Fondazione Don Carlo Gnocchi

epr Learning & Innovating Together

Enabling High Quality Rehabilitation Through Technologies

Final report of the EPR "INTEREHA" Working Group

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Acknowledgements

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Introduction

INTEREHA (which stands for "*INtegrated Technology-Enabled REHAbilitation*") is the working group of the European Platform for Rehabilitation devoted to analysing, sharing and summarising the good practices in using technology in the fields of rehabilitation, social services and long-term care.

In the last two years (2024-2025) members of the INTEREHA WG worked together to analyse a set of technology applications in rehabilitation and social services that were selected based on the level of interest of all participants. Medical, social and organisational aspects were addressed, as well as existing challenges and future opportunities.

The present report showcases the good practices and experiences of EPR members that have been gathered within the Working Group, and provides a set of policy recommendations based on the key challenges that emerged from the discussion. The good practices presented in the following pages offer a comprehensive overview of the current and potential uses of technologies in the diversified world of rehabilitation services, while the policy recommendations target different levels of policy making with the aim to support the adoption of technologies to provide high-quality and innovative services to persons with disabilities and other needs.

1. Methodology

A grid was circulated in early 2024 to collect evaluation about the topics that each organisation would have liked to address.

The grid had a list of nine technology-related topics proposed by the WG coordinator (Fondazione Don Gnocchi, Italy): artificial intelligence, robotics, wearable systems, telerehabilitation & telemedicine, virtual/mixed reality, smart environments & independent living, data management, technology for health management and training & education on technology in rehabilitation.

Each of these topics was split into five different cross-perspectives: trends in R&D, daily practice including projects, policy & regulations, sustainability and industrial relations.

The participants had to give a score to both their interest and actual experience for each of the nine technologies and five perspectives. The allowed scores were: 1 (none); 2 (a little); 3 (some); 4 (a lot).

Based on the scores collected from 6 organisations, the topics were ranked as reported in the chart in Figure 1.

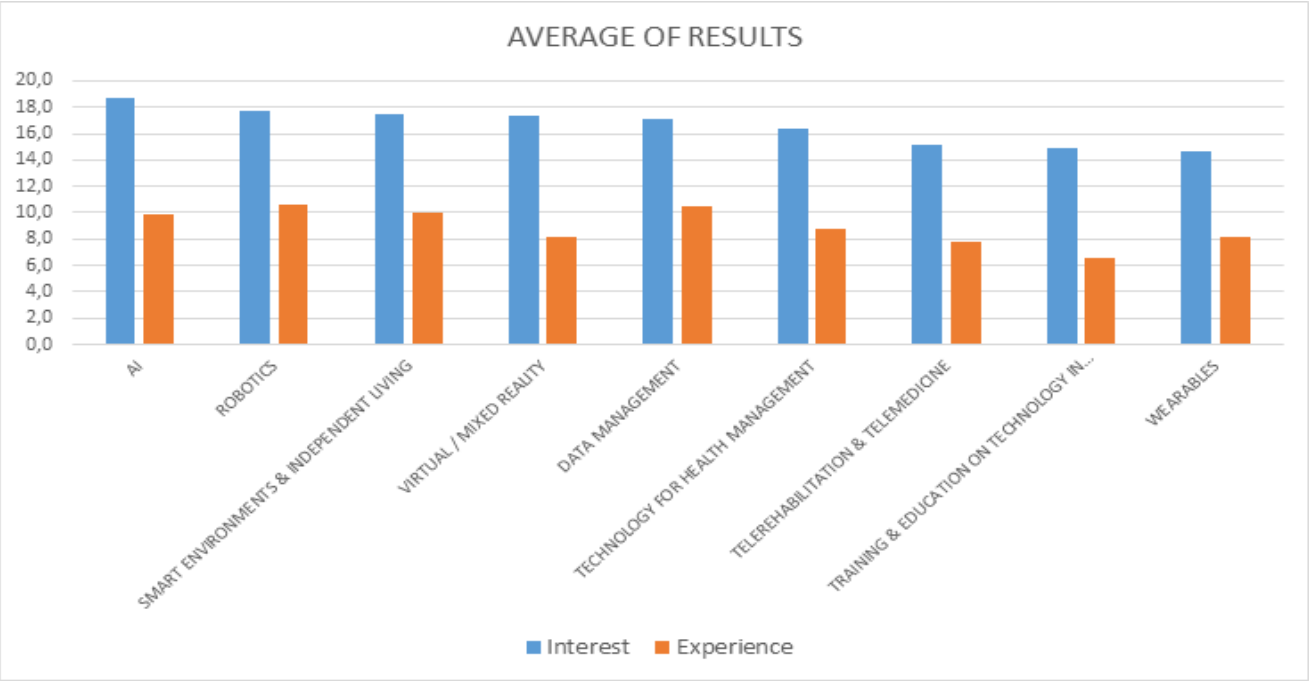

Figure 1 - The average interest and experience levels related to the proposed topics

In spite of the first position reached by artificial intelligence, the INTEREHA members commonly decided not to treat this topic since it was already the subject of the Annual Conference 2024 organized by EPR on "*AI and New Technologies for Inclusion: Leaving no one behind in the digital transition*" (final report available online). Consequently, the remaining eight topics were addressed over the two years (four topics per year) by the most experienced members, on a voluntary but planned basis.

Presentations were given by member organizations, reporting their experience, opportunities and challenges when using the selected technology in daily practice and possibly highlighting more than one perspective among the five listed above.

The presentations and the results of the discussions following the talks were all collected in common repository as a basis for a more structured body of knowledge on technology-assisted rehabilitation and long-term care.

At the end of the two years of common work, an effort was made to summarise the main messages collected from members' presentations into a large table reporting the eight technologies/applications in columns and the five perspectives in rows (see Figure 2). Two further columns were added, 1) to summarise the most frequent aspects mentioned per each perspective, across the whole set of technologies, and 2) to fill-in with recommendations that the INTEREHA WG members would like to address to decision makers within the group of stakeholders related to the five perspectives: research community, service providers' community, policy makers and regulators, health economists and payors, industry.

PERSPECTIVES	TECH 1	TECH 2	…	TECH 8	MOST FREQUENT ASPECTS	RECOM-MENDATIONS
R&D						
DAILY PRACTICE						
REGULATORY						
SUSTAINABILITY						
INDUSTRY						

Figure 2 Structure of the final table summarising contributions, take home messages and recommendations

2. Technologies in rehabilitation: an overview of the EU landscape

Digital and health technologies are being increasingly adopted in the field of rehabilitation and social services with the aim to provide more personalised, equal and efficient care services to persons with disabilities and to promote their independent living and social inclusion in the community. The types of technologies used are many and include, among others, robots for rehabilitation and social inclusion, wearables for remote monitoring, software for telerehabilitation and virtual or immersive environments. These solutions can be further empowered by Artificial Intelligence (AI), which offers new opportunities to design and develop tools tailored to the needs of persons with disabilities.

