preliminary Economic Impact Analysis

Next generation integrated care digital solutions bring disruption to the traditional market of health and long-term care services. The absence of historic data (it is an emerging new offer) cannot support the detailed characterisation of the market but it does not prevent the establishment of insightful estimates on the market's potential, using the comparable market approach.

When the market for wireless services emerged, it revolutionised how society communicated on-the-move: the added-value of mobility, while maintaining the ability to be always reachable, changed the *status quo* of the entire economic and social activity. As a whole, society gained richer channels of communication, empowered by audio and video calls, the capability to send and receive text messages and to share files and the opportunity to use a panoply of mobile applications and follow multiple social media platforms. This is similar to the current proposition of SHAPES. Therefore, it is possible to use the wireless services market to perform a comparative analysis.

In the first ten years following the introduction of wireless services to the market, the economic status of the market changed to accommodate new entrants, substantial innovation, high-value venture capital investments and increased demand. Now, the European Union announces the EU economy to be on a turning point: the growth of economic activity is expected to return in spring, as inflation progressively stabilises⁴². These are positive news for SHAPES partners and the market of next generation integrated care digital solutions.

SHAPES has been a key Action in fostering the market success of integrated care digital solutions because the feasibility of the technical solutions implemented highlighted how the benefits and added-value of the new next generation capabilities

⁴² https://economy-finance.ec.europa.eu/economic-forecast-and-surveys/economic-forecasts/autumn-2022-economic-forecast-eu-economy-turning-point_en.

outweighed identified barriers and the absence of sustainable business models. Still, at this moment, it is not possible to ascertain the full costs and benefits of SHAPES because the Action's focus has been on the development of workable solutions to specific customers and the definition of a viable and sustainable deployment strategy. Nevertheless, based on the extensive feedback received during the Action, it is possible to illustrate how SHAPES may accelerate the introduction of next generation integrated care services into the European market.

Based on the principles behind the Technology Acceptance Model (TAM) developed by Davis, Bagozzi and Warshaw [31], it is possible to identify the impact channels of SHAPES and to understand how users come to accept and adopt advanced integrated care digital solutions. SHAPES has a direct impact on the **perceived usefulness** of advanced health and long-term care digital solutions (degree to which a user believes that using SHAPES improves the performance and quality of care delivery) and on the **perceived ease of use** of advanced integrated care digital solutions (degree to which a user believes that using SHAPES is free of additional effort), indicators of the behavioural intention towards next generation integrated care services.

For the duration of the Action, the SHAPES user community emphasised their acknowledgement and understanding of the SHAPES benefits and added-value to citizens and to health and social care service providers, with respect to the improved performance and quality of integrated care delivery. On the citizens' perspective, it was clear that no additional effort would be required on their part, while interacting with the advanced health and long-term care digital solutions; on the part of the care workforce, there were concerns of additional workload but it was sharply demonstrated by SHAPES that care workforce's workload would be highly improved with SHAPES's new capabilities, that interoperability among health and social care services was enhanced and that informal caregivers and older individuals were part of the information/communication loop.

SHAPES is seen as a means enabling the attainment of the users' needs, interests, expectations and ambitions and it has demonstrated the potential to become a **top market solution for the provision of next generation capabilities to health and long-term care services**, solving pressing needs, such as the accessibility and equality of access to healthcare and social care services, the improvement of monitoring and follow-up procedures by the care workforce and the strengthening of the interoperability between health and social care service providers, therefore contributing to enhance the performance of health and social care services and the citizens' satisfaction with the access to care services' response.

With the wide deployment of next generation integrated care services across the EU remaining one of the largest challenges in the health and social care services' sector, **SHAPES has made a clear breakthrough**, pointing a focused and well-informed spotlight on the challenges and opportunities affecting the future of health and social care systems. The support SHAPES partners received for more than three years from

multiple stakeholders is key to provide the way ahead that includes a firm commitment to maintain the *momentum* achieved and keep the debate on the delivery of high-quality health and long-term care digital solutions and services at the top of the European and national agendas.

7 SHAPES Market Deployment: Challenges and Opportunities

Throughout the SHAPES Action, the SHAPES Advisory Board provided privileged access of the SHAPES partners to a wide range of stakeholders defending different perspectives but all acknowledging the benefits and positive impact of next generation integrated care services and of the SHAPES implementation, in particular. Challenges and opportunities involving the market introduction of SHAPES and the uptake of advanced health and long-term care digital solutions across Europe were discussed and specific business impact drivers were identified. This is thus the base for preparing the SHAPES sustainable business operations, construed to be implemented during and beyond the SHAPES Action's timeframe and initiated by the exploitation activities embraced individually or jointly by the SHAPES partners.

