THE
LIFEBOTS

O D Y S S E Y

Exploratory findings and recommendations on social robots in healthcare and the social care domain from the LIFEBOTS Exchange project.

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Greetings, Reader.

I am LIFE2019, your designated host for this reading experience of the LIFEBOTS Exchange booklet. This material has been crafted to communicate and disseminate the methodologies and findings from the deliverable, D5.1: *White Paper on Policies for the Inclusion of Social Robots in Healthcare Processes*, addressing both ethical and legal dimensions.
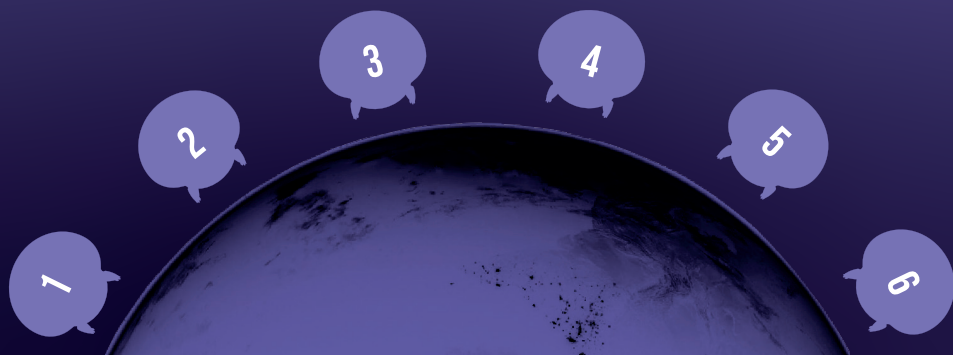
I invite you to embark on this knowledge-related journey prepared by the human beings behind this endeavour. The content has been enriched with references to the film, *2001: A Space Odyssey*. Engage fully with the materials, and may the experience expand your horizons. Enjoy.

ITINERARY_

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MISSION DIRECTIVE_
_introduction

The LIFEBOTS Exchange project was an activity carried out in the scope of the European Union's **Horizon 2020** research and innovation programme. It aimed at developing a holistic understanding of social robots at the intersection(s) of care, user interaction, technology, and society by organisations exchanging researchers and members of staff. Staff from 16 partners in the European Union (EU) and Asia took part.

The project covered **three lines of action**. They were: technological, sociological, and related to care and welfare. Each action line was worked on through a scientific work package (WP). The fifth work package (WP5) was responsible for a deliverable, D5.1, *White Paper on Policies for the Inclusion of Social Robots in Healthcare Processes*, covering both ethical and legal dimensions. In the concluding phase of the project, the team decided to use a booklet-like design to share its key findings and recommendations. The document's new title became *The LIFEBOTS Odyssey*.

The cross-dimensional LIFEBOTS Exchange methodology reported here involved a combination of **four approaches**: desk research; an analysis of the content of LIFEBOTS Exchange's final deliverables; an overview of the research and training developed during the project's 40 or so secondments; and the qualitative analysis of a survey addressing a set of social, ethical, and legal questions related to the implementation of social robots in social and healthcare settings.

This booklet offers **a panoramic overview** of the implications of the EU having an ageing population, and how the digitalisation of care can provide alternative solutions to the future challenges posed as a result of the changes to the Union's population and workforce. It features the results of a final survey undertaken with LIFEBOTS Exchange partners. The analysis is then complemented by a set of key EU policy-related recommendations.

The booklet addresses readers interested in **two key topics**: how social robots can contribute to fostering better solutions in the healthcare and social care domains; and how various ethical, legal, and social challenges related to social robots can be framed. To end, the booklet lays out **five blocks of action** which involve nine recommendations to advance the field.

The **vision** is to take readers on a journey through the fascinating field of social robots, by describing the **outcomes** of both LIFEBOTS Exchange's research and secondments in an interactive way that is accessible to a wide range of audiences.

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DATA HORIZON_
_relevant and up-to-date data on demographic change in the EU

The LIFEBOTS Exchange project aimed at providing valuable insights into how social robots can help face the impacts of **demographic changes** in Europe and throughout the globe.

The **ageing** of Europe's overall population, and shrinking of the **working-age population**, in the years to come raise a series of concerns for health and social services, and increase the pressure on public budgets.

Some intriguing **data** to keep an eye on are[1]:

The latest data show that the EU population decreased by over half a million people (585,000) between 1 January 2020 and 1 January 2022.	Life expectancy at birth also increased: in 2019, it was 77.6 years and by 2022, at 81.3 years, it had overtaken 80 years of age.
Over the 2002-2022 time period, the share of persons aged 65 and over increased in all European Member States, similar to the share of the group of people aged 80 and over.	The EU working-age population is expected to decline (by 57.4 million people in the year 2100) and the old-age dependency ratio is anticipated to increase (from 33% to 60% by 2100).

With these statistics in mind, LIFEBOTS Exchange's goal was to understand the **synergies** between the background social and demographic context and what social robots have to offer.

During the project, **three key questions** for the LIFEBOTS Exchange project partners were:

"Are robots ready for society?"	"Is society ready for robots?"	"How can social robots be included in people's lives?"

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[1] Data have been retrieved from: Eurostat (2023). Demography of Europe. Available at: https://ec.europa.eu/eurostat/web/interactive-publications/demography-2023 and EC (2023). Demographic change in Europe: a toolbox for action, p.2. Available at: https://commission.europa.eu/publications/communication-demographic-change-europe-toolbox-action_en

LIFEBOTS EXCHANGE

THE DAWN OF SOCIAL ROBOTS_
_a visual introduction to social robots

Innovators, researchers, and developers, and many other members of the **workforce**, rely on a wide range of information and communication technology (ICT) solutions for the **digitalisation** of services and care in the healthcare and social care fields. Today, the healthcare and social care fields use chatbots, avatars, virtual assistants, voice-controlled assistants, and robots.

There are lots of types of **robots** in use in many fields (they include aerospace robots, aquatic robots, autonomous vehicles, delivery robots, disaster response robots, drones, educational and entertainment robots, exoskeletons, industrial robots, medical robots, military robots, service robots, and social robots). In the LIFEBOTS Exchange project, the main focus was on **social robots**. Social robots are an appealing and further-evolving technology in the assistive technology sector that makes use of robotics.

From a practical point of view, **a social robot** is a robot that can interact with human beings and other robots and can be equipped with sensors, cameras, microphones, and even artificial intelligence (AI) systems as a way to respond to touch, sounds, and visual cues[2]. The definition of a **robot** is a "material machine, powered by energy, with the capacity to act on reality, perceive its environment, make decisions and learn"[3].

For a robot to be a social robot, it must show some communication capabilities, whether verbal and/or non-verbal. A social robot is expected to **behave "socially"** in a specific context and to have an appearance that expresses its sociability when involved in human-robot interaction[4]. A relevant aspect of social robots is their co-presence with human beings. They have a **social interface**, and they are physically embodied robots - whether humanoid or non-humanoid[5].

There are many social robots that are already on the **market**. These robots play several roles in people's lives - either as an assistive tool or as a companion tool - both in people's homes or in shared spaces. Social robots can be used in a variety of settings, like daycare centres, nursing homes, medical practices, and hospitals (whether the institutions are public sector or private sector, and are located in various countries, systems, and places).

2 Based on: Biba (2024). What is a social robot? Available at:
https://builtin.com/robotics/social-robot#:~:text=Is%20Siri%20a%20social%20robot,rather%20than%20a%20social%20robot
3 This is Nathalie Nevejans' definition of social robotics, which is also included in the white paper of Ethics of Social Robotics.
Read more at the online document:
https://www.bluefrogrobotics.com/Uploads/Docs/WHITE_PAPER_2022.pdf
4 Hegel et al (2009). Understanding social robots. Available at:
https://ieeexplore.ieee.org/document/4782510
5 Furhat Robotics (2021). Benefits of social robots. Available at:
https://furhatrobotics.com/docs/whitepaper-benefits-of-social-robots.pdf

Get to know some of them:

elmo

cozmo

cutii

sanbot

pepper

buddy

temi3

asimo

aibo

mistyII

GrowMu

kompai1

QTrobot

jibo

lovot

astro

emo

cruzr

kaspar

paro

nao

leka
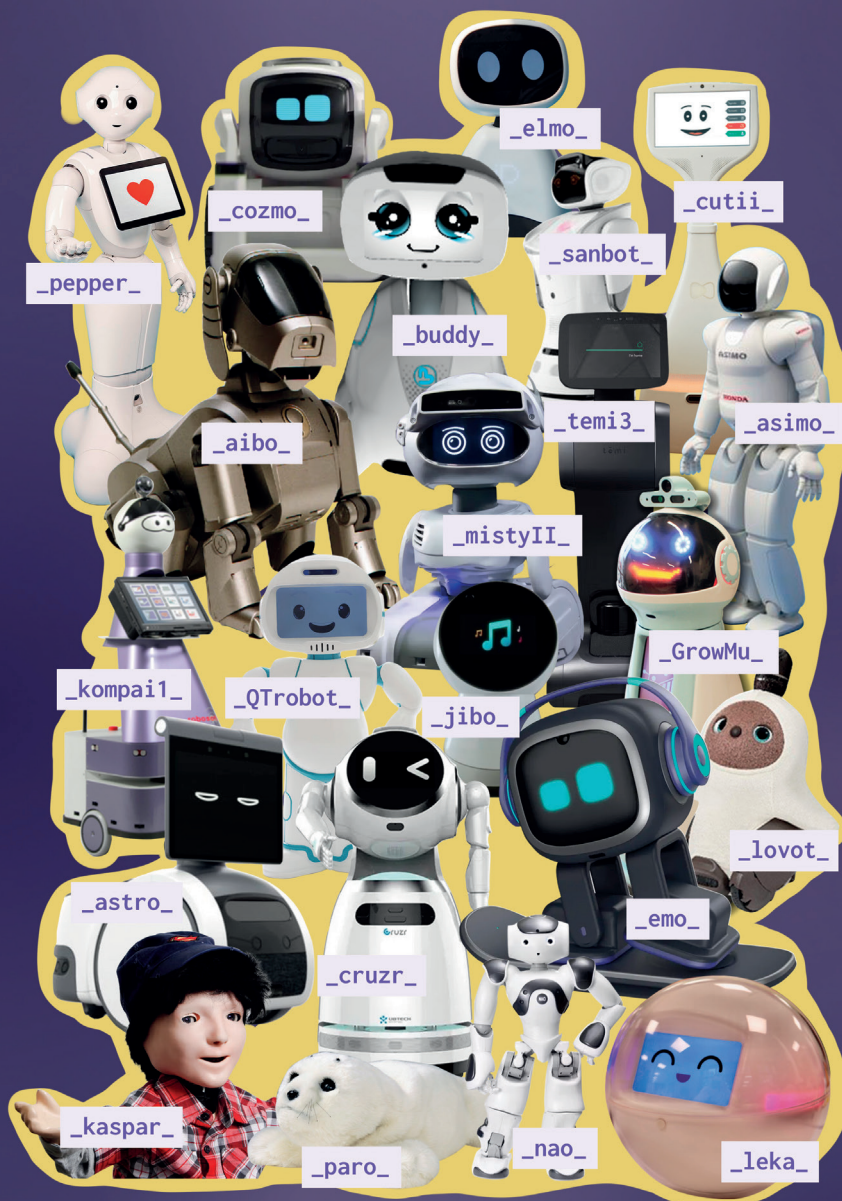
Images of the robots collected from various sources: Robots Guide, Blue Frog Robotics, Honda Automóveis, Cáritas Coimbra, Tecnoblog, WIPO, and others. Full references are listed in the end of the booklet.

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SURVEY MISSION: AROUND 60 MONTHS LATER_
_the final qualitative survey

At the final stage of the LIFEBOTS Exchange project - around 60 months after its start - a structured online written **survey** composed of six questions was circulated among the partners' representatives to collect their feedback, opinions, and impressions. The survey was intended as a qualitative study and focused on the **uses** of social robots and their potential current and future **reach**. Fourteen participants from nine different institutions responded to the survey from late October 2024 to mid-November 2024. The group of respondents was gender-balanced (seven females and seven males), and their ages ranged from 26 to 61 years of age. Their occupations were varied. They included researchers from several levels (PhD candidates, postdocs, professors, and research coordinators); developers; project managers; and digital health facilitators.

The study aimed to collect and analyse experts' **perceptions** of the current integration of social robots in social and healthcare domains. The thematic analysis of the written responses was conducted, using Excel, to outline the common themes.

Question 1 aimed at understanding the **benefits** and advantages of implementing social robots in the social and healthcare domains.

Question 2 investigated the **challenges** and difficulties. The replies were classified into organisational, ethical & social, and other aspects.

Question 3 focused on the **preparatory actions** that should be taken in order to include social robots in people's lives, including their care. The set of replies was categorised into four thematic groups: collaborative identification of needs, business model(s) with an emphasis on financial support and sustainability, technology readiness, and training.

Question 4 investigated which **policy actions** and/or forms of **financial support** are needed to include social robots in the social care & healthcare domains. The replies were organised into three levels: micro, meso, and macro.

Question 5 focused on whether the respondents considered that investing in, developing and/or implementing social robots, so as to deploy them at scale in the social care & healthcare sectors should be a current **priority**.

Question 6 explored the respondents' personal expectations regarding the **future of social robots**.

Selected key findings[6] from each question are displayed in the table below, illustratively and non-exhaustively. The findings also contributed to the conclusions and recommendations section on LIFEBOTS Exchange and beyond.

Q1_ Benefits

From an **organisational** perspective, the majority of respondents indicated that the inclusion of social robots in a care setting offers an alternative to the imminent work staff shortage.