In Europe, health technologies and digital health tools represent a growing R&D field and an expanding market. According to the figures presented by MedTech Europe, in 2025 health technologies accounted for around 8% of the total healthcare expenditure in Europe, following pharmaceuticals (18%) and care practice for inpatients and outpatients (74%). Digital health has the potential to ease some of the most pressing challenges for the health and social care systems. These solutions are a critical enabler for high-quality social and rehabilitation services, because they can increase efficiency by leveraging real-world data, while empowering service users in terms of autonomy, inclusion and rights.

All the actors of the European care ecosystem recognise the enabling role of technologies for rehabilitation and social support of persons with disabilities. Key European policy initiatives, such as the EU Strategy for the Rights for Persons with Disabilities and the EU Care Strategy, underline that innovative digital solutions and technologies such as robotics and telemedicine can play a significant role in improving access to high-quality and person-centred support services, facilitating transition towards independent

living in the community, and overcoming accessibility barriers for persons with disabilities, including the elderly. Service providers play a substantial role in supporting innovation and adoption, not only by testing these tools in their real practice, but also by collaborating with the industry to research and co-design solutions that take into account the needs of the end users from the beginning. Often this collaboration is done with SMEs and start-ups, which represent around 95% of medical device and health technology companies in Europe, but large companies are also taking further steps into the field of rehabilitation and social care as well, with a special interest in homecare.

Despite all this progress, major challenges remain in the field of technologies for rehabilitation. These include technical obstacles, such as the availability of data and interoperability issues, social challenges, like the need to increase digital literacy of the workforce and end users or barriers to access and affordability, and systemic challenges, such as the full integration of innovative tools in current service provision and the need for new sustainability models for innovations.

3. Technologies in rehabilitation: collection of good practices and experiences from the INTEREHA WG members

The technologies presented in this chapter have all a high potential to be enablers of effective and efficient rehabilitation services. The EPR network understands rehabilitation in a broad and holistic meaning to include all activities working with individuals with a disability and others in vulnerable situations to empower them and enable them to access their rights, be included in all aspects of life and have the best possible quality of life. It encompasses all services that work to achieve this and throughout a person's life, including prevention and early intervention, medical rehabilitation, social care, support and housing and social rehabilitation, vocational rehabilitation, vocational education and training; employment support.

The good practices and experiences collected reflect the variety of services and settings, ranging from medical to social and vocational rehabilitation.

3.1. Robotics

Robotic rehabilitation is a type of rehabilitation that uses robotic devices to support persons with motor disabilities in regaining or improving physical functions. Nowadays, many types of robots are available on the market: upper-limb robots, for the rehabilitation of hand, wrist, arm and shoulder; lower-limb robots and exoskeletons, for the rehabilitation of legs and improvement in mobility, walking and balance.

Additionally, robotic rehabilitation can be integrated with Virtual Reality (see Par. 2) and AI to provide interactive exercises in immersive environments that resemble real life situations. This allows to engage service users and support them in regaining autonomy.

Robotic rehabilitation in Fondazione Don Gnocchi (FDG, Italy)

Fondazione Don Gnocchi introduced robotic rehabilitation in 2015 to respond to the need for a more scientific and measurable approach in medical rehabilitation. The robots were initially selected by a **multidisciplinary team** including physiotherapists, doctors, researchers, engineers, IT and administrative staff. The team evaluated different types of robots based on a list of criteria, ranging from proven efficacy in scientific literature to appropriateness for the target groups. Four upper-limp robots were then purchased (Fig. 3).

A **pilot study** was carried out in a centre of FDG were there was a medical doctor acting as a "champion" and supporting the adoption of the technology among her colleagues. **Training** was key to overcome the

initial cultural resistance. Some therapists were trained directly by the company and then trained their peers. The robotic gym was organised in time-slots to allow its use with both outpatients and inpatients in compliance with the rules of the National Health System. After the successful pilot, robotic rehabilitation was scaled up in other FDG centres. The main challenges relate to the maintenance process and high purchase costs, the initial cultural resistance of practitioners and patients, organisational difficulties and limitations of robotic assessment.

Nowadays robots have become a key part of therapy in FDG, because they allow intense practice while keeping **motivation and cognitive involvement** of the patient, with a relevant impact on **recovering functional ability**, such as carrying out activities of daily living. They offer the possibility to support with numerical data the validated clinical scales used for pre- and post-assessment, to gather feedback to keep the patient's attention, and to **optimise resources**, because one therapist can follow simultaneously more patients who work on different devices without reducing the effectiveness.

Figure 3: the upper-limb robots used in Fondazione Don Gnocchi

Additional resources

- Aprile I et al. (2020) "Upper Limb Robotic Rehabilitation After Stroke: A Multicenter, Randomized Clinical Trial." J Neurol Phys Ther doi: 10.1097/NPT.0000000000000295 - link
- Gower V et al. (2024) "Cost analysis of technological vs. conventional upper limb rehabilitation for patients with neurological disorders: an Italian real-world data case study." doi: 10.3389/fpubh.2024.1445099 - link

Robots for accessible cities: the AccessRobots project by Fundación ONCE

Regarding robots, Fundación ONCE, together with Inserta Innovación, carried out the *AccessRobots* project and developed ARI (Intelligent Robot Assistant), the first **assistive robot in large environments** that guides people with different kinds of disabilities in complex public settings such as airports, train stations and supermarkets. The robot was developed in collaboration with OMRON, a company that has provided the prototype which has been equipped with AI developed by the experts at Inserta Innovación. The **multidisciplinary research team co-designed** the robot with users in order to make it accessible. More information can be found in section 3.5 on Smart Environments and Independent Living.

3.2. Virtual and mixed reality

Virtual, mixed and augmented reality are technologies that blend the digital and physical worlds. There are slight differences among these three types of technologies: Virtual Reality (VR) creates a fully immersive environment, while Mixed Reality (MR) provides a view of the physical world with additional digital objects that can interact with real surfaces and physical elements. Augmented Reality (AR) is a less advanced form of Mixed Reality, where a layer of digital elements is added on the physical world, but there is no interaction between physical and virtual objects.

Arcadia: *a mixed reality platform for mental health and wellbeing by Fundación SASM (SASM, Spain)*

Fundación SASM has been exploring the application of immersive technologies for people with mental health issues. Each type of immersive technologies has potential for these service users (Fig. 4): augmented reality (AR) can help improve **social skills practice** and exposure therapy for certain phobias; virtual reality (VR) can be used for **personalised exposure therapies, relaxation and meditation**; mixed reality (MR) can help visualise imaginary concepts while maintaining contact with the therapist.

Figure 4: the different types of immersive technologies that can be applied to rehabilitation and social services

In 2022, Fundación SASM collaborated with ITI, a leading Technological Centre located in Valencia, to carry out a project called *Arcadia (Extended Reality for Mental Health and Wellbeing based on Gamification and Serious Games),* funded by the Instituto Valenciano de Competitividad Empresarial (IVACE) and the European Union through the European Regional Development Fund (ERDF). The project aimed to design and develop **gamified experiences and serious games for Mixed Reality environments**, oriented to the improvement of mental health and well-being. These immersive experiences were **co-designed with mental health professionals** from SASM and are presented through the ARCADIA platform as a complement or accompaniment to therapy, where the use of game-based strategies allows to increase the benefits of these applications. The platform also provides users with an **emotional avatar** that reacts to biofeedback collected through sensors and reflects the user's physiological and emotional state in real time, with the aim to **facilitate emotional self-awareness** (Fig. 5). A pilot study was carried out with both mental health professionals and patients. The former considered ARCADIA to be a promising tool for their clinical practice, while patients showed interest in continuing using the application.

Figure 5: the ARCADIA emotional avatar

Additional resources

Following the success of this project, SASM and ITI have started *Arcadia 2* in 2023, with the aim to expand the work done, for example by introducing haptic and tangible interaction with the avatar and improve the recognition of emotional states by combining different sensors:

- ARCADIA project outline, ITI (in Spanish)
- ARCADIA: A Gamified Mixed Reality System for Emotional Regulation and Self-Compassion | Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems - paper

Cortex and Cortex 2: developing a mixed-reality therapeutic workspace, by Fundación SASM (SASM, Spain)

Fundación SASM carried out the Erasmus+ project *Cortex*, in collaboration with the Valencia Institute of new Technologies (ITI). The project aimed at developing a **therapeutic workspace** based on mixed reality that provides immersive, personalized and accessible experiences for **mental health service users and therapists**. Following the success of the project, SASM continued to work on this platform with ITI in *Cortex2*, in order to enable remote and immersive therapy sessions connecting service users with therapists, use gamification to improve emotional regulation, enable multiuser sessions and to allow real-time integration of physiological data in order to personalise treatment.

Additional resources

- CORTEX project outline, ITI (in Spanish)
- News articles about the project: link 1 and link 2, in Spanish
- Presentation video on Linkedin

Virtual reality and AI for job training of young people with neurodevelopmental disabilities by Theotokos (Greece)

Theotokos has developed in collaboration with the University of West Attica a program that combines VR and AI to help **young people with neurodevelopmental disabilities** to prepare for **job interviews**. This program is one of the first of its kind in Greece and has been developed using the Meta Oculus VR headsets. Theotokos' team defined the roles of both the interviewer and interviewee to make the experience **realistic and tailored** to participants' needs.

A **first pilot case** was designed, with a scenario of a job interview for a warehouse clerk position in a paper-products company. In this scenario, two **HR avatars** acted as interviewers, with flexibility to change their prompts and questions. Before beginning the pilot phase, the program underwent 4 revisions by a testing group of 10 professionals from different services. The pilot test was carried out with 8 young trainees from the Transition Department in Theotokos, who were preparing the enter the labour market. The results of the pilot showed that the delay in the avatar's response due to translation needs was perceived as helpful by trainees, because it allowed them extra time for thinking and reduced anxiety. The questions made by the AI, however, were initially too complex and had to be simplified and clarified. A gender difference was also found, with boys feeling more comfortable using the headsets compared to girls, who usually have less gaming experience. The VR offered a **safe environment to practice** without pressure and independently, and enhanced job interview skills, later reinforced through real-life training. Theotokos has planned to continue the testing with the participants of the career orientation team and further develop the model with the University of West Attica.

The GAMISEM Tournament: the first "Olympics" of gamification for mental health in Spain, by Fundación SASM (SASM, Spain)

The 1st National Mental Health Video Game Tournament (GAMISEM) was organised by the ISEM Network together with Fundación SASM with the aim to create an inclusive environment where everyone feels valued through gaming. This initiative was proposed in the final phase of the *DIGISEM* project on digital transformation for mental health organizations, funded by NextGenerationEU within the Recovery,

Transformation, and Resilience Plan managed by the Ministry of Social Rights, Consumption, and the 2030 Agenda.

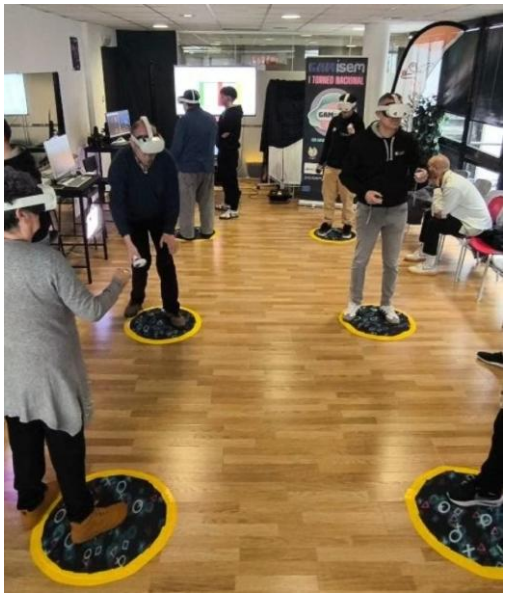

Figure 6: users testing VR technology during the GAMISEM tournament events in Spain

The GAMISEM tournament included sessions on **gamification using virtual reality headsets** for people with mental health challenges, which took place across different locations in Spain, with the involvement of other 2 EPR members, Fundación INTRAS and Fundación Rey Ardid (Fig. 6). A final event in Alicante was attended by approximately 175 users from across Spain accompanied by mental health professionals, where they were able to experience first-hand the technologies used in the tournament and participate in talks about the potential of virtual reality in the field of mental health. The main benefits of these activities were enjoyment, **enhanced autonomy** through gaming experiences that promote independent decision-making in daily life, **improved social skills and confidence** and an increased **sense of belonging to a community**. The event raised awareness about the importance of including people with mental health challenges through technology and promoting their social interaction and autonomy.

Additional resources

- News article on GAMISEM, ITI (in Spanish)
- Presentation video of the initiative on YouTube

3.3. Telerehabilitation and telemedicine

Telerehabilitation refers to the provision of clinical rehabilitation services through information and communication technologies, and is highly regarded as a promising approach to promote equitable health systems by providing improved access to expert support, patient empowerment, cost-effectiveness and scalability.