7.1 Challenges for SHAPES Market Deployment

Depending on the different SHAPES's next generation capabilities, specific benefits and barriers rise to influence the success in the market. For example, next generation capabilities that benefit from the existing infrastructure or the prevailing organisational culture reveal lower barriers than those requiring the modernisation of the infrastructure or organisational change. And if the infrastructure is modernised and the organisational performance evolves, there are increased benefits resulting from the adoption of additional next generation capabilities.

The most significant challenge concerning the general adoption of advanced health and long-term care digital solutions, technologies and services is the **cost of the implementation**. These solutions, technologies and services are enabled by the integration of Internet-enabled technology and it is foreseen that this modernisation process will remain expensive in the near future. Until the technological evolution towards a universal Internet-based infrastructure is provided at a better price, advanced integrated care digital solutions, technologies and services are likely to rely on European and governmental support in the form of (purchase) subsidies. But it is important to recall the diversity of the national health and social care systems within, a fact that bears influence on the uptake of the SHAPES results at several levels.

Aside from the perception of cost competitiveness, whether in terms of total cost of ownership (TCO) or purchase price, a most critical factor to motivate users/customers to adopt advanced integrated care digital solutions, technologies and services is the pressure to improve the performance, effectiveness and efficiency of health and social care services, particularly in the face of less positive outcomes with higher publicity reach. In this context, the investment is framed in ambitious plans highlighting the societal impact and dictated by the interest in meeting the increased demand from citizens (beneficiaries). The widespread convergence to Internet access, the

implementation of economies of scale and the continued research in the improvement of the public health and social care services are likely to reduce the TCO of advanced integrated care solutions and services in the future. In fact, in this context, it is foreseen that maintaining traditional approaches to the delivery of health and of social care services will become a non-sustainable cost in the long-term for public and private organisations. Hence, the tipping point where the cost for advanced integrated care digital solutions and services will turn from a barrier into a key driver in not that far ahead into the future.

A specific challenge is associated with **regulation and standardisation**. The need to ensure a high level of quality of service with respect to the adequate satisfaction of citizens' needs has determined the role played by EU and national regulation in what refers to the delivery of health and long-term care services. As the scope of care delivery changes to embrace the widespread distribution of Internet connectivity and of the Io(M)T, also the regulation concerning the responsibility of adopting Internet-enabled and Io(M)T technologies is important, to ensure the same level of quality of service. In addition, due to the proliferation of connected technologies and the absence of updated health and social care services' legislation, stakeholders in the health and social care sector are looking for EU and national regulators to provide guidance and direction for them to make decisions with respect to the modernisation of health and long-term care services. Still, national regulation could also be a challenge to the SHAPES market. Since the EU does not have a common regulation on how to adopt health and long-term care digital solutions, each Member State is responsible for its national regulations. The SHAPES Marketplace, gathering a large variety of health and long-term care digital solutions, and open to new solutions alike, is an added-value to answer to different demand needs, allowing different entities to adopt different digital solutions, always fitting their specific needs.

In addition, there is a number of standardisation efforts being implemented today to establish commonality of technical approaches to specific elements concerning integrated care services, involving the exchange of health data, the secondary use of health data, the non-intrusive application of eHealth digital solutions and smart living platforms. Interoperability indeed remains a key challenge to next generation integrated care for it is still to be achieved the harmonisation of standards and protocols enabling interoperability at a European-wide scale that ought to contemplate not only technical but also political, economic and scientific considerations. The improvement of cooperation among health and social care systems' stakeholders will also enable the identification of common needs and the definition of common solutions, based on the exchange of knowledge, experience and best practice, while ensuring that the different perspectives of relevant stakeholders are considered within the process of defining new goals, regulations or processes. With the evolution on connected technologies and the smart city concepts, it is expected that the pan-European standardisation effort continues so that **interoperability** amongst health and social care services is supported.

Directly associated with the interoperability challenge, the EU and national policies on **data privacy, data security and the secondary use of health data** are relevant concerns. Although the exchange of health-related data should be encapsulated by a dedicated health data framework, it cannot overlook existing regulation. Throughout the SHAPES Action, strict compliance with prevailing data security and privacy norms has been applied, providing a sound basis to continue the work ahead, including the support to health and long-term care service providers also adapt to the new requirements involving health data security and privacy (abiding to the EU GDPR and to the secondary use of health data).

A fourth challenge to be aware of refers to **user acceptance** and the adherence of the health and long-term care service providers, the care workforce and older people to the benefits of the employment of next generation capabilities by health and long-term care services across Europe. The SHAPES partners learned early that users have a clear understanding of the requirements that they want to be in place in order to overcome the existing shortcomings of current healthcare and social care systems and to lead towards the adoption of advanced health and long-term care solutions and services. Throughout the SHAPES Action, it was possible to identify the key drivers influencing user acceptance, including the ease of use of the SHAPES results and the ease of use to access the SHAPES results; foremost, next generation integrated care services require a broad and stable connectivity, based on a nation-wide Internet-enabled information and communications infrastructure, capable of fostering advanced health and long-term care digital solutions, technologies and services.

There have been numerous Europe-wide efforts to support the deployment of Internet access and networks, accompanied by national programmes of incentives. Also, EU policies have consistently emphasised the importance of digital solutions such as eHealth and have accentuated positive aspects of how digital innovations can improve integration of care through up-to-date information channels and deliver more targeted, person-centred (or personalised), effective and efficient healthcare, reducing errors and length of hospitalisation. Despite all these efforts, there is still scepticism towards accepting the evolution towards Internet-enabled health and social care systems and this will likely remain until users' requirements are fully satisfied. Moreover, a framework for assessing the digital transformation of integrated care services and its impact is vital to generate the evidence required for decision-making on stimulating, using and/or funding digital integrated care strategies at various levels in the healthcare and social care systems.

Another factor of influence on user acceptance is the general reluctance towards change and the digital care service concept. The organisational culture of health and social care services is characterised by safety and security mindedness. Risk aversion (avoid harm and system/service failure) may especially lead to a reduced willingness to tolerate the risks, vulnerabilities and uncertainty associated with how much added value is brought by new technology compared to existing technology. It seems that

stakeholders are waiting for steps to be taken – often steps associated to the European Union – to better understand prevailing risks and learn from mistakes. Considering the increasing distribution of modern technology, namely through the digitally-enabled generations, and the risk aversion attitude from health and social care service providers, it seems that conflicting interests affect key users of next generation integrated care services. On the one hand, health and social care service providers claim they do not have sufficient knowledge of the perceived benefits and risks associated with next generation integrated care services and advanced health and long-term care digital solutions; on the other hand, the general public is eager to see implemented next generation capabilities that improve the public healthcare and social care systems, and they have years of supportive incentives to Internet access, networks and technologies to reinforce their claims.

A specific example of the above relates with the **use of AI technologies in healthcare**. One of the major concerns arising from using AI in general is the potential replacement of people in their daily work; this concern becomes a major issue in healthcare, for professionals are a key element in the full health and care process. It is near impossible for AI to replace medical professionals, but AI can be a real support to their activities. Hence, user's acceptance and recognition of AI as a support tool in the daily healthcare routine is a key success factor. At the start of the technology introduction, the first move is to show the full potential of the tools as assistants and facilitators, so that healthcare professionals become aware of their full value and how the technology can facilitate their workload. Provided AI tools should be flexible, personalised and available on demand, but also relevant on the professional's perspective. Once value is recognised, the synergy starts: humans and tools start to collaborate in an effective manner and the wheel moves in a smoother and faster manner, with technologies and humans working towards the same direction. The technology can speed up some processes, like diagnosis and analysis, and can perform some monotonous work, leaving more time to the care practitioners to look after the patients, but it will never fully replace practitioners. It will then improve the productivity and efficiency of care delivery [32, 33]. To be accepted by healthcare professionals, the concept of **Explainable AI** [34] is very important. This recent term refers to methods and techniques applied to the AI tools so that the results provided by the AI tools are understood by human experts. It contrasts with the *black box* concept, which could lead to a lack of acceptance by experts. Modern AI systems are currently being designed to adopt this concept, explaining *what is behind* the result, and the SHAPES AI tools embraced explainable AI to reinforce user acceptance levels.

It is the SHAPES partners' firm belief that the introduction of the SHAPES Platform and Digital Solutions will help to increase the levels of user acceptance, thus facilitating to get access to next generation capabilities and helping to stimulate the market growth of health and long-term care digital solutions.

7.2 Opportunities for SHAPES Market Deployment

The opportunities presenting with respect to the deployment of advanced health and long-term care digital solutions refer not only to existing challenges but also with the prevailing and future trends affecting the integrated care services market.

Despite being considered a challenge for the deployment of next generation integrated care digital solutions and services, **costs** may also be viewed as an opportunity for the deployment effort. The costs associated with the acquisition of a full set of advanced health and long-term care digital solutions are quite similar, no matter the business model to be applied. However, the costs associated with the different SHAPES capability services are very dynamic and may be affected by different factors: generally speaking, the overall cost is likely to decrease in the next years due to the developments of computing and AI technologies and the facilitation of access to Internet connectivity, as well as to the increasing integration of smart technologies and the Io(M)T.

In addition, next generation integrated care services are a major **technology-driven shift**. The delivery of health and long-term care services benefit from an element of communication and information exchange, but the global trends associated with the Information Technology Age, the digitalisation processes and the Io(M)T have ensured the need to rethink the traditional mindset of health and long-term care services, namely when considering they are in essence a *public* service and society keeps changing. With these new technological tendencies, new opportunities for business will arise, leveraging on the associated synergy effects and the rapid proliferation of digital-enabled and cloud-based services (which bring an added-value to the health and long-term care digital solutions market). The SHAPES Platform and SHAPES-compliant developments will be able to harness this enormous potential and also contribute to it, thus further advancing today's vision of next generation integrated care services. Already now SHAPES is exploiting the opportunity to be a major player in the field, enabling the relation of significant stakeholders, technologies and development initiatives.

Furthermore, it is reasonable to estimate that the technological development will lead not only to the improved performance of health and long-term care digital solutions and services, for example about the monitoring of physical and mental health parameters, the optimisation of medicine, the exchange of health data or interoperability, but also to the increased trust and confidence of citizens, namely older individuals, and care professionals in the role of digital solutions to improve the delivery of health and long-term care services, particularly in what refers to the now perceived additional risks and vulnerabilities that often function as mental barriers to the adoption of *the new*.

Another element that may be seen as an opportunity for the deployment of health and long-term care digital solutions and services relates with the current high acquisition cost of some of these solutions. If the reduction of this cost is not deemed feasible in the short-term, it is possible that **attractive financing mechanisms** are considered to ensure sales performance and growth, especially when EU and governmental incentives are phased out. Another alternative avenue is the opportunity to increase the scope of the cloud-based System as a Service (SaaS) options and even to establish particular licensing agreements. Absolutely invaluable would be to adapt the financing instruments to the different scales, starting off with seed investment for new ideas on digital solutions and services for the Silver Consumer and completing the cycle with actual pan-European deployment campaigns and additional support for research and innovation activities for additional areas of the health and long-term care ecosystem. Certainly, the exchange of experiences and best practices from policy-making to strategic planning and implementation routes is key to involve all EU Member States in the dialogue, cooperation and multilateral or cross-border joint activities envisioning the development of adequate financial instruments to address common areas of need and advance towards the adoption of advanced health and long-term care digital solutions and the next generation integrated care services.

Aside from the role played by public investment in the support of innovation in health and social care systems and the offer of fiscal subsidies, also private entities and businesses may uphold a significantly larger role with respect to the financing of digital solutions' deployments. Meeting public demand for improved accessibility and availability of health and long-term care services is an example of innovative business solutions that serve the long-term sustainability of next generation integrated care services. It seems that a higher involvement of the private sector would be achieved if catalyst public measures are in place for fostering new markets and launching the initial deployment stage. In specific contexts, public-private partnerships to explore integrated care services may be interestingly transformative in young markets. Moreover, the private sector's participation would benefit from EU and governmental **clarity with respect to regulation**. Currently, the regulation on health and long-term care digital solutions has been placed upon the solutions' providers through the enactment of the Medical Devices Regulation (MDR), resulting in the health and long-term care services' trust on the largest medical technologies' providers in the market. This situation may affect the viability of the business models of SME providers, often associated with highly innovative (e.g., robotics) or scalable (e.g., eHealth Apps) solutions that gain traction in meeting the public's needs. It is foreseen that as much regulatory certainty as possible is encouraging to yield private investments for a majority of EU countries. As soon as the uncertainty level associated with integrated care delivery is reduced, also the negative perceptions will tend to fade. And the SHAPES partners have received from all stakeholders a positive feedback on the digital solutions, technologies and services for integrated care, praising how the societal and economic benefits outweigh existing barriers.

The discussion on the deployment of next generation integrated care services also serves as an opportunity for a long due debate on a smarter approach to the delivery of health and long-term care services across Europe. Initiatives to multiply point of care centres and cover all cities are confronted with successful experiences on the increased specialisation of health and social care units and the sharing of resources for additional economic efficiency. The new capabilities enabled by Internet-based communication, information and interoperability technologies may provide further enlightenment of viable options that not only maximise the deployment of next generation integrated care services but, more importantly, allow for the **optimisation of the deployment of those services** and address it from an integration perspective of a broader pan-European health and long-term care ecosystem.

As mentioned, stakeholders in the health and social care services sector are wary of the existing **regulatory framework** and the need to adjust it in the foreseeable future. Each EU member states has its own legislation and the EU also publishes several regulatory initiatives, all of which must be considered for the planning of the deployment of next generation integrated care services and are relevant for the participation level of the different stakeholders in this particular market. Hence a major challenge may also become a relevant opportunity to the deployment of advanced digital solutions in support of improved integrated care services, particularly if solid commitments and measures follow regulations.

An opportunity also presents for the deployment of advanced digital solutions supporting next generation integrated care services when considering the **high-level of awareness** generated by the SHAPES Action and other related initiatives and its multiplying positive effect in the debate of integrated care digital solutions' deployment. The strength in numbers may also be applied to the expected profitability of SHAPES exploitable results: for example, the SHAPES eHealth Apps become more attractive, and therefore more profitable, if combined with the SHAPES smart living platforms, assistive robotics or connected devices. Hence, depending on the customer segment, different requirements determine that different SHAPES packages be implemented and deployed. The diversification of these packages, and their fit to the user/customer specific context, empower the reach of SHAPES and of third-party integrated care services. SHAPES is therefore in the unique position to identify distinguishing user demands and derive adequate service packages for each customer segment.

Notwithstanding the particular perspective of each stakeholder group on health and long-term care digital solutions and integrated care services, the SHAPES Action was capable of gathering a comprehensive understanding of the health and social care systems sector, also considering prevailing technological trends associated with digitalisation of health, the IoT and smart cities. The combination of these major developments is likely to generate significant synergy effects and influence the market uptake of next generation integrated care services – and the EU is a well-positioned

actor to promote such attractive combination and convey therefore a European-wide synergistic approach that is prone to stimulate societal engagement and acceptance.

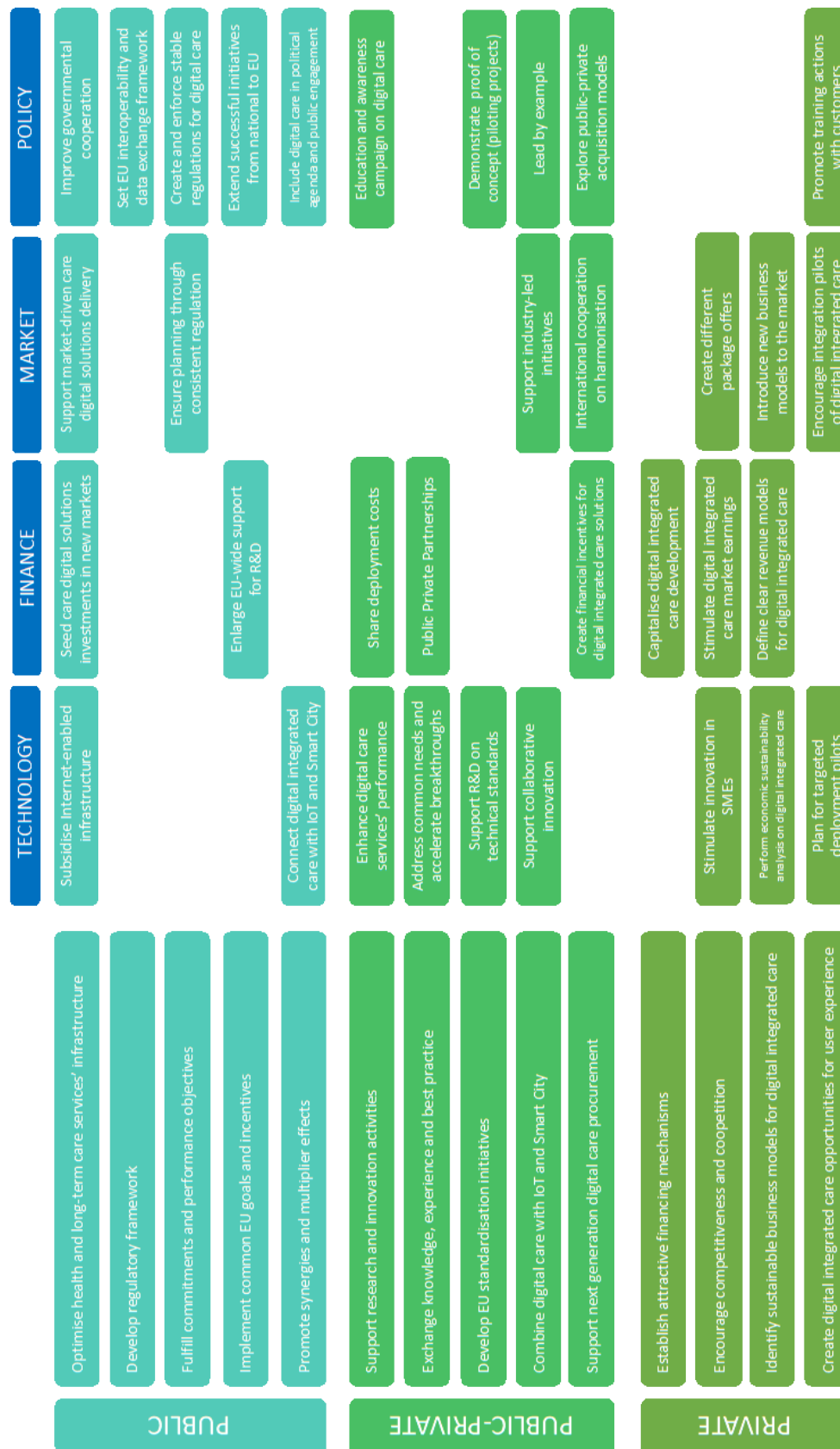


Figure 7 - SHAPES Deployment Opportunity Matrix

The SHAPES Platform involves an ecosystem of health and long-term care digital solutions, technologies and services and technical implementations (the SHAPES Technological Platform's enabling components) that provide the opportunity to address different aspects of the systems in use by healthcare and social care services across Europe. This address did not consider external elements to the SHAPES Action's scope, such as the network coverage and the distribution of mobile and Internet-based connectivity and access points. Hence, for the SHAPES testing, piloting and validation activities, the requirement for good Internet access and available wireless coverage was assumed. Moreover, it is acknowledged by the SHAPES Action the overall tendency to move forward with the global adoption of broadband communications and the proliferation of entities offering inter-personal communications services and eHealth mobile applications. In addition, the SHAPES Technological Platform implemented relevant standards, protocols and open source implementations that could best serve its purpose and affect less the overall development costs.

With respect to the general perspective of the impact of digital solutions in next generation integrated care services, it is identified a **new paradigm of accessibility, affordability and availability**. SHAPES offers a broad diversity of easy to access and user-friendly digital solutions to support older adults in managing their health, maintaining their social connections, and staying engaged in their communities. These solutions are accessible, affordable and available: SHAPES's communication tools introduce the Total Conversation model (voice, video and real-time text) to the communication between the health and social care services or informal caregivers and older people, being specifically attentive to the needs of citizens experiencing blindness, deafness, hearing and speech impairment; and the use of and access to affordable eHealth Apps and connected devices and wearables (including through the SHAPES Marketplace) broadens the reach to wider population and geographies, reinforcing the ability to always be connected and to perform remote monitoring. The new capabilities brought forth by SHAPES is seen by the community groups as truly relevant and its societal impact is immediately recognised and praised to be in full alignment with the existing regulations towards the offer of affordable, accessible and available products and services, namely the access to the public health and social care systems.

Importantly, the unparalleled **accessibility, affordability and availability of SHAPES's digital solutions, technologies and services render it a valuable competitive advantage**: SHAPES is the only platform in the market to accommodate a marketplace functioning as a one-stop-shop presenting a broad variety of reliable and trusted digital solutions specifically tailored for and validated by older adults that meet their needs in supporting them to manage their health and wellbeing, to maintain their social connections and to be engaged within their communities. Older adults do not spend additional effort to reach different digital solutions and are able to exercise

their informed choices on the selection of the digital solutions they want to use to improve their health, wellbeing and quality of life.

There are important areas to improve, such as the care professionals' willingness to be always available and the effect of continuous monitoring on user/patient behaviour. However, it is the conviction of the SHAPES partners that the use and adoption of health and long-term care digital solutions, technologies and services will be an upstanding best practice, contributing to the sustainability of healthcare and social care systems. In this context, SHAPES digital solutions' reinforced accessibility and availability is undoubtedly a key business impact driver for SHAPES.

Health data exchange, because of its role in improving health and long-term care quality, safety, and patient/user outcomes, is a key feature in healthcare and social care response. Citizens are concerned with the ability to provide their health data unchecked, whereas the existing silos within healthcare and social care delivery are responsible for a negative impact in the speed, quality, safety and cost of patient/user care: up to 18% of the patient safety errors generally and as many as 70% of adverse drug events could be eliminated if the right information about the right patient is available at the right time [35]. Abiding to current interoperability standards, SHAPES introduces a **new paradigm of health information exchange**, by combining the traditional health data with new wellbeing information, including self-reported measures, and the smart device-provided environmental information. With the application of the new SHAPES improved health information, it is possible to substantially increase the quantity and quality of available patient/user data with significant impact in enabling care professionals, patients/users and caregivers to work together to make fully informed care decisions, improving care safety and quality and avoiding the duplication of efforts.

The improved health information capability enabled by SHAPES is acknowledged by the user community as particularly relevant for the quality of service provided by healthcare and social care systems. The benefits of this capability are further reinforced if framed in the EHDS initiative: over ten years, the EHDS it is expected to save for the EU around €11 billion, €5.5 billion will be saved from better access and exchange of health data in healthcare and another €5.4 billion will be saved from better use of health data for research, innovation and policy-making⁴³. Notwithstanding, the **competitive advantage of the SHAPES improved health information** capability resides on its uniqueness in the market: SHAPES is the only platform that fully integrates the combination of different health, wellbeing and environmental data, ambitioning to deliver the most reliable, precise and accurate health information of the patient/user. Also important, this is accomplished without requiring additional setups that function in the periphery of the health and social care systems; as a result, the information is processed, updated and provided to the care workforce using the SHAPES Platform and digital solutions, without adding to the workload. Again, this

⁴³ https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_2712.

SHAPES added-value is perceived by users as not requiring additional effort and significantly contributing to improve the performance and quality of healthcare and social care response.

It is nonetheless important to improve the trustworthiness of health information, especially considering the use of connected IoT devices, wearables and smartphones and the susceptibility of their data manipulation. Still, considering the timeframe, it is the belief of the SHAPES partners that regulatory efforts will inevitably address the increased security of connected devices and mobile technologies, rendering null the possibility of manipulating device-provided data. Moreover, the use of the SHAPES integrated improved health information is expected to be widespread across Europe – thus, SHAPES's improved health information capability is certainly a key business impact driver for SHAPES.

Further, SHAPES innovates health and long-term care services with the **paradigm of the application of AI techniques and Big Data analysis to patient/user data**. The SHAPES Technological Platform supports the use of AI-enabled data analytics to provide to healthcare and social care professionals additional information on the patient/user health and wellbeing condition. Currently, health and social care systems only rely in the data and information provided by the patient/user. Not only the absence of more integrated information hinders the care professionals' ability to understand the patient and underlying situations and generate accurate awareness but also it may lead to a response that lacks relevant information for optimal effectiveness. With SHAPES, not only a panoply of real-world data is available for each patient/user, but also there are a set of AI-enabled data analytics on wellbeing assessment, risk prediction and user profiling to support care decision-making. For example, the indication of irregular sleep patterns may support medical diagnosis and treatment plans; the indication of an imminent decompensation episode may prevent the same from happening alongside with its associated negative health and wellbeing implications; and the creation of user profiles assists with the identification of an appropriate care pathways and medicine prescription.

The benefits of having access to AI-enabled data analytics are fully understood by users, due to their life-saving potential in critical situations, by helping to provide the best care response possible. The **competitive advantage of the SHAPES AI-enabled big data analytics** is determined by its uniqueness in the market: SHAPES is the only platform gathering unprecedented amount of integrated health, wellbeing and environmental real-world data supporting the application of big data analytics with advanced AI-enabled algorithms and techniques that help the care workforce to develop improved awareness of the user/patient condition at all times and respond timely with the right resources (no additional workload is involved and there is a perceived improvement of the performance and quality of care response).

There are still important concerns to address, namely through regulation on the use of AI in healthcare environments that will assist to overcome the main clinical, social and

ethical risks posed by AI in healthcare, more specifically: potential errors and patient harm; risk of bias and increased health inequalities; lack of transparency and trust; and vulnerability to hacking and data privacy breaches. Still, the prevailing benefits of the use of AI in healthcare (delivering powerful tools to automate tasks and support and inform users, care workforce and policy-makers on the most efficient strategies to promote health and quality of life at a population and individual levels), the increasing tendency towards AI-enabled big data analytics and the need to support the structured integration, correlation and pattern-identification in millions of health datasets, as well as the importance of optimising healthcare services' workload and efficient resource management, are subjects that will advocate the adoption of SHAPES's AI-enabled big data analytics capability 2025-2035 timeframe, in the SHAPES partners' opinion. The capability to produce actionable AI-enabled big data analyses is therefore considered a key business impact driver for SHAPES.

As technology no longer stands in hindrance of the adoption of next generation integrated care services, as supported by the conclusions and results of the SHAPES Action, it is fundamental to consider the role played by the **citizens' demand of advanced health and long-term care digital solutions, technologies and services** as a business impact driver. It is true that the market does not present yet a comparable solution to SHAPES but the SHAPES partners are responsible for hosting an EU-wide awareness raising and education campaign on the advantages and positive impact of SHAPES in particular, and next generation integrated care services in general, duly supported by hands-on piloting activities that convinced involved participants of SHAPES's merits.

Being that health and social care systems have a truly public service nature, targeted solely to the public, the involvement of citizens and civil society organisations, namely in representation of specific community groups – blind, deaf, deaf-blind, hard-of-hearing, speech impaired, the older adults –, in the different stages of the SHAPES development has ensured that SHAPES is aligned with the users' needs and serves well the task of assessing the relevance assigned by citizens to health and social care services. And although it is true that necessity is the mother of all things, most citizens have had or heard of at least one experience involving health and social care systems. The outcome of the experience usually dictates the general attitude towards health and social care services but it has become clear during the SHAPES Action that, once individuals are aware that existing technologies, with which they are becoming increasingly familiar, may make a difference in critical situations, it is very difficult for them to be sympathetic about regulatory absence or constrain, additional risks pointed by care professionals or conservative policy-making.

On the contrary, (older) individuals feel empowered by initiatives such as the SHAPES Action that provide relevant awareness and education on health, wellbeing and care, themes of their direct interest. Consequently, older individuals participating in SHAPES pilots and events have expressed the willingness to spread the information

and to contribute to the build-up of the public's engagement with this subject, namely through their local and national representations – in this context, the policy-making context will also have a predominant role in shaping the demand. Overall, the SHAPES partners view the citizens' demand of SHAPES as a key impact driver to the future of sustainable business opportunities involving SHAPES, likely to be an important trigger to the pan-European deployment of advanced health and long-term care digital solutions and technologies to support next generation integrated care services and systems.

In this context, it is important to recall the role of the COVID-19 pandemic in the rapid development and uptake of health-related digital solutions, technologies and services. Teleconsultations and remote care were two of the most visible innovations in health and long-term care services during the pandemic, playing a fundamental role in maintaining access to care. Similarly, the pandemic highlighted the importance of data sharing to support care coordination. Countries with advanced Internet-enabled infrastructure were faster to promote the new services and many countries were more prepared to overcome fast the legislative, financial and technical barriers to implement them and make them accessible and available to all. Overall, the expansion of the range of care services due to the adoption of digital solutions, technologies and services was welcomed by the citizens serviced and there was broad public agreement on the value of these services in maintaining access to care. However, there were also concerns about the exacerbation of pre-pandemic inequalities in access to care concerning the older, the poorer and the people living in rural areas. In addition, the COVID-19 pandemic revealed that further investment was required in health data infrastructures to promote improved data sharing, while at the same time protecting data privacy.

In conclusion, the analysis of the SHAPES's business impact drivers sustain that it is important to prepare the campaign for next generation integrated care services if this new reality is to be attained in the envisaged timeframe. Aware of the involved challenges, and leveraging on identified drivers, the SHAPES partners are committed to explore the opportunities leading to the adoption and market uptake of SHAPES digital solutions and next generation integrated care services.

8 Conclusion

Exploitation is the phase in which the valorisation of the Action's results is pushed forward. It requires collaboration, ongoing development and creativity to use the Action's results and incorporate them into relevant market analyses so as to clearly understand the market's characteristics, demonstrate the innovations' added value to its targeted customers, and create the increased demand that is capable of sustaining future business operations. It is also a phase to reinforce the Action results' impact and integrate it at the local, national and European levels, focusing on mainstreaming exploitation directed at policy-makers and decision-makers and on multiplying exploitation shaped for targeted users/customers.

With the clear identification of SHAPES key exploitable results, the SHAPES partners conducted an analysis of the SHAPES market: a sound application of the PESTEL and SWOT tools was performed, the customer segmentation exercise was carried out, the market shaping strategy was in place and the SHAPES results were fitted into an adequate competitive market positioning package, to send a clear message across: it is time to roll out SHAPES as the perfect introduction of older individuals, care workforce and care service providers to the next generation of health and long-term care digital solutions designed with them and for them. In this context, the SHAPES partners ensured that bottom-up approaches were well-balanced and complementary to top-down initiatives with respect to the SHAPES exploitation. This lays the foundation for a long-lasting pan-European ecosystem that supports active and healthy ageing, ageing in place and independent living to continue after the Action's lifetime.

9 Ethical Requirements Check

The focus of this compliance check is on the ethical requirements defined in D8.4 – *SHAPES Ethical Framework* [36] and having impact on the SHAPES solution (technology and related digital services, user processes and support, governance-, business- and ecosystem models). In the left column, there are ethical issues identified and discussed in D8.4 (corresponding D8.4 subsection in parenthesis). For this deliverable, relevant requirements have been identified. For the requirements not relevant for the deliverable, N/A was entered in the right-hand column.

Table 5 - Compliance Check on Ethical Requirements

| Ethical issue (corresponding number of D8.4 subsection) | How we have taken this into account in this deliverable (if relevant) |
|---|--|
| Fundamental Rights (3.1) | Fundamental Rights have been considered in the analysis of the active and healthy ageing market, though the application of the PESTEL tool. |
| Biomedical Ethics and Ethics of Care (3.2) | Biomedical Ethics and Ethics of Care have been considered in the analysis of the active and healthy ageing market, though the application of the PESTEL tool. |
| CRPD and supported decision-making (3.3) | N/A |
| Capabilities approach (3.4) | N/A |
| Sustainable Development and CSR (4.1) | N/A |
| Customer logic approach (4.2) | Customer-centric business logic has been a reference for the analysis of the SHAPES market and definition of a market shaping strategy. |
| Artificial intelligence (4.3) | N/A |
| Digital transformation (4.4) | Digital transformation is one of the key drivers in the market of active and healthy ageing. It is therefore addressed in this deliverable, particularly in the application of the PESTEL and SWOT tools and in the analysis of the opportunities for the market deployment of SHAPES results. |
| Privacy and data protection (5) | Privacy and data protection are key selling points for eHealth digital solutions and have been considered in the application of the SWOT tool and in the challenges for the SHAPES market deployment. |
| Cyber security and resilience (6) | Data security and resilience are key selling points for eHealth digital solutions and have been considered in the application of the SWOT tool and in the challenges for the SHAPES market deployment. |
| Digital inclusion (7.1) | N/A |

| Ethical issue (corresponding number of D8.4 subsection) | How we have taken this into account in this deliverable (if relevant) |
|---|---|
| The moral division of labour (7.2) | N/A |
| Caregivers and welfare technology (7.4) | Caregivers were addressed in this deliverable as a key customer segment within the SHAPES market. |
| Movement of caregivers across Europe (7.4) | Caregivers were addressed in this deliverable as a key customer segment within the SHAPES market. |

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