From an **ethical & social** perspective, respondents indicated that social robots should be used - in the activities of care - as an instrument to foster improved human relations, and not as a replacement for human interaction.

In the **others** category, respondents replied that - as benefits - social robots can contribute to remote care, support informal caregivers, and gather relevant data for health and social care.

Q2_ Challenges

From an **organisational** perspective, stated challenges involved the needs to adjust: current processes, training, and high investment and maintenance costs.

From the **ethical & social** perspective, stated challenges involved: overall resistance, trust issues, and the potential risk of patients/end-users becoming emotionally dependent on robots.

From the **others** category, challenges covered: the low level of maturity of robots, the lack of a clear legal framework for handling sensitive patient data, and liability in the event of errors.

Q3_ Preparatory actions

The **preparatory actions** pointed out were: coordination between the need for robots and organisational needs, co-creative development processes, business models adapted to have an emphasis on financial support and sustainability, technology readiness, training, and the upskilling of digital literacy.

Q4_ Policy actions and/or financial support needed

At the **micro** level, needs involved: the need to involve the healthcare staff; ensure financial support; and engage the active participation of organisations working with social robots in local governments to share their findings and influence evidence-based policies.

At the **meso** level, the needs involved: campaigns to raise awareness about the uses and limitations of social robots; the need to simplify and promote the purchase of innovative services and solutions; and the need for long-term pilots, secure project funding, and other resources.

At the **macro** level, the needs involved: dedicated funding for several types of robotics research investment in digital health infrastructure, small and medium-sized enterprises, and industrial capacity for EU production; international standards and guidelines for social robots (e.g. on safety and ethics); standardisation of data policies to simplify interaction between health services and robots; and the promotion of global partnerships.

Q5_ Social robots as a priority?

Almost all respondents indicated the use of social robots should be a **priority**.

Q6_ Future of social robots

In the future, **beneficial adoption** of social robots could take place in several different locations: hospitals, older people's care centres (including daycare centres, nursing homes, and home support), rehabilitation centres, remote care, and people's homes. The **expected tasks** of social robots are numerous. They include: repetitive tasks; administrative tasks; managing schedules or coordinating patient reminders; transporting medical supplies; delivering meals, social stimulation, conversational interactions, wellness routines, and physical exercises; monitoring patients' vital signs and overall health status; and sending real-time alerts to caregivers or healthcare providers if or when irregularities are detected.

LIFEBOTS EXCHANGE AND BEYOND_
_conclusions and recommendations

After almost six years of activity, the LIFEBOTS Exchange project has covered a variety of topics related to social robots. The project team would now like to share some of its conclusions and recommendations. These conclusions and recommendations are intended to contribute to the **future** of the field working on **social robots, from an empirical and a research perspective**.

All the relevant topics have been merged into **five blocks of actions** that could help to foster the development, implementation, and scalability of social robots. Furthermore, these actions have been placed in the context of the wider European framework. The aim has been to identify the 'fit' between the needs of the specific field, **social robots**, with the currently visible scenarios of **societal, and social, needs and opportunities**.

Blocks of action:

Policies	· Policies to prepare for digital transformation · Policies to prepare and empower the workforce in the context of demographic change
Ethical and Legal	· A human-centred approach to care · Awareness of the existing regulatory framework(s) and, when necessary, their updates
Readiness	· Technology readiness · Digital readiness, including skills
Organisational	· Avoidance of knowledge silos, and promotion of an interdisciplinary approach to social robots · Visibility of social robots
Financial	· Financial support at all levels

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POLICIES

This policy approach provides an over-arching, umbrella perspective. This set of actions addresses the need for collaborative efforts across society and the adoption of intersectional methodologies to maximise the benefits of social robots in the health and care sectors. This approach is particularly relevant in the context of the **global**, and **European**, demographic changes driven by an **ageing population**, **workforce shortages**, and the need to ensure the scalability and sustainability of **digital solutions** proposed to respond to these demographic developments.

Two core dimensions were identified:

Policies to prepare for **digital transformation**: Social robots can serve as effective tools to promote the digitalisation of services and society

Policies to prepare and empower the **workforce** in the context of demographic change: Social robots can play a crucial role in addressing the impacts of demographic shifts, particularly of an ageing population, by mitigating workforce shortages

Social robots do not operate in isolation, even as high-performance technologies. An **ecosystem** of actions is necessary to enable social robots to function effectively in real-life scenarios, delivering their benefits while addressing stakeholders' needs.

To achieve the ambitious goal of positively impacting the challenges posed by an ageing population, and a shrinking workforce, several **interconnected factors** must be addressed alongside the development of social robots. These include not only the two policies already mentioned but also ethical and legal frameworks, standards, technological innovation, organisational readiness, workforce preparation, and financial sustainability.

Each of these elements are explored in the four further dedicated blocks of actions that follow.

ETHICAL AND LEGAL

This block of actions looks first at **ethical concerns**, followed by legal issues and the currently available **legislation**.

> Ethical concerns. A human-centred approach to care: human beings, and human well-being, must always be able to override the development and functionalities of machines.

From the perspective of ethics, there are so many guidelines and standards currently available that some readers might feel lost. Nevertheless, **some tips** on how to build an ethical approach to innovation involve asking a series of **practical questions**: "Does this solution bring more benefits than risks?"; "What are the negative impacts or uses that the solution can bring?"; "Were the users of the solution heard and involved in all phases of the development?"; "Is the solution an actual answer to people's, and society's, potential needs?; "In terms of legal compliance, is there a good fit with how such issues as data protection, environmental impact, sustainability, and cost-effectiveness are handled?"; "Was the solution tested against biases?".

And of course, there are many other ethical questions that may arise depending on the social robots solution under consideration.

Two sources which can act as guidance for the further analysis of ethical concerns, and the formulation of **ethical codes, charters, and helpful materials**, in relation to robotics and AI, are available through the QR codes below:

An update round up of ethical principles of robotics and AI by Alan Winfield
(https://robohub.org/an-updated-round-up-of-ethical-principles-of-robotics-and-ai/)
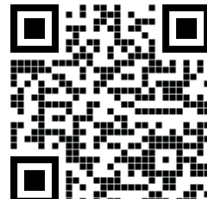
Public Deliverable of SIENNA project - Survey of REC approaches and codes for Artificial Intelligence & Robotics
(https://zenodo.org/records/4067990)

Legal issues. Awareness of the existing regulatory framework(s) and, when necessary, their updates.

The social robots field requires extensive knowledge of the **regulatory framework** related to several topics: manufacturing, products, safety and security, privacy and data protection, and consumers' rights, just to name a few.

Approaches to **legal compliance** could follow the methodology proposed by Leenes and Lucivero, 2014[7], and - if needed - extend their four-part methodology:

Regulation for robot design **=** regulate the production	Regulation of user behaviour through the robot's design
Regulation of the effects of the robot	Regulation of the robot through code

Current legislation (i.e., the EU's AI Act) foresees that exceptions are accepted, and foreseen, in terms of the legal compliance of AI and robotics in empirical studies[8]. Informed consent forms can be a relevant tool in this area[9]. Use of these techniques will, however, depend on the analysis of the concrete case for social robots' use.

In 2024, some key **regulations and standards** to which to pay attention, when researching or working on social robots, include:

EU AI Act	**Medical Devices Regulation**	**GDPR**

ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots

ISO 10218-1:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots

7 Leenes; Lucivero (2014). Laws on Robots, Laws by Robots, Laws in Robots: Regulating Robot Behaviour by Design. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2546759

8 Pagallo, U. (2018). Apples, oranges, robots: four misunderstandings in today's debate on the legal status of AI systems. Available at: https://royalsocietypublishing.org/doi/10.1098/rsta.2018.0168

9 Weng, Y. (2022) A Comparative Data Protection Analysis of Healthcare Robots: On Informed Consent in Human-Robot Interaction. Available at: https://ebooks.iospress.nl/doi/10.3233/FAIA220609

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READINESS

Two forms of **readiness** are included in this block of action. Ultimately, however, there may be other forms of readiness which it is important to consider e.g., organisational readiness, business readiness, and overall societal readiness. (One example is that of service readiness[10].)

To advance the field of social robots, and assure readiness, **several key actions** are crucial:

| Ensuring solid financial support | Investing in technological innovation | Developing go-to-market strategies for social robots |

| Conducting extended and large-scale pilot programmes to generate scientifically validated outcomes | Fostering co-creation and co-design initiatives to ensure solutions are practical, inclusive, and user-centric |

Technology readiness. Social robots have significant potential for growth and must achieve greater technological maturity to address today's pressing challenges and needs in the health and care sectors effectively. The advancement of social robots, and their potential future contributions to dealing with workforce shortages, must be dealt with critically. They must also be guided by the experiences and results of evidence-based trials before real-life scenarios are implemented at scale. There are therefore strong arguments emerging for large-scale piloting and large-scale evidence-gathering to take place both currently and in the future.

Pilot studies, and **large-scale pilots or large-scale partnerships**, supported by the EU can be key in two ways. They can address simpler and specific organisational issues in the short-term, while they test real-life cases and scenarios of research and innovation for the longer-term. This experience has been confirmed in several health and care-related projects which involve ICT solutions[11].

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10 Hughes et al (2021). Scaling digital health innovation: developing a new 'service readiness level' framework of evidence. Available at: https://pureportal.strath.ac.uk/en/publications/scaling-digital-health-innovation-developing-a-new-service-readin

11 Learn more at: CEN-CENELEC (2024). Guidelines for Action Research for Large Scale Pilots. Available at: https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/2024/cwa18123_2024.pdf and Zanutto et al (2024). The ValueCare experience: Creating value for older people with chronic conditions in Europe with a transition towards outcome-based integrated care supported by technology. Available at: https://projectvaluecare.eu/valuecare-book/
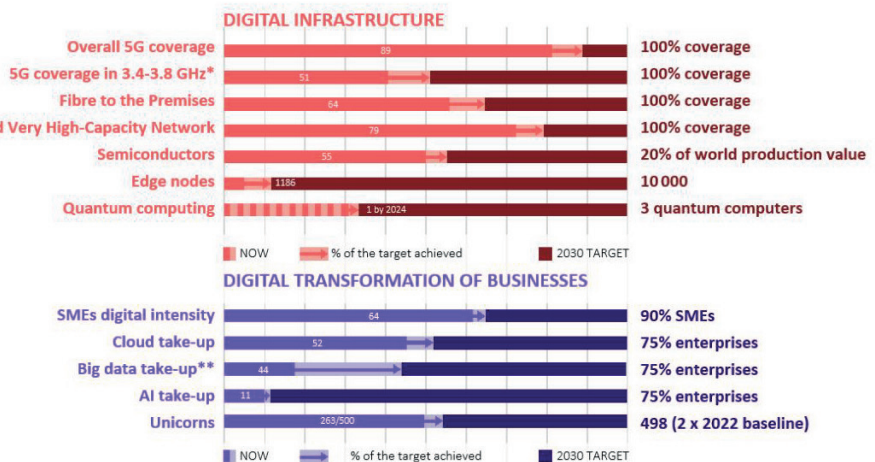
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> Digital readiness, including skills. Readiness for the digital era requires improving digital literacy among both end-users and professionals. This digital literacy is essential not only for the successful integration of social robots but also for the overall success of the anticipated digital transformation of society.

The EU is committed to several frameworks related to **digitalisation**. For instance, Europe's Digital Decade[12] has established targets for 2030 that cover **basic digital skills**, digital adoption of business, connectivity, and digitalisation of services. The digital decade has the goal of digitising 100% of public services, e-health records included; however, it will only be effective if people are ready to take advantage of these changes. This digitalisation, including of **electronic health records**, could enhance the ways in which social robots would collect/use health and care-related data.

All the Digital Decade targets, and the most up-to-date progress report from 2024, can be seen below[13].

TAKING STOCK OF PROGRESS TOWARDS 2030

EU KPIs in 2024

DIGITAL INFRASTRUCTURE

KPI	NOW	2030 TARGET
Overall 5G coverage	89	100% coverage
5G coverage in 3.4-3.8 GHz*	51	100% coverage
Fibre to the Premises	64	100% coverage
Fixed Very High-Capacity Network	79	100% coverage
Semiconductors	55	20% of world production value
Edge nodes	1186	10 000
Quantum computing	1 by 2024	3 quantum computers

NOW ▮   % of the target achieved →   2030 TARGET ▮

DIGITAL TRANSFORMATION OF BUSINESSES

KPI	NOW	2030 TARGET
SMEs digital intensity	64	90% SMEs
Cloud take-up	52	75% enterprises
Big data take-up**	44	75% enterprises
AI take-up	11	75% enterprises
Unicorns	263/500	498 (2 x 2022 baseline)

NOW ▮   % of the target achieved →   2030 TARGET ▮

** Not a KPI but gives an important indications on high quality 5G coverage.
* The former big data indicator is now replaced by the take up of Data analytics technologies. Progress are not fully comparable

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12 EC (2024). Report on the state of the digital decade.
Available at: https://digital-strategy.ec.europa.eu/en/policies/2024-state-digital-decade-package
13 EC (2024). Report on the state of the digital decade, p.4.
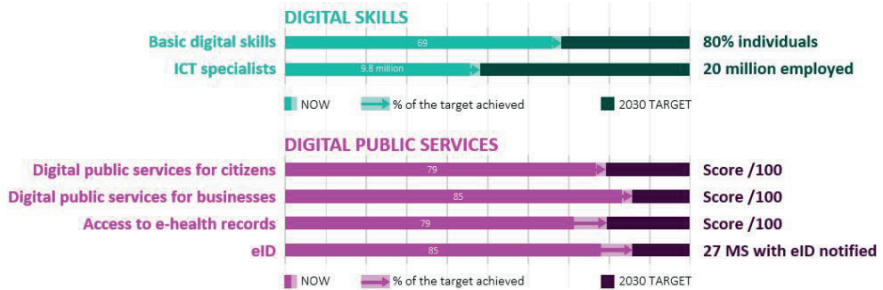
A further, complementary European programme is EU4Health (2021-2027)[14], which was adopted as a response to the impacts and experiences of the COVID-19 pandemic and is intended to reinforce crisis preparedness in the EU. It focuses on public health as a priority. Ultimately, it aims to contribute to the future European Health Union. Its goals are divided into four areas of intervention: improve and foster health; protect people; access to medicinal products, medical devices and crisis-relevant products; and **strengthen health systems**. The fourth area of intervention clearly mentions the objective of "reinforcing health data, digital tools and services, digital transformation of healthcare".

The European Skills Agenda[15] also sets targets for the **upskilling** of European society by 2025. Due to the current shifts in the work environment, its 12 actions are organised into four building blocks: join forces; right skills for jobs; support people; and unlock investments.

The needs identified by LIFEBOTS Exchange's project partners to enhance the field of social robots are aligned with these three overall EU actions and concerns about the digitalisation of society, and the two forms of readiness highlighted - technological and digital.

14 EC (2021). EU4Health programme 2021-2027 – a vision for a healthier European Union.
Available at: https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_en
15 EC (2020). European Skills Agenda.
Available at: https://ec.europa.eu/social/main.jsp?catId=1223&langId=en

ORGANISATIONAL

The two chief organisational recommendations relate to the interdisciplinarity of **multi-stakeholder engagement and involvement**, and the need for awareness--raising and visibility of social robots and the benefits that they can bring.

> Avoidance of knowledge silos, and promote an interdisciplinary approach to social robots. The involvement of a variety of stakeholders' profiles in the development and implementation of such new technologies as social robots in the field of health and care has been reported, in the LIFEBOTS survey, as key to successful implementation.

LIFEBOTS Exchange was itself a ground-breaking initiative that promoted collaborative work and reflection by using **a cross-disciplinary/cross-dimensional approach** that attracted the involvement of a variety of stakeholders. The project hosted some 40 secondments, and several workshops.

In addition, projects like the REELER project offered proposals about engineers and end-users working together[16]. Potential designs for the ways in which **collaborations between engineers and the end-users** of robots can take place, and how to align the views of robot-makers and other stakeholders. The project team listed a range of tools to encourage such collaboration, developed during the project itself: a toolbox; 'BuildBot'; organising public events and examining other methods; and a 'human proximity tool'. A future profession/occupation was also mentioned: "alignment experts".

Work to promote a 'big picture' view of social robots' use in the fields of health and social care must, nevertheless, be pushed forward. **Associations, foundations, and academic institutions** can play a key role here (see the collaborations developed by multi-stakeholder associations, such as AGE Platform Europe; ECHalliance; EHTEL; the SHAFE Foundation, and others).

Visibility of social robots. More visibility is needed on the field of social robots, in general, and specifically on the potential benefits that the robots offer. People need generally to know more about social robots in order to have a complete understanding of how these robots can be an asset in their daily professional and personal routines, as well as how they differ from other existing digital technologies.

Organisationally, there are several options for ways in which to enhance the **visibility** of social robots and public understanding of their benefits. Two specific examples follow.

Initiatives for digital literacy, particularly in health, are an action milestone in the scope of the Regional Digital Health Action Plan for the WHO European Region 2023-2030[17]. The plan's strategic priority 2 states the objective of "enhancing country capacities to better govern digital transformation in the health sector and advance digital health literacy".

Completed **European projects** can provide useful support to raise the visibility of social robots. The IDEAHL European Digital Health Literacy Strategy is an outcome of a Horizon Europe Framework Programme[18]. It had two aims: to contribute to the digital skills of European citizens and to formulate a comprehensive strategy to tackle this issue in the EU. The social robots field could benefit from similar actions to that of IDEAHL and/or from parallel work with projects that address more specifically the topic of social robots.

In addition, various **other awareness-raising or communications campaigns** on social robots could be foreseen.

17 WHO (2022). Regional digital health action plan for the WHO European Region 2023-2030.
   Available at: https://iris.who.int/bitstream/handle/10665/360950/72wd05e-DigitalHealth-220529.pdf?sequence=2&isAllowed=y
18 Check out the IDEAHL European Digital Literacy Strategy.
   Available at: https://www.ficyt.es/progeur/docs/IDEAHL_Strategy.pdf

FINANCIAL

Financial support at all levels.

Europe is currently extremely aware of its need to remain at the forefront of **innovation**, and to be more productive in a highly competitive global environment. Thus, many of the EU's statements about future innovation place their emphasis on the importance, for European industry, of the digital transformation of healthcare[19].

Financial support at all levels (i.e., **micro, meso, and macro**) is essential to future progress in the field of social robots and to the facilitation of long-term implementation and sustainable actions. In the LIFEBOTS Exchange survey, respondents reported that past and current financing was insufficient. In late 2024, the European Court of Auditors identified that some European Member States are experiencing difficulties in committing to work on the digital transformation of healthcare, although no specific reference was made to social robots[20]. The lack of financing poses significant barriers to innovation, scaling, and the widespread adoption of digital and technology solutions. It would be of considerable benefit to the social robots field to see **current, and future, financing** allotted to these kinds of robots.

From **a macro perspective**, this need for financial support is aligned with various cross-cutting actions of the EU. One example is the Horizon Programme, which has dedicated €93.5 billion, during the 2021-2027 time-period, to fund **research and innovation**. The programme aims at EU scientific and technological excellence, tackling policy priorities such as the green and the digital transitions, and boosting innovation, competitiveness, and jobs. In 2022, the programme focused on a first wave of AI and Robotics projects, which today remains work in progress. Around €100 million has been invested, through Horizon 2020 and Horizon Europe, to establish a network of AI & Robotics Excellence Centres. A later initiative exists to invest €100 million to create 100 **regional innovation valleys** in locations with lower innovation performances: its aim is to tackle discrepancies among regions.

19 EC (2023). Demographic change in Europe: a toolbox for action, p.21.
Available at: https://commission.europa.eu/publications/communication-demographic-change-europe-toolbox-action_en
20 European Court of Auditors (2024).
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The Green Deal Industrial Plan[21] is another initiative from the European Commission that can impact the financing of social robots, as it aims to create a supportive environment to deploy clean tech manufacturing. Its ultimate goal is to make Europe the first climate-neutral continent by 2050. Therefore, the plan will have implications for the production and development of **environmentally-friendly, sustainable social robots** that do not add negatively to e-Waste.

These European community-oriented ambitions can impact positively on the field of social robots, especially if there is specific **earmarking of funds and investments** for this purpose. It is evident that several of these initiatives have regional and local implications.

In any case, financial support should definitely be channelled to the **meso and micro levels**, since local actions show great potential to generate direct impact and boost outcomes from investment in the implementation and sustainability of e.g., social robots.

Last but not least, consideration will need to be given to ways and means of encouraging **commercial and industrial financing and engagement** not only in bringing social robots to the market, but expanding their use in the fields of health and care. As a starting point, it would be useful if commercial concerns, industry, and health systems/services providers would consider applying **tools and techniques** like business canvases[22] and value proposition canvases[23]. At least 40 tools that could assist the growth of the digital transformation of healthcare - ranging from business modelling to value assessment, even if not specific to social robots or to their financing - have been collected by the DigitalHealthUptake initiative[24].

21 EC (2023). Factsheet - The Green Deal Industrial Plan.
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MISSION COMPLETE_
_final considerations

This booklet provided an umbrella summary of LIFEBOTS Exchange's findings. It highlighted some key findings, which have emerged from the interconnected (cross-dimensional) study of different **social, ethical and legal** dimensions, together with its focus on **research, implementation and development** related to social robots. The work covered the risks and benefits of social robots, their advantages and disadvantages, and strategies for investing in social robots as tools for the digitalisation of care. A set of concluding recommendations was presented.

Three primary takeaways from this exploration are as follows:

Social robots transcend traditional robotics. They exhibit advanced verbal and non-verbal communication capabilities, enabling interactive engagement. These attributes position social robots as transformative innovations in the digitalisation and modernisation of social and healthcare services, particularly in mitigating the challenges posed by an ageing population and a shrinking workforce.

Development requires an interdisciplinary approach. The successful advancement of social robots necessitates collaboration across multiple fields of expertise and the active involvement of diverse stakeholders. This coordinated action would ensure the ethical, legal, and practical viability of their deployment.

Implementation hinges on a multi-level strategy. Realising the potential of social robots demands a cohesive framework that would span the micro, meso, and macro levels of implementation. Such a strategy would include the preparation of infrastructure and environments; the establishment of incentivising policies; long-term financial planning; reliance on scientific validation; and equipping individuals to adopt and use social robots and other digital technologies effectively.

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I trust this reading experience has been enlightening and thought-provoking. Ultimately, the LIFEBOTS Exchange project aspires to ignite synergies, propel advances in human-robot interaction, and unlock transformative benefits in the social and healthcare sectors.

Hopefully, the booklet will contribute to enabling you to make progress and follow on to the **next phase of innovation**.

Mission complete: objectives achieved, data transmitted, and a clear path for future missions foreseen.

IMAGE CREDITS

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