Telerehabilitation in Fondazione Don Gnocchi (Italy)

In 2016 FDG initiated the collaboration with technological partners in order to develop a telerehabilitation platform that could later be integrated with the IT systems in the organisation. The resulting platform was tested with stroke and multiple sclerosis patients via an experimental protocol, which included 2 patient evaluations in presence (one before and one after the intervention) and 18 sessions of telerehabilitation based on **exergames** (Fig. 7).

During the remote sessions, **one therapist** at the FDG Centre **followed two patients at the same time**. The first results showed that the platform was **reliable and easy to use** for patients, as well as that the exercises generally **improved balance, autonomy and quality of life**. Among the advantages pointed out there was the possibility to expand the population served, improve **continuity of care**, increase users'

motivation and collect data with predictive statistical value. The main challenges included the need for basic digital literacy of users in order to ensure the correct use of the platform, **cultural resistance**, the need of adequate space at the patient's home to perform the activities safely and the fact that not all rehabilitation activities can be done remotely. A key message was that telerehabilitation **supplements, but does not replace**, conventional outpatient or home rehabilitation activities. FDG has continued to develop its telerehabilitation system and integrate it into the services provided, and since 2020 it has carried out around 60.000 treatments in 13 centres.

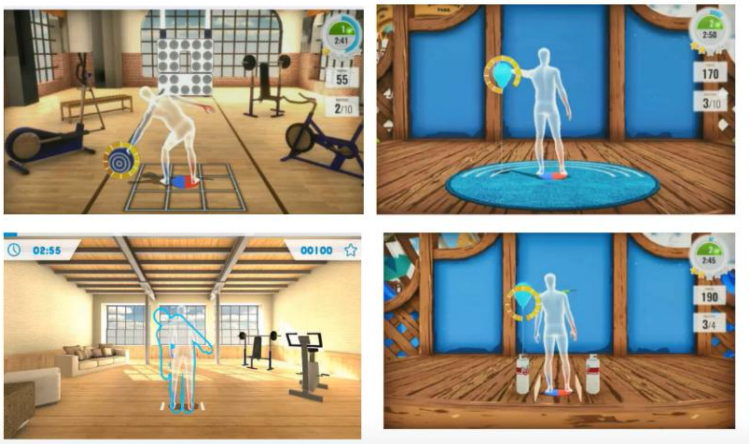

Figure 7: examples of exergames used in telerehabilitation

3.4. Wearables

From 2023 to 2024, Fundación ONCE carried out the *WalkerPISA* project (Smart, Sustainable and Accessible Pavement), which aimed to develop a new technological solution for a **sensing urban pavement** based on AI (see also 3.5 on smart environment and independent living). Through a **wearable device** worn by the person, this pavement is capable of providing **personalised assistance** to persons with disabilities moving in urban areas shared among pedestrians, cyclists and drivers. For example, if the person is walking on a bicycle lane, the wearable gives a sign to alert them.

Wearables by Fundación INTRAS (Spain)

As part of the APOYATEC project (section 3.5), pilot tests have been carried out with different technologies aimed at improving **independence and safety** in the home and outdoors. These include wearable devices, such as telecare watches. The **telecare watches** were piloted internally at the INTRAS Foundation in response to high demand from the older adults cared for by the organisation. To this end, various commercial products offering specific solutions for safety and care in emergency situations were evaluated, allowing their effectiveness and ease of use in real-life contexts to be analysed.

Along the same lines, other **geolocation-oriented technologies** were explored, such as smart key rings, belts, T-shirts and pendants. These types of devices usually incorporate **fall detection functions** and, in many cases, connect to applications that allow the user's movements to be visualised. These features are particularly useful, on the one hand, to ensure rapid response in the event of an accident and, on the other, to locate the person in situations of disorientation. From a professional perspective, these technologies facilitate the promotion of **personal autonomy** and specific work on aspects related to **spatial orientation** in people with difficulties in this area.

Smart Objects in Fondazione Don Gnocchi (Italy)

For several years, Fondazione Don Gnocchi has been exploring the use of **smart objects** in the rehabilitation of **children with motor difficulties**. Over the past year, tests have been conducted on children with hemiparesis using sensing objects via IMU that are manipulated during exercise.

These sensors make it possible to collect highly valuable kinematic data, capable of detecting even minimal differences between the paretic limb and the healthy one. The integration of wearable sensors

offers significant advantages: on the one hand, it enables the extraction of descriptive performance metrics to support clinicians; on the other hand, it provides **real-time feedback to end-users**, fostering their **active engagement** in the rehabilitation process. Furthermore, the low cost of these devices and their **adaptability to different care settings**, including home environments, make them highly scalable. The large amount of data collected requires robust and secure infrastructures for storage and sharing, fully compliant with GDPR. When properly processed and ensuring data quality, these datasets can be used not only to monitor progress but also to enable **early diagnosis and prevent potential deterioration**, thanks to the application of AI techniques.

The experience gained by FDG highlights the importance of adequate **training** for both healthcare professionals and end-users, in order to minimize issues during device use. Sustainability studies on rehabilitation protocols involving wearable sensors still need to be conducted, but scientific literature suggests that the sustainability of wearable-based systems is closely linked to the type of equipment adopted; classification as a medical device, in fact, significantly impacts purchase costs.

3.5. Smart environments and independent living

Smart environments use technologies like sensors and smart devices in everyday settings. They include smart homes and smart cities. Smart environments can support independent living of persons with disabilities by providing safety, for instance through fall detection and telemonitoring, convenience, for example by automating tasks like controlling lights and temperature, and promote social connection for individuals, particularly older adults, by facilitating communication with family and caregivers.

Technologies for accessible smart cities: the AccessRobots, WalkerPISA and PULSE projects by Fundación ONCE (Spain)

Fundación ONCE has carried out projects related to the concept of **smart cities**, which are urban environments characterised by principles of accessibility, usability, safety, sustainability and efficiency. **Accessibility** in particular can be supported by technologies like AI for automatic descriptions and captions, robots guiding people in complex environments and haptic technology to access information by touching.

Regarding robots and AI, Fundación ONCE, together with Inserta Innovación and the company OMRON, carried out the *AccessRobots* project and developed ARI (Intelligent Robot Assistant), the first **assistive robot** in large environments that guides people with different kinds of disabilities (sensory, physical, and cognitive) in **complex public settings** such as airports, train stations and supermarkets (Fig. 8). The multidisciplinary research team co-designed the robot with users in order to make it accessible. Thanks to sensors, ARI can **recognise and avoid obstacles** and can **guide the user** from one point to another, as well as to intermediate points on a complex surface, such as a bar or a restroom in a train station. It **communicates with the user**, even in sign language, via an app.

Figure 8: a user with ARI, the Intelligent Robot Assistant

The *WalkerPISA* project (mentioned in section 3.4 on wearables) was another project by ONCE that supports persons with disabilities in moving in an accessible, free and safe way in the urban environment.

The collection and management of data coming from technologies used in smart cities can provide the possibility to offer **person-centred and tailored services** to citizens.

Fundación ONCE, Nayar Systems, and the Spanish Business Federation of Elevators have developed the *PULSE* mobile application. This app is designed to allow people with disabilities to **access and use elevators through their smartphones**, without having to touch any buttons. PULSE is particularly advantageous for individuals with physical and visual disabilities, as elevator control panels are not always accessible to these user groups.

Additional resources

- Accessrobots project outline, ONCE (in Spanish)
- Presentation videos on Accessrobots and WalkerPISA on Youtube
- News article on Accessrobots test in Oviedo, ONCE (in Spanish)
- News articles on WalkerPISA (in Spanish): link 1 and link 2
- News article on PULSE, ONCE (in Spanish)

Apoyatec: a methodology to select and implement assistive technologies in the household, by Fundación INTRAS (Spain)

Fundación Intras developed a methodology, named *Apoyatec*, which develops the different steps to be taken for the implementation of assistive technologies for people and their households. The *Apoyatec* methodology aims to contribute to the definition of a **technology-based care model** that improves the quality of life of users at their homes, tackles the digital gap, increases the sense of security and improves family communication. Concerning the professionals, the methodology aims to optimise work, improve communication and the **quality of the working environment**, foster technological research and provide more personalised interventions.

Apoyatec comprises 8 phases for the implementation of ATs: 1) needs detection, 2) technological surveillance, 3) technology selection, 4) technology acquisition, 5) training, 6) technology adaptation, 7) implementation and 8) evaluation. Within the methodology, a **catalogue of innovative assistive technologies** is being developed and constantly updated through technology surveillance.

The methodology can be applied to different situations and technologies ranging from **technologies for daily life** (e.g., Alexa), to technologies for **security** (e.g., environmental control sensors) and technologies for leisure (e.g., adapted tablets, robot cats etc.). The methodology was implemented with sample groups of 41 elderly people living at home in rural areas and 50 people with mental health issues living in supervised flats or residential homes. Metrics were used to evaluate the impact of the technology on users' quality of life and the implementation of the technologies by professionals. The analysis showed that the use of technology had a **positive impact on the participants' quality of life**, with a reduction of the level of dependence, an increase in the perceived social support and an improvement in social relations. The results also detected the need among elderly people and families for technologies that enable **tele-assistance and monitoring**, which make them feel safe.

SALSA: a project on sensors and home automation for freedom, safety and autonomy, by Fondazione Don Gnocchi (Italy)

Individuals with vulnerabilities and their families are increasingly seeking technological solutions that enable **tele-assistance and remote monitoring**, enhancing their sense of safety. To address this need,

in 2024 Fondazione Don Gnocchi, in collaboration with Informatici Senza Frontiere (IT no-profit) and Cascina Biblioteca (social no profit with assisted living apartments), launched the *SALSA* project (Sensors and Automation for Freedom, Safety, and Autonomy) funded by CARIPLO Foundation. The initiative aimed to improve the lives of people with motor, psychological, or social fragility by introducing **smart technologies and home automation into assisted living apartments** located in residential buildings in the city.

SALSA involved over 50 vulnerable adults. Their individual needs were assessed, and based on this evaluation a **personalised kit of sensors and automation systems** was provided to each user, with the goal of improving **safety, autonomy, and accessibility**. The identified needs were related for example to the risk of fire or theft in the apartment and the risk of falls. **Data** collected from the technologies allowed to detect risky behaviours that could be improved through person-centred training (for example leaving the home door open when going out) to ensure more safety to both service users and other residents in the building.

The individual progress of participants related to their needs was measured using the Goal Attainment Scaling (GAS). The results show that, for most individuals, the personalized solutions selected and installed in the apartments have successfully addressed their needs, improving their autonomy and safety in their home environments.

Additional resources

- SALSA project website (in Italian)
- The personal experience of a user with SALSA (in Italian)

3.6. Data management

Data management involves a range of processes and policies that govern the entire data lifecycle within an organisation. It includes data collection, organisation, storage, protection and usage, and aims at ensuring accuracy, security, and accessibility. Data management for healthcare and social care providers can be particularly challenging, due to the nature of the data collected and used (health and personal data), the numerous regulatory requirements related to privacy and cybersecurity, and the fragmentation of data collected in software which don't communicate with each other. However, the efficient management of data helps providers to make informed decisions based on evidence, foster research – including AI systems development and training – and ultimately improve the quality of their services through innovative solutions and processes built on real-world data and users' needs.

Addressing the challenges of data management in medical rehabilitation: the adoption of e-forms by Inkendaal (Belgium)

Different software systems are often used to collect data from service users. Especially in medical settings, the **variety of tools** used within a single hospital makes the merging of patient data problematic, as well as the export of data for medical research and quality checks. Sometimes, **regional or local differences in funding and service provision** among hospitals can lead to greater challenges related to data management and data usage. In Flanders (Belgium), for example, individual rehabilitation hospitals are governed by the Flemish government, whereas in the other parts of the country rehabilitation centers are part of general (or university) hospitals and governed by the federal government. This leads to an "unequal level playing field" where Flemish rehabilitation hospitals receive limited funding for ICT and cybersecurity

compared to general and university hospitals which are part of the federal government. Moreover, clinical rehabilitation data from patients treated in rehabilitation hospitals in Flanders are not represented - or represented very little or wrongly - in governmental data collection and reports, which leads to biased data at national level. Rehabilitation Hospital Inkendaal, which is based in Flanders, is working to improve internal and external data management constraints. In particular, it adopted a **set of e-registration forms** for hospitalisation and ambulatory treatment. Through mandatory fields, the form enables internal optimisation in terms of data collection and allows for the extraction of datasets in Nexuz Health databases. The hospitalisation e-form includes a specific rehabilitation scale (RCSE) and has to be filled in by the referral hospital to **better identify the rehabilitation needs** of the patient. This allows one to better understand whether the patient has to be referred to a specialised rehabilitation centre or to a general hospital. The Belgian government has started a research project in October 2025 investigating the use of RCSE and other scales to support a renewed financial model for rehabilitation.

Additional resources

- Hospitalisation e-form developed in Inkendaal, available in French and Dutch (link)

3.7. Technologies for health management

Technologies for managing the health of service users include sensor-based systems, wearables devices, smart home systems, software and assistive devices. These tools enable more efficient health monitoring, communication with providers, medication management and daily activity support, including cognitive stimulation activities. They can contribute to increased independence and quality of life of service users on the one hand, and to optimisation of workforce resources and time on the other.

Technologies for health management of elderly service users in residential care, by Fundación Rey Ardid (FRA, Spain)

Fundacion Rey Ardid has adopted different types of technologies with the aim to improve the health management of elderly service users in some of their 20 residential care centers for older people across Spain. For example, FRA installed in the Rosales residential center *Helpnex*, an assistive communication system developed by the company Ibernex. The system works with tablets and sensors placed in various places in a room. The staff can use a badge for identification and **record and access information** on the patients' care needs (e.g., diet, medication etc.) in the room **through the tablets**, without being at the computer. This system enables **better resource management and monitoring**, positive reception and motivation for workers, while challenges faced are related to technical difficulties during implementation and the **learning curve for staff adaptation**. FRA is also developing a collaboration with *Maximiliana*, an adapted mobile phone for older adults, which helps to **prevent social isolation**, protect users from frauds and is highly customisable.

Concerning technologies used to keep cognitive stimulation of elderly service users in residential care, FRA provides through tablets two **cognitive stimulation apps**, *GRADIOR* developed by Fundación INTRAS and *NeuronUp*. Both offer personalised content and are engaging for users, although they require basic infrastructure, such as WiFi and tablets. For service users with dementia, a therapy programme is being tested now which is based on the use of **therapy animal dolls and animal social robots** to elicit reactions from people with moderate or advanced dementia who are often in a state of apathy. This

programme requires little financial investment; however, it requires preparation for both professional staff and family carers of the user to avoid the risk of infantilisation of the activity.

3.8. Training and education on technology in rehabilitation

Training and education of professionals play a key role to ensure that promising technologies and solutions are effectively adopted within provider organisations. Training on rehabilitation technologies can be offered through university programs, but also through upskilling and mutual learning initiatives promoted by service providers, and study visits organised with companies providing the technologies. Such initiatives help professionals to learn how to use technologies in their daily work, address cultural barriers and resistance to change, and enable the introduction of technologies in service provision to improve quality of services.

Promoting technological expertise and upskilling among professionals, by Inkendaal (Belgium)

Inkendaal has been increasingly working on **building technological expertise** among its professionals as a means to **address staff shortages**, provide quality care and promote **the sustainable implementation of technologies** in therapeutical settings, such as robotic rehabilitation. In particular, Inkendaal is working on the aspects of ownership and shared expertise within **specialised multidisciplinary clinical teams**, by offering opportunities for development and specialization. In order to enable this as an institution, Inkendaal has adopted the principles included in the Rehabilitation Competency Framework developed by

WHO (Fig. 9), which defines **the core values and beliefs shared by the rehabilitation workforce**, and encompasses the competencies, behaviours, knowledge and skills required. This initiative aims to move away from a hospital-wide curriculum, focusing on facilitating expertise development within the specialised rehabilitation programs and further **transitioning towards new integrated activity-oriented teams**. These specific teams are based on the ICF principles and will focus on specific rehabilitation goals of clients with similar care needs within "**skills labs**". In these skills labs, group therapies will be offered based on the functional possibilities and concrete wishes of clients, regardless of the underlying medical diagnosis. Service users will train with expert therapists to **regain their autonomy and be empowered**, also through the use of technological aids (e.g., for functional training of the upper limbs, balance training, training of activities of daily living), to make sure that the skills that service users will learn through technology-based rehabilitation can be applied in their daily life. Skills labs also offer the opportunity for therapists to increase their agency and the **sense of responsibility and belonging**.

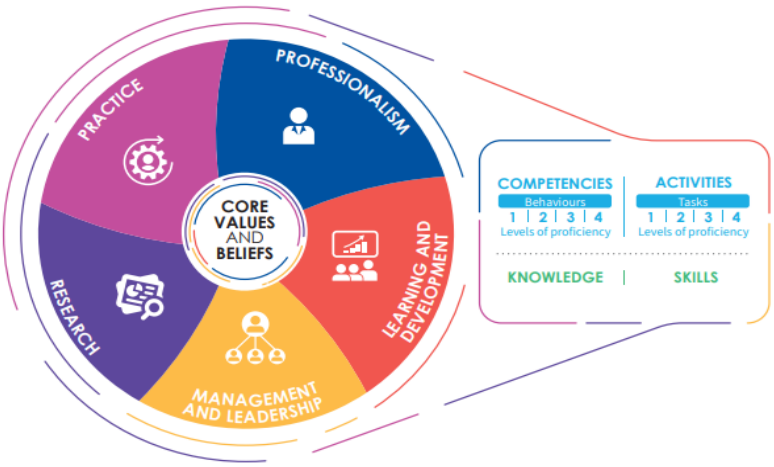

Figure 9: the structure of the WHO Rehabilitation Competency Framework

Addressing resistance to change through training to promote adoption of technologies, by EKA (Greece)

EKA has implemented initiatives for training on technology-based interventions among professionals, with the aim to address barriers to the implementation of technologies in rehabilitation, which include technological issues, regulatory challenges, financial constraints and resistance from clinicians. Regarding **resistance to change** from professionals, EKA conducted an informal survey to explore this issue internally. The survey revealed that some professionals were technologically illiterate due to age, or had fear of damaging devices, while others found the use of technology time consuming and had insufficient knowledge about indications. To address these issues, the organisation has introduced mandatory seminars on technology in healthcare as part of **continuous education** of its professionals. Conferences are organised also in **collaboration with other Greek institutions**, like the Tech Lab of Medical School of Athens. To further strengthen staff competences, EKA regularly invites experts on rehabilitation technology (including the companies providing the devices) to give training courses, and organises **study visits to tech-friendly rehabilitation centres** and research centres in Greece and abroad. Such initiatives are supported also by the participation in a European network like EPR, which offers opportunities for new collaborations and keeps the motivation of professionals.

Additional resources

- Rehabilitation Competency Framework, WHO 2020 – Full document
- Rehabilitation Competency Framework, WHO 2020 - Information Sheet

4. Key challenges across the technologies

The perspectives explored within the INTEREHA Working Group have highlighted a set of recurring and cross-cutting challenges that can influence the development and implementation of technologies for rehabilitation and inclusion. A summary of the key elements identified for each perspective is presented below and in Figure 10.

4.1. Current trends in research and development

All participating organizations are actively involved in research and innovation projects or pilot testing of innovative solutions that integrate technology into programs to support service users. These initiatives reflect a shared commitment to exploring new approaches that improve autonomy, participation, and personalization of services. A recurring challenge is the need to make sure that **project results are fully exploited** and the solutions developed are **adopted in daily practice in a sustainable way**.

4.2. Opportunities and challenges in daily practice

The use of technology in service provision offers significant benefits in terms of user motivation, quality and continuity of support, treatment effectiveness and efficiency. Another advantage is the ability to collect large volumes of data during rehabilitation activities and service provision. These data can be used to support decision-making, improve service personalization, and monitor progress over time. At the same time, the adoption of technology presents challenges related to **cost, staff training, digital literacy of end-users, data security and compatibility with existing infrastructure**. Successful implementation requires a flexible, **multidisciplinary approach** that addresses **cultural and organisational barriers** and supports sustainable integration into workflows.

4.3. Policy and regulatory aspects

Technologies used in rehabilitation and social services must comply with strict regulations concerning safe and ethical use and data protection. In particular, due to the nature of the data collected, it is crucial to **safeguard privacy and security of data** in respect with GDPR. European and national legislation, along with local and regional initiatives, play a key role in shaping how digital solutions are adopted and used, but can also cause **fragmentation at regional levels in terms of funding and support measures** available. An appropriate level of **awareness of the relevant regulatory framework** is often missing in organisations using technology-generated data in rehabilitation and social services.

4.4. Sustainability

The long-term sustainability of technological solutions depends on their **scalability**, the **organisational model used for their implementation**, and the availability of **appropriate reimbursement models**. Differences between reimbursement schemes at national and even regional level are a relevant challenge to a sustainable adoption of technologies by service providers. Organizational efficiency, cost reduction, and equitable access to services are shared goals, but achieving them requires **careful planning and active involvement from all stakeholders**.

4.5. Relations with industry

Collaboration between health and social services and technology providers is increasingly important to develop and effectively implement innovative solutions that are also accessible and inclusive for persons with disabilities and other needs. Co-design processes help create tools that better meet real-world needs and facilitate integration into the workflows of service providers. Small and medium enterprises (SMEs) can often adapt more easily and rapidly their solutions to specific contexts compared to large industry, but need adequate support and collaboration with service providers, which hold the expertise on inclusion and accessibility of vulnerable groups. There is a lack of shared good practices on successful frameworks to speed-up the co-design and adoption of technologies for rehabilitation and social services.

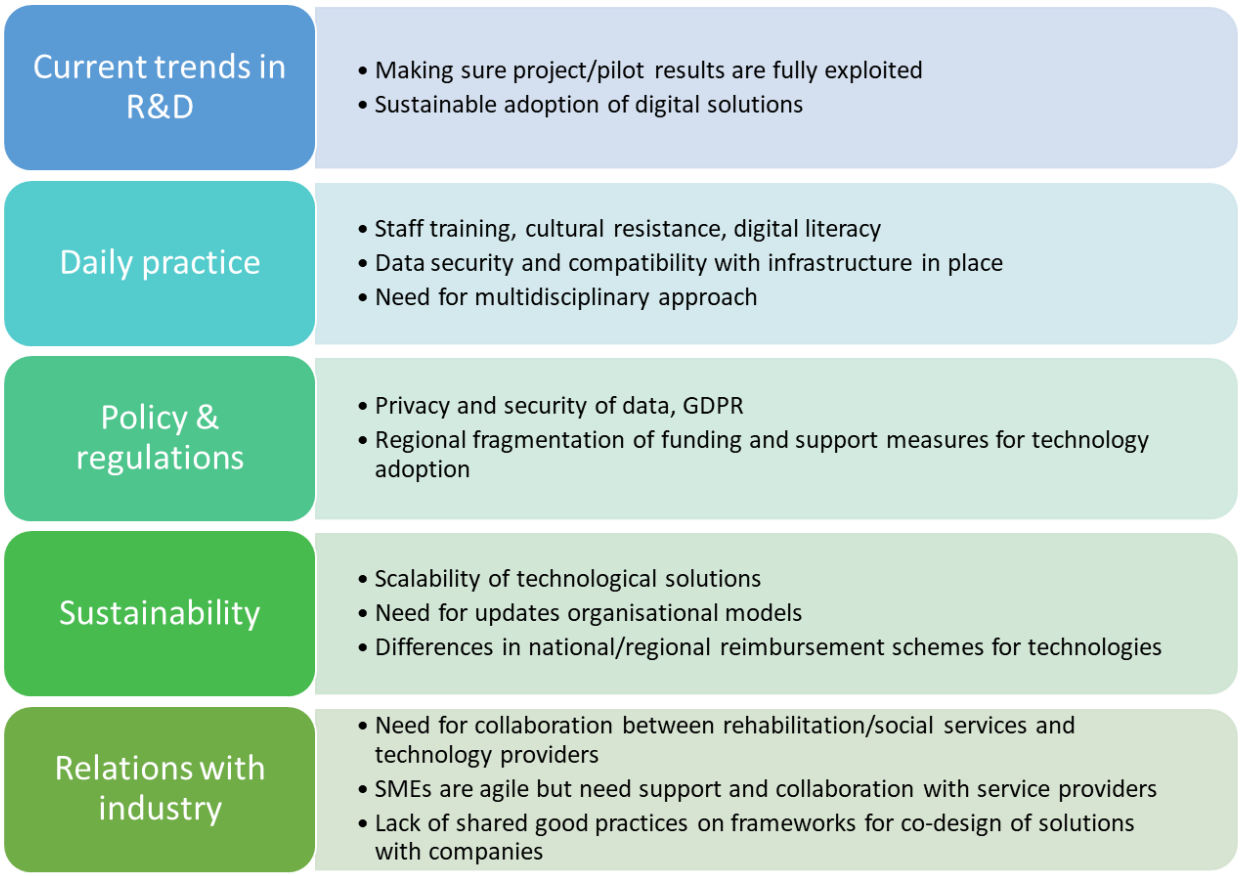

Figure 10: summary of main challenges across the five perspectives

5. Policy recommendations

The following set of policy recommendations is based on the key messages and most frequently challenges highlighted during the discussions of the INTEREHA Working Group. The recommendations are organised across the 5 perspectives used to analyse the adoption of technologies in rehabilitation: current R&D trends, opportunities and challenges in daily practice (including in projects), policy & regulatory aspects, sustainability and relations with the industry. Each recommendation targets one or more levels of decision-making (European, national, regional or local).

Current R&D trends

- **FUNDING**: at **EU level**, leverage research funding programmes (Horizon Europe, EU4Health…) and include calls on R&D of innovative technologies for rehabilitation, disability management and support to independent living, designed to be adapted to and integrated in different settings across the continuum of health and social care.
- **FUNDING**: at **EU and national level**, provide funding through specific calls to R&D initiatives for prototypes or solutions that target groups of patients/service users that can benefit from technology but are at risk of being excluded from industry-led studies and trials (e.g., children, patients with particular cognitive impairments or mental health disorders, etc.).
- **STRATEGIC PARTNERSHIPS FOR R&D PROJECTS**: at **EU level**, provide funding and opportunities for networking, matchmaking and the development of strategic partnerships among service providers, academic institutions and/or businesses that can further enhance the applications for collaborative and high-value R&D projects, for instance in Horizon Europe.
- **INCLUSIVE MUTUAL LEARNING**: at **EU level**, continue to provide opportunities for mobility exchange of professionals and persons with disabilities through Erasmus+ to enable inclusive upskilling of service providers and service users, with a focus on the use of technology in different settings of service provision.
- **MUTUAL LEARNING**: at **Organisation/management level**, provide opportunities for professionals in the organisation to exchange current trends in clinical practice and R&D ideas, through the creation of a space for regular meetings and dialogue inside the Organisation, enabling interdisciplinarity of research ideas and cross-fertilization among different professions and care departments.
- **MUTUAL LEARNING**: at **Organisation/management level**, leverage the international network of contacts offered by networks like EPR to establish collaborations and mutual agreements in order to share facilities for testing and research activities, both for EU-funded projects and for SMEs and start-ups developing technologies for rehabilitation.

Opportunities and challenges in daily practice (including in projects)

- **TRAINING**: at **national level**, make training curricula for healthcare professionals in rehabilitation and LTC more homogeneous, to ensure that all professionals gain a similar level of knowledge on the use of technologies and can therefore ensure the same principles of quality of care across different regions of the country.
- **TRAINING & UPSKILLING**: at **Organisation/management level**, encourage and provide opportunities for continuous training of the staff. Training can be organised in collaboration with tech-friendly service providers abroad, leveraging networks like EPR, or companies and SMEs that are technology providers, for example by organising joint seminars, study visits or preparing educational material. Continuous training can contribute to overcome cultural barriers or resistance to change, as

it can help professionals to feel more confident and perceive the use of technologies in daily practice as a facilitation and not as a burden or risk to their jobs.

- **UPDATED STUDY PROGRAMS**: at **national level**, recommend the development of study programs that include specific modules on the adoption of technology within the rehabilitation processes and the organizational impact, to train and prepare future healthcare professionals and managers to introduce technological solutions in their work in an effective way. The modules on technology could benefit from the collaboration with other university departments (e.g., biomedical engineering) and the participation of SMEs that can bring concrete study cases.
- **INFRASTRUCTURE**: at **EU level**, promote the definition of international standards of interoperability for technologies common in rehabilitation, e.g., ATs, smart homes systems, robotic rehabilitation, which often are integrated and need to exchange data. International standard organisations should then provide guidance to manufacturing companies, including SMEs, to ensure the adoption of the standards.
- **TRAINING OF SERVICE USERS**: at **national, regional and local level**, provide funding opportunities for public and private organisations to deliver initiatives on digital literacy training and awareness raising to service users, caregivers, elderly citizens etc.

Policy & regulatory aspects

- **CYBERSECURITY**: at **Organisation/management level**, raise awareness about cybersecurity and threats to data protection with training and seminars for all professionals, also in view of the future diffusion of digital tools for rehabilitation.
- **CYBERSECURITY**: at **national level**, provide adequate funding to healthcare and social care providers to support the implementation of cybersecurity requirements, which are often costly for single organisations but are necessary for the prevention of cyber-attacks.
- **ACCESSIBLE CYBERSECURITY PROGRAMS**: at **national and EU level**, ensure the availability of raising awareness initiatives and educational programs on cybersecurity that are accessible and inclusive for persons with disabilities, in order not to exclude them from prevention measures and to increase their safety in digital environments.
- **REGULATORY AWARENESS**: at **Organisation/management level**, propose additional training and courses on specific regulatory aspects (e.g., related to cybersecurity, privacy of data etc.), to fill any relevant gaps of knowledge among staff using technologies in daily practice.
- **POLICY BRIEFS**: at **EU level**, co-develop with other service providers, leveraging networks like EPR, policy briefs on ethical and inclusive adoption of rehabilitation technologies.

Sustainability

- **REIMBURSEMENT SCHEMES**: at **national level**, introduce reimbursement tariffs that take into account also the costs initially paid by the centre to purchase the technology (e.g., robots).
- **PROVISION OF FINANCIALLY ACCESSIBLE TECHNOLOGICAL TOOLS: at national or regional level**, include technologies that could be of common use among services users in reimbursement schemes, to ensure that they are financially accessible for service users who would benefit the most. The provision of technological solutions through reimbursement schemes should take into account that often service users avoid using technological solutions because such tools are only available in rehabilitation centres and not affordable for personal use.
- **INSURANCE:** at **national and EU level**, establish dialogue with insurance companies to change their view and role in the rehabilitation and LTC sector, finding new models of insurance (e.g., value-based,

bundle payments). Work on agreements between insurance companies and excellence centres of rehabilitation providing top-quality care to patients.

- **INNOVATION TRIALS:** at **national and EU level**, institutional actors should provide support to define new reimbursement schemes, also based on optimised conditions of use of the specific technology.
- **TECHNOLOGY ASSESSMENT:** at **national and EU level**, encourage the collaboration of service providers of excellence with businesses, technology assessment agencies and academic and research institutions to contribute to Health Technology Assessments and cost-benefit analyses of innovative technologies applied to rehabilitation settings, to support reimbursement.

Relations with the industry

- **FUNDING**: at **EU level** (European Commission, European healthcare industry trade associations), **national and regional level** (Ministries, regional authorities, clusters bringing together research, industry and service providers, national healthcare industry trade associations), provide funding opportunities for collaboration between service providers and companies, know-how exchange and co-design of new solutions for rehabilitation and LTC services, as well as opportunities for public-private partnerships.
- **EDUCATION:** at **national level**, recommend the introduction of post-graduate courses or masters on innovation procurement and innovation management in health and social care, in order to teach young professionals how to interact with the industry to develop and adopt innovative solutions in their care settings.
- **RESOURCES IN THE ORGANISATIONS:** at **Organisation/management level**, enable the creation of a new role focused on innovation management, which includes networking and collaboration with companies in the field of rehabilitation technologies.
- **NEGOTIATION POWER WITH VENDORS:** at **Organisation/management level**, promote procurement processes that involve more than one centre for the purchase and shared use of expensive equipment e.g., VR licenses. This could help to negotiate lower costs and/or customisation for medical and data management software, which can be very expensive for provider organisations, especially when such devices are meant for restricted target groups of service users. Common procurement processes can become more effective if centres can negotiate as a group, both at national and European level, lower prices with the vendors providing the device or software licences (including future AI-based software licences).