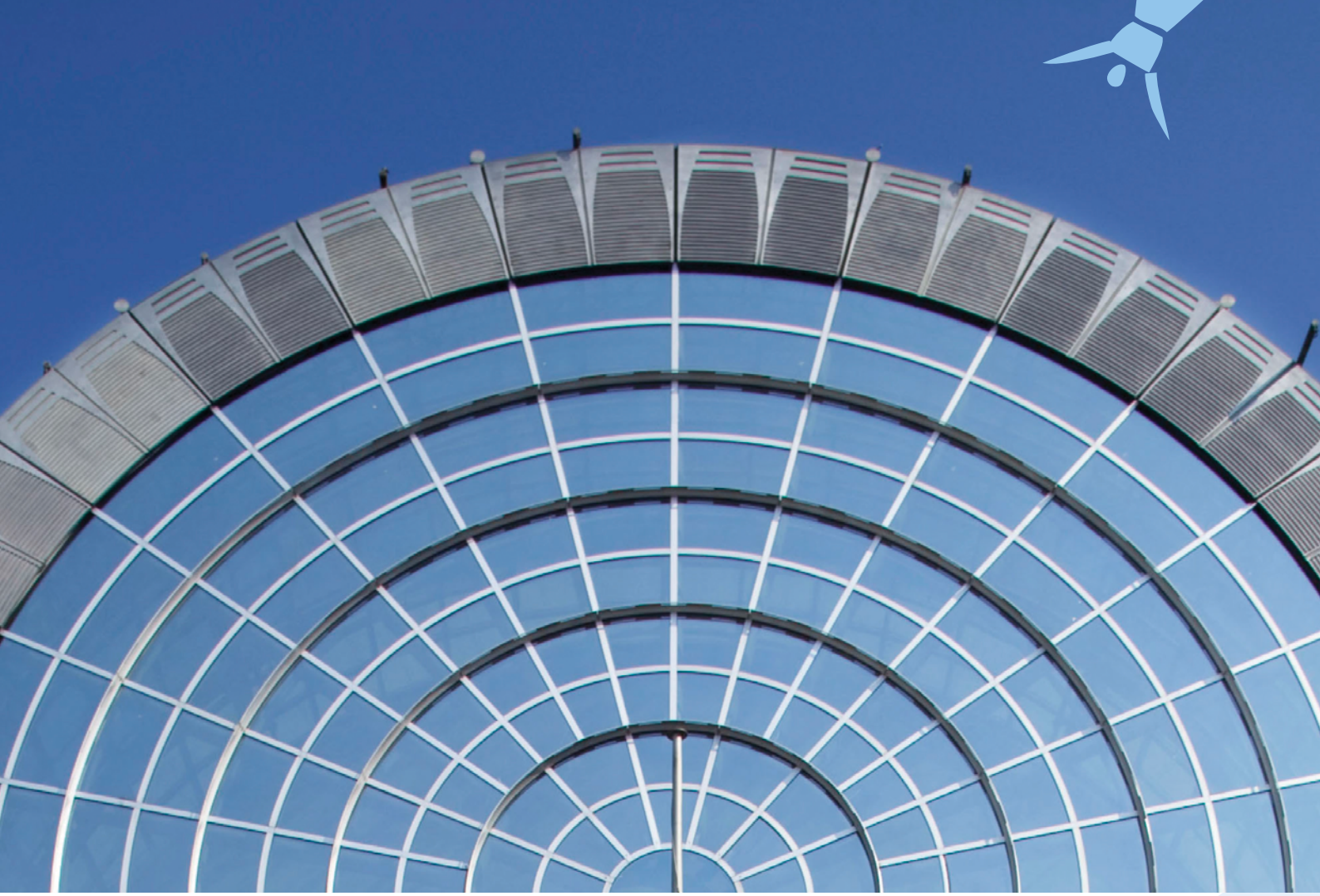

Digital Inclusion

A WHITE PAPER

entelis
European Network
for Technology Enhanced Learning
in an Inclusive Society

Acknowledgements

This White Paper was produced in the framework of the ENTELIS project funded by the European Commission under the Lifelong learning programme.

Lifelong Learning Programme

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1. Introduction

This white paper will provide the reader with insight into the role technology plays for the full participation of persons with disabilities and older people in the digital society. The authors consider equal opportunities to participate in all realms of life a human right. The paper will help the reader to understand what the barriers to full digital inclusion for these groups are, how changing scenarios in society should lead to the definition of new goals and how these goals could be reached.

At this moment **still too many people worldwide are disabled by inaccessible technology**, or **do not have access to assistive technology (AT) based solutions** that could help them to participate on an equal footing in modern society. The same holds true for older adults that, adequately supported and trained, could benefit if they wish from appropriate technology to remain **independent**, **socially connected** and with **a good quality of life** in their homes and communities. Yet most of the time it just doesn't happen because technologies do not match their needs, digital skills and desires or because care organisations do not want or are unable to change their service delivery models.

The rapid rate of innovation in **Information and Communication Technologies (ICT)** brings the risk that some groups remain, often unwillingly, behind in the adoption of new technologies. A **digital divide** occurs when structural factors create barriers leading to unequal opportunities. It is important to analyse the causes and to see what can be done to bridge the divide and to reach full digital inclusion.

Bridging the divide is important in order to ensure individuals can lead **more fulfilled lives** based on freedom and choice. It is equally important for society. Access to employment, for example, will **reduce poverty and dependency** from state grants and benefits, where these are available. It will help to grow the local and national economy, while reducing, in many cases, the burden of informal care and the costs of formal care. Access to education is an important factor for **personal development** and access to more qualified work. Access to the Internet and social media is important for **social, political and cultural inclusion**. But most of all, equal access to opportunities is **a human right** that should be guaranteed by society.

This white paper looks forward and challenges the reader to identify **strategies to tackle the digital divide**. In the first section, it analyses trends and policy objectives as defined by the international community in 6 different areas relevant to the digital divide:

- Disability and participation
- Education
- Employment
- Health and social care
- Technology
- (Social) Media

Where policy areas can be distinguished one from another, **human lives are unique**. It is the same person that wakes up in the morning, goes to school or to work, uses services, uses technology and accesses media. Human life goals might differ from one individual to another, but very likely "having choice", "feeling knowledgeable", "feeling safe", "being independent", "being respected" and "dignity" are high priorities for all and in all areas of life. Technology can either support people reaching these goals, or be a barrier.

The challenge of modern society is to make sure that technology leads to a better quality of life. Therefore, in the second section, this white paper will explore the **opportunities** technology offers in various areas of life but also assess the major **barriers** to access and effective use of technology by persons with disabilities. The third and last section is about **goals** and **strategies** to reach these goals. The paper will define long term goals in different areas of intervention and elaborate on **a roadmap to reach these goals**. This section is based on the previous ones, but also on foresight work done in the framework of the ENTELIS project.

The writing of this white paper is the result of a three-year long project funded by the European Commission under the **Lifelong Learning** Programme. The **ENTELIS project** has brought together various organisations from different European countries and beyond and has resulted in **the establishment of a sustainable network**, supported by three European umbrella organisations: **EASPD** (European Association of Service Providers to Persons with Disabilities), **AAATE** (Association for the Advancement of Assistive Technology in Europe) and **EVBB** (European Association of Vocational Training Institutes). For them supporting the network means creating an opportunity for their member organisations and other interested stakeholders to actively engage with technology and technology users with disabilities in education, vocational training and person centred support services. Their common understanding is that ICT and AT can empower people with disabilities, lead to more fulfilled lives and a more inclusive society but that this can only be reached if there is effective collaboration between sectors. Their expectation is that the network will empower their member organisations in making this become reality and this document and in particular the roadmap contained in there might provide good guidance for that.

For more information about the ENTELIS network and how to join it: *http://www.entelis.net*.

2. The digital divide - Areas of concern

2.1 Disability and participation

By Evert-Jan Hoogerwerf (AIAS Bologna onlus)

The most reliable data on the prevalence of disability in the European Union (EU) is that reported by Eurostat in its "Statistics on Income and Living Conditions" survey. Disability is associated with limitation in activities due to health problems and is based on the self-evaluation by the respondents of the extent of which they are limited in activities people usually do, because of health problems, for at least the last 6 months.

Disability defined as such affects **a considerable proportion of the population**: in 2013, about 26.9% of persons aged 16 and over in the EU declared an activity limitation due to a long term health problem (26.1% in 2012). This rate represents about 109 million people with limitations aged 16 and over living in private households in the EU (106 million in 2012).[1] **Disability prevalence increases steadily with age**. At the EU level, the disability prevalence among elderly people aged 65 and over is about 54.5% compared to 19.0% among persons aged 16 to 64. Also in 2013, 8% of people aged 16 to 29 living in the EU-28 reported health-related long-term (longer than 6 months) limitations in usual activities.[2] An analysis of all data collected against the headline objectives of **the Europe 2020 strategy** regarding employment, education, and reduction of poverty shows that people with disabilities have less success in education and in employment and have a higher risk of poverty and social exclusion compared to people without disabilities.[3]

Non-stigmatised thinking around disability and participation was boosted by the approval in 2006 of the **Convention on the Right of Persons with Disabilities (CRPD)** by the United Nations (UN) General Assembly, a milestone in the shift from the medical model to perceive disability to the rights based model. In the Preamble the Convention states that *"disability is an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on an equal basis with others"*. As a consequence the Convention does not claim specific rights for persons with disabilities, but the right to live as anyone else and it shifts the attention from the person's health condition as an impediment towards the barriers the person meets.

The Convention is now ratified by 172 UN member states and consequently it is part of the legislative framework of those countries. The articles of the Convention reflect a model of inclusive society where people with disabilities participate on equal footing in education, employment, social, cultural, political activity. The barriers in an inclusive society based on rights are as much as possible eliminated, and where barriers still exist, they highlight the responsibility of society and not the inability of the person to cope with them. The Convention is **an important policy driver** now in many countries and the monitoring of the implementation of the various articles see the involvement of disabled people's organisations (DPO's), governments and other stakeholders worldwide.

Not surprisingly the Convention in various articles refers to Universal Design, Accessibility and Assistive Technologies as rights enablers.

1 Eurostat, 'Statistics on Income and Living conditions', 2013 survey.

2 Eurostat, 'Being young in Europe today'. 2015 Edition.

3 ANED/CESEP ASBL, 2015.

"Universal Design" refers to products, services and environments that have been designed so that they could be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability.[4] Universal Design is clearly a forward looking concept as it refers to innovation and inclusion. When products, services and environments are not designed according to these principles, people might meet barriers in accessing them and using their functionalities.

"Accessibility" describes the degree to which an environment, service, or product allows access by as many people as possible, in particular people with disabilities.[5] Often products services and environments can be made accessible to specific user groups, but clearly retrofitting is not as efficient as designing them accessibly right from the start.

"Assistive Technology" (AT) is an umbrella term indicating any product or technology-based service that enables people of all ages with activity limitations in their daily life, education, work or leisure.[6] AT can be specifically designed for persons with disabilities, such as an electronic wheelchair, or not, for example a tablet or smartphone. The term thus does not relate to a specific category of products, but to their enabling function. When AT involves digital technology it is often referred to as ICT-AT.

Making products and services accessible and providing people who might benefit from it with AT, allows people not only to participate, but also to access their rights. It further allows people to access opportunities and to change their lives, the conditions of their families and the situation of their communities. Due to the slow pace of change it seems inevitable that in the near future **accessibility requirements will be enforced by legislation**. The USA already has such legislation, just as some European countries, while the European Accessibility Act is close to being approved by the European Parliament.

In September 2015, the General Assembly of the UN adopted **the 2030 Agenda for Sustainable Development** that includes 17 Sustainable Development Goals (SDGs). Building on the principle of "leaving no one behind", the Agenda emphasises a holistic approach to achieving sustainable development for all. Disability is referenced in multiple parts of the SDGs, specifically in the parts related to education, growth and employment, inequality, accessibility of human settlements, as well as data collection and the monitoring of the SDGs. More specifically the Agenda defines as relevant goals for the inclusion of persons with disabilities: to **reduce inequality** within and among countries, to ensure **equal access to all levels of education and vocational training**; to empower and promote the **social, economic and political inclusion of all**; to achieve **full and productive employment** and decent work for all. Apart from being by default part of inclusive models of development, in many places people with disabilities actually have an important role in achieving sustainable development goals and access to and effective use of AT is, according to organisations such as the WHO and the ITU, a determinant of success. Also UNESCO in its recent summary report on access to ICT for people with disabilities highlights the empowering role of technology.

Due to the digital revolution that has changed our way of living, learning, working, staying connected, access to ICT has become fundamental for people's participation in all areas of life and there is no reason to think that this will be different in the future. Tools and technology since the stone age have enhanced people's functioning and interaction with their environment. Therefore **all people, in order to participate meaningfully in the digital society, will have to develop digital literacy skills**.

According to the reports of the Academic Network of European Disability Experts (ANED) on EU law and policy the growing recognition of the importance of technology and accessible ICTs to persons with disabilities has been explored in Commission policies since the early 2000s, and a number of important disability-related measures have been adopted.[7] These include mostly Directives on the accessibility of telecommunications, media services and electronic content. Nevertheless, policy objectives on the empowerment of

4 Centre of Excellence in Universal Design (CEUD), Dublin. *http://www.universaldesign.ie*, 2016.

5 World Health Organisation (WHO), 2011, reported in the ENTELIS Taxonomy and glossary. *http://www.entelis.net.*

6 Service Delivery Systems for Assistive Technology in Europe. AAATE & EASTIN Position Paper. 2012.

7 ANED Reports on EU Law and Policy are available at: *http://www.disability-europe.net/theme/eu-law-and-policy.*

digital literacy of people with disabilities and relevant education are less prevalent and less obvious in policy (legal and other) instruments. Article 24.3a of the CRPD refers to the right of people with disabilities to learn how to use alternative means of communication, reading and writing, actually suggesting the right to competence development in ICT and ICT-AT use.

In 2016 the European Commission adopted a new **Skills Agenda for Europe** (retrievable from *http://ec.europa.eu/education/news/2016/0610-education-skills-factsheet_en.htm*) which seeks to promote a number of actions to ensure that the right training, the right skills and the right support is available to people in the EU, so that they are equipped with skills that are needed in a modern working environment, including digital skills. The European Commission is further working on a number of initiatives to boost ICT skills in the workforce, as part of a broader agenda for better skills upgrading, anticipating skills demand and matching skills supply to demand. For example, it is estimated that there will be 756,000 unfilled vacancies for ICT specialists by 2020. With the advancement of accessibility and enabling environments in all realms, many of these jobs could be fulfilled by appropriately trained people with disabilities. For them it will be important to demonstrate that technology has enabled them to compete with others and that the only remaining barriers between them and employment are in the minds of the people that consider first of all their disability and only secondly the difference they can make as a professional.

An important risk factor for digital exclusion is age. Many among the current generation of older adults have poor digital skills. Their concept social participation and networking is less related to technology. It might be that the generation of digital illiterate will become smaller, but due to age related functional decline and rapid advancements in technology characterised by disruptive innovation and changing interaction paradigms, at a certain moment in life many people will give up keeping pace with developments. **More natural interaction techniques and enhanced user experiences with technology will have to be developed** in order to delay this process and make sure older adults that wish to do so can use technological solutions to increase their self-management abilities and have more independence.

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2.2 Education

By Katerina Mavrou and Maria Meletiou-Mavrotheris (European University Cyprus)[8,9]

Models: inclusive vs. special education

For many years the education of children with disabilities was associated with the provision of special education in segregated educational settings and with specialised curricula. Rooted in the medical model of disability, special education represented the view that any 'problems' and 'deficits' were located within the child and thus these problems had to be remedied in order for the child to fit the 'norm', a view also associated with the charity model, that perceives disabled people as dependent and passive individuals in need of charity rather than rights. In the 80s approaches for the education of children with disabilities started shifting from special schooling to the integration into mainstream schools, which however was (and sometimes still is) perceived as an opportunity for socialisation rather than education. Following the discussions on integration in research and educational policy the philosophy of inclusive education evolved in the 90s with as a milestone the UNESCO Salamanca Statement of 1994 which advocated that **mainstream schools should be restructured at all levels** in order to accommodate the needs of all children on equal terms. **Inclusive education perceives diversity as part of human nature**, and as such the school (and not the child) has to change dramatically in order to provide **quality education for all children**. This view is in line with the **social model of disability**. According to the social model, society and not the disabled person has to change in order to include people with disabilities. Within this context, an inclusive education approach demands an **inclusive curriculum** and learning processes based on the philosophy of **embedded accessibility and universal design for learning**.

Also the Agenda for Sustainable development of the UN of 2013 embraces inclusive education under Goal 4: *"Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", which includes "build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all"*.

Data available from the European Agency of Special and Inclusive Education for 2012-2013 show that there are **big differences among European countries** in the placement of children with official decision in formal education settings:

Table 1. The distribution of pupils with Special Educational Needs between different types of education in a number of European countries

YEAR 2012-13	Pupils are enrolled in all formal educational settings		Pupils with official decision of SEN		Pupils with official decision of SEN in formal mainstream settings at least 80% of time		Pupils with official decision of SEN in separate special classes in mainstream schools		Pupils with official decision of SEN in separate special schools	
	ISCED Level 1	ISCED Level 2	ISCED Level 1	ISCED Level 2	ISCED Level 1	ISCED Level 2	ISCED Level 1	ISCED Level 2	ISCED Level 1	ISCED Level 2
Cyprus	53.746	28.665	5%	7%	80%	81%	14%	10%	6%	5%
Denmark	400.590	179.78	4%	8%	4%	2%	62%	57%	34%	40%
Finland	351.633	176.008	6%	9%	34%	43%	54%	44%	12%	12%
France	4.155.600	3.303.600	4%	2%	41%	76%	33%	15%	26%	9%
Germany	2.890.468	4.578.121	6%	5%	43%	24%	Missing	Missing	57%	76%
Netherlands	1.277.199	805.669	4%	7%	38%	33%	Missing	Missing	62%	67%
Poland	2.166.961	1.162.606	3%	4%	53%	43%	0	1%	43%	56%
Spain	2.934.648	1.663.474	3%	3%	77%	77%	5%	5%	19%	18%
Sweden	617.436	291.849	1%	2%	13%	12%	Missing	Missing	87%	88%

Based on data provided by The European Agency for Special Needs and Inclusive Education

8 With contributions from Marcia J. Scherer (IMPT) and Evert-Jan Hoogerwerf (AIAS Bologna onlus).

9 A fully referenced version of this section is available on the ENTELIS website: *http://www.entelis.net/en/node/349*.

Technology in education

Rapid advances in ICTs have provided the opportunity to create entirely **new learning environments** by significantly increasing the range and sophistication of possible instructional activities in both conventional and e-learning settings. A wide diversity of powerful and readily available technological tools, offer myriad opportunities for transforming pedagogy through the adoption of **learner-centered instructional approaches**. Multimedia tools offer novel and creative ways of teaching that can address a variety of learning styles. Web 2.0 tools (e.g. video-sharing websites such as YouTube, blogs, wikis, podcasts, social networks such as Facebook and Twitter, virtual worlds, RSS feeds, social bookmarking, etc.) can inspire **innovative teaching methods** that stimulate collaboration among learners, creation and sharing of information, and development of online **learning communities**. This advancement of technology brought forward a huge range of **opportunities** in the education of learners with disabilities aiming to reinforce the efforts for inclusive education. As research indicates that the pedagogical practice is still not totally ready for inclusion, the advancement in ICT and ICT-AT is anticipated to present an important contribution to differentiated learning and instruction and universal design for learning, establishing a creative learning environment and supporting teachers in an inclusive classroom. Recent studies provide evidence of the **positive impact** of the utilisation of technology on the learning experience of children with disabilities, with examples such as the use of mobile devices for the enhancement of maths skills, or robots for the development of play and participation skills.

Nevertheless, as a consequence of these rapidly changing scenarios, **digital competences** become a vital part of the education of learners with disabilities as the digital divide seems to be a reality among a variety of settings and groups of people.

Assessment strategies

In order to advance **quality and equity of instruction**, education should provide **fair and valid assessment** for all learners, including people with disabilities. The rapid technological change and spread of information technology has greatly impacted educational assessment, creating both new prospects and new challenges with regards to the assessment of learners with disabilities.

Advances in technology have created unprecedented opportunities for assessment to adhere to the principles of Universal Design for Learning. Contemporary ICT-AT applications support a variety of flexible, **learner-centered assessment strategies** that are customised and adjusted for individual needs, thus addressing the diverse needs of all learners, and leading to improved fairness and validity of assessments. **Assistive technologies** (e.g. voiceover screen readers, magnifiers, etc.), often coming as **built-in features** in off-the-shelf products such as the iOS and Android-based phones and tablets or as downloadable applications, have made it easier and more affordable to accommodate disabled students' specific needs for presenting instructions and test items during an assessment. They provide **multiple pathways** for disabled students' actions and expressions and alternative means for them to communicate their questions or ideas and to express what they have learned. Moreover, the multiple tools offered by contemporary technologies for continuous collection and analysis of rich data related to each individual student's learning progress, are a valuable resource for inclusive education, **facilitating differentiation** of instruction and **individualised learning**. Through employing such tools, educators can use formative indicators of student performance as a guide for developing data-driven solutions for instructional improvement that can, in turn, help each student maximise his/her learning.

While the employment of new technologies can facilitate a variety of effective techniques and strategies for the assessment of learners with disabilities, increased innovation in testing (e.g. adaptive assessment, simulations, etc.) can also present serious challenges. Technology-based assessment techniques utilised by school teachers and other educators often do not meet the principles of Universal Design, leading to intersectional forms of exclusion due to inaccessible design. The emerging trend towards standardisation, coupled with the enactment of laws incorporating or referencing technical standards are key drivers towards combating this phenomenon and ensuring that the new computer-based delivery platforms and assistive technologies do not alter the construct(s) to be assessed or make the assessment process more complicated or even inaccessible for some learners. Standards from the domain of technology such as **European Union's Standardisation Mandate 376 of 2013**, define technical requirements for designing accessible features covering all disabilities and all aspects of software products, document files, and websites. The field of assessment has also developed its own standards to ensure accessibility and universal design of assessment instruments, so as to support the individual needs of a diverse intended population of test takers.[10] In addition to technical and assessment standards, the **accessibility legislation** currently being enacted in different EU countries and internationally, also helps to ensure that people with disabilities are being treated fairly through the development of accessibility features in computer-based and technology-enhanced assessments.

The current move towards more complex and interactive test items being delivered on a range of different platforms is likely to continue in upcoming years, posing further significant challenges to assessment developers as they attempt to address accessibility issues. Moreover, emerging technologies such as 3D-printed objects or augmented reality might offer further options for assessment, but their appropriateness needs to be verified through research evidence. Thus, an urgent need exists for high quality research on the **optimal design of accessible assessments**, and particularly on the integration of mainstream ICT-AT and accessibility in computer-based and technology-enhanced assessments. To harmonise the critical requirements of assessment and accessibility, and thus meet the needs of a broad range of disabled test takers in a fair, valid and reliable manner, the focus of this research should be on better understanding learners' needs and requirements and the ICT-AT they use both **in and out of the classroom**.

Assessment of (assistive) technology needs

Assessing which technologies and other supports, and their combination, will best benefit each individual student is a key aspect of educational services today. Often the school might not have the resources to provide a full assessment into technology needs, but **specialised services** can help. Tools to accomplish such an assessment exist.[11]

Assessing the whole school environment

As indicated in the paragraphs above, it is important for the school environment and infrastructure to support students in the **development of ICT and ICT-AT skills**. ENTELIS has developed **a tool to guide schools** and educators in understanding and inventorying how well they are doing in many key areas and where additional efforts should focus in order to **increase student achievements and outcomes**.[12]

10 See the Section "For further consultation" for details.

11 See the section "For further consultation" for details.

12 See the section "For further consultation" for details.

For further consultation

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2.3 Employment

By Andreas Koth and Andrea Solander-Gross (EVBB)

The right to work

Regarding the participation of people with disabilities in employment the current situation in the European Union shows that progress has been made since the EU Directive on discrimination in employment was adopted in 2000, but not all objectives have yet been achieved. The Directive prohibits direct and indirect discrimination on a number of grounds, including disability. The Directive also states that "reasonable accommodation" shall be provided, which means that employers are to take appropriate measures, where needed, to enable a person with a disability to have access to, participate in or advance in employment, or to provide training, unless such measures would impose a "disproportionate burden" on the employer.

Article 27 of the CRPD describes the right to work for people with disabilities. This right to work includes *..."the right to the opportunity to gain a living by work freely chosen or accepted in a labour market and work environment that is open, inclusive and accessible to persons with disabilities. States Parties shall safeguard and promote the realization of the right to work, including for those who acquire a disability during the course of employment, by taking appropriate steps, including through legislation..."*. Article 27 further states that people with disabilities have the same rights as others to favourable conditions of work *"... equal value, safe and healthy working conditions, including protection from harassment, and the redress of grievances..."* (27b). Furthermore it should be ensured that every person, despite their work and health conditions, has access to technical and vocational guidance programmes and training and placement services (27d).

The implementation of the CRPD has definitely increased the efforts worldwide to integrate people with disabilities in vocational training and employment. This involves the design, development and implementation of strategies and tools for the sustainable integration of people with disabilities into appropriate quality jobs.

Inclusion in the European labour market

Notwithstanding the existence of relevant legislation, **access to employment is still a challenge**. For people with disabilities it is often harder to get properly trained and employed. According to an ANED analysis of Eurostat data referring to 2013, at an EU level there are about 48% of persons with disabilities employed compared to 71% of persons without disabilities. The employment gap is about 23 percentage points (26 percentage points in 2010).[13] These numbers show there are big differences in the **employment rates** for disabled and non-disabled people. The above mentioned ANED report also shows that the EU **unemployment rate** of people with disabilities in 2013 is 19.0% (18.1% in 2012) compared to 11.8% (11.2% in 2012) of people without disabilities. There are big differences between the various countries. A recent report on Employment from the European Commission and the Council further highlights that people with disabilities tend to leave employment early and are particularly affected by poverty and social exclusion.[14]

These numbers show that there are considerable challenges for improving the employment rate of people with disabilities in Europe. The Europe 2020 strategy target of the European Commission is to reach an employment rate of people aged 20 to 64 of at least 75% in the EU by 2020.[15] Without supporting groups that experience more barriers than others and those that are at higher risk of exclusion, this target will be more difficult to reach.

13 ANED/CESEP ASBL, 2015.

14 See section "For further consultation" for details.

15 Europe 2020 strategy indicators *(http://ec.europa.eu/eurostat/web/europe-2020-indicators/europe-2020-strategy)*.

Negative effects of the economic crisis in Europe are felt in the social, employment and education sector hitting hard the most vulnerable groups in the labour market, including people with disabilities. It is therefore necessary to assess which models of employment for persons with disabilities are leading to the highest social, financial and personal outcomes. A recent review commissioned by the European Association of Service providers to Persons with Disabilities (EASPD) demonstrated that among the different strategies "supported employment" seems to be the most effective. Not only for its impact on building a more inclusive society, but also because cost studies of supported employment compared to some forms of sheltered employment and other vocational rehabilitation models have shown significant financial benefits for taxpayers and individuals from delivering jobs through inclusive employment.

Impact and challenges

There is **a correlation between unemployment and poverty**. As statistics from ANED show, national unemployment rates have an immediate effect on the unemployment rate of people with disabilities. Therefore, if the unemployment rate changes significantly to the worse the risk of poverty for people with disabilities is considerably higher.

Positive changes can be achieved by **increasing the employability** of people with disabilities by improving access to social services, changing social security systems and access to job opportunities in a way that they are accessible for people with disabilities and meet their individual needs. An increase in the employability will increase the acceptance in the labour market and reduce the unemployment rate and therefore the risk of exclusion and poverty for people with disabilities.

Contemporarily the labour market is changing. Particularly Industry 4.0 and the digitalisation of the world of work create opportunities and chances for new working models such as teleworking and part-time working models or changes at work places themselves (e.g. simplified and automated workflows connected with IC technologies). A recent report of the World Economic Forum estimates that some 65% of children entering primary schools today will likely work in roles that don't currently exist. The further digitalisation of society asks for new competences and skills. The European Commission in its recent communication on a new skills agenda for Europe highlights the importance of VET and the development of digital skills. One of the essential recommendations of the Europe 2020 strategy is the qualification and ongoing further education of teaching and training staff in VET institutions to address all specific aspects and vocational and occupational fields.

Also financial support should be provided for purchasing suitable assistive technology to enable people with disabilities to fully participate in the labour market, as well as incentives for businesses to implement ICT-AT accommodations.

For further consultation

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2.4 Health and Social Care

By Evert-Jan Hoogerwerf (AIAS Bologna onlus) and Sarah Weston (Hft)

The care sector is challenged by different developments, among which demographic change, the economic crisis and the advancement of technology are the most important ones. Europe's population is rapidly ageing and changing social patterns and expectations are leading to rising demand for high quality care services. National and local governments and authorities can hardly cope with this increasing demand, especially in periods of low economic growth, and therefore must look for more sustainable models of social and health care delivery.

The social care sector is one of the most rapidly developing economic sectors, with expected workforce shortage rising up to 20 million in the EU by 2025, also due to existing workers stepping away because of poor working conditions and low salaries.

Not surprisingly the EU and many national governments are worried and have identified in a wider application of technology in care a potential win-win opportunity: more qualified work, higher quality care, lower costs. **Disruptive innovation** in the care sector by the **introduction of digital technologies** should drive the **silver economy** and should invest Europe's industry with global leadership.

This scenario requires extensive thinking on how care should look in the near future. To avoid that the introduction of technology just leads to higher costs, **new models of care** have to be developed based on a shared vision and new agreements among the stakeholders and with organisational change as the pathway to follow. Conducting these processes should be seen as **an investment, rather than a cost**.

Often **"integrated care"** is seen as a strategic objective as it helps break through silos. It places the care receiver at the centre of the care ecosystem and it prioritises the need for a personalised care plan. It could also save money as double work is avoided and resources are geared towards shared goals. Technological solutions can help to manage integrated care pathways, for example by making anytime and anywhere electronic health records accessible to those health care workers that need them, by facilitating the planning and communication among the different stakeholders in the care ecosystem and by collecting faster more reliable data for the system's coordination. Being so central to care the expectation of the formal care system from the older care receiver is that he or she is as independent as possible in the self-management of chronic conditions including medications, and living as long as possible at home referring to community services and only to hospital or institutional care when there is a real need to do so.

With an increasingly ageing population and increasing life expectancy of people with disabilities, the need to encourage **self-care** is a trend that is spreading across Europe. Technological solutions can support early detection, leading to early intervention, possible prevention and more effective management of long-term conditions. This will require a major shift in the cultural approach to supporting people with disabilities and older people.

For many older people the fact that technology should play a role in this is not an automatically attractive perspective, especially when this technology is imposed on them and they are not fully involved in the decision making process leading to technology adaptation. Many will consider the technology complex or not useful compared to their traditional way of doing things. Advocacy organisations therefore insist on older people being involved in all phases of the technology adoption cycle.[16]

In their recent Blueprint on *Digital transformation of health and care for the ageing society* the authors, a group of leading public and private players in the care sector, argue that digital (health) literacy is one of the enablers of the digital transformation in the care sector. Education systems have increased the level

16 Interview with Anne Sophie Parent (Age Platform) In: AAL Forum 2016. Executive summary. Innovative technology for active and healthy ageing. Page 11-13.

of digital literacy among the population, but clearly many older people lack sufficient skills to successfully engage with a self-management care app on a smartphone or tablet.

Health and social care providers are increasingly aware that **digital literacy is key for their staff and service users** to be more independent and effective in managing the opportunities provided by technology.

Equally "independent living" for people with disabilities is a strategic objective, as well as deinstitutionalisation. **Living as independently as possible in the community** is in fact a human right and, compared to institutional care, often much cheaper and has much higher levels of satisfaction. Technology is an important enabler of independent living with a wider range of solutions for **staying safe** and **comfortable**, for **communication** when needed or desired, for **remote support**, for **in- and outdoor mobility**, for **personal care**, for **remote learning and employment**, and for **social connectedness**. These technologies are not without costs, but there is increasingly evidence that in the long term people indicate to have more fulfilled lives, while **overall social costs are significantly lower compared to institutional care**.

Many of the above mentioned applications of technology will have to be used directly by the care receiver and they therefore will have to be as straightforward as possible. Although there is growing awareness among developers that these technologies and their interfaces should be designed according to Universal Design principles, there are still many systems on the market that present barriers to their use. Making existing interfaces accessible to different user groups, so called retrofitting, is expensive, sometimes more expensive than their redesign. The **"user experience",** in order to motivate, should match the expectations and abilities of the users and developers need to understand the potential impact that attractive and functional design has on the success of their products and services.

However, current commissioning and regulatory structures do not encourage the provision of technology as part of the care package. Changes in these structures will require new training models, changes in roles and responsibilities and a move to a measurement of outcomes for individuals, rather than outputs and processes. In most countries this should lead to innovation in AT service delivery as well, with investments in independent assessment centres to identify the most appropriate technologies for the individual user.

For further consultation

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2.5 Technology and digital revolution

By Klaus Miesenberger (University of Linz)

Developments and opportunities

Forecasts regarding the development of Internet protocol (IP) traffic show continuous growth involving all platforms, but with smartphone traffic exceeding Personal Computer traffic by 2020. According to the Cisco Visual Networking Index 2015-2020: *"In 2015, PCs accounted for 53 percent of total IP traffic, but by 2020 PCs will account for only 29 percent of traffic. Smartphones will account for 30 percent of total IP traffic in 2020, up from 8 percent in 2015. PC-originated traffic will grow at a CAGR [Compound Annual Growth Rate] of 8 percent, while TVs, tablets, smartphones, and machine-to-machine (M2M) modules will have traffic growth rates of 17 percent, 39 percent, 58 percent, and 44 percent, respectively."*

The digital revolution impacts on almost all domains of our lives and will continue to do so. It is difficult to list and even more to discuss the fast changing ICTs interfacing the environment with sensor and actuator technology, from the nano- to the macro-cosmos, e.g. Internet/Web of Things (IoT/WoT), robotics, nano technology. This might include ourselves (e.g. exoskeleton, cyborgs, nanobots) and our ways of networked, mobile, ubiquitous interacting and communicating with e.g. Virtual/Augmented Reality (VR/AR), holograms, tele-presence, natural language interfaces, touch, wearable and tangible interfaces. Specialised and mass media are filled with discussions about these technologies and their impact.

It is above all doubts that these developments offer a striking potential for people with disabilities both in terms of a) providing better Assistive Technologies (ATs) for increased and self-determined activity and participation and b) increased and universal accessibility for interacting and communicating within digital environments. Persons with disabilities always have been seen as beneficiaries and amongst early adopters and power users. Nevertheless there are also risks coming along with the potential as e.g. security, safety and privacy issues and these regard persons with disabilities just like anyone else.

Supporting trends towards more inclusive ICTs

The following technology related trends could be identified and strengthened in order to increase the impact of technological development on the way people participate in the information society.

1. Focus on accessible Human-Computer Interface (HCI) and AT for HCI access

In all this revolutionary uncertainty there is one thing that is stable: The HCI. Invented in the 60s of last century the basic principles of HCI are still using a limited number of basic elements (e.g. WIMP: windows, icons, menus, pointers) and applying a few basic actions (e.g. Create, Point&Click, Drag&Drop, Copy&Paste, Delete). There are endless variations of these simple principles but only very few fundamental changes happen (e.g. SILK: speech, images, language, and knowledge or touch gestures). Devices might change but these simple interaction principles have remained the same. Once learned, people apply them universally: on desktops and mobile devices, ATMs, consumer and home electronic, in cars. No manufacturer or information provider today can step away without the risk of losing clients. More and more domains converge with the standard and support interacting with their tools using the standard HCI.

The ICT revolution therefore has a central point of access, a sort of gateway that has to be mastered, before it gets operational for all and also for PwD: the universal HCI. If the standardised HCI can be interfaced with ATs (or accessibility features included in mainstream devices) and if (and only if!) accessibility standards are respected and supported, the HCI becomes the universal access point for inclusion and participation. The more the ICT revolution advances with accessible new products and services, the bigger the potential for inclusion. ATs to access, skills in handling and services to master the HCI are pencil and paper of the information age.

2. Make the HCI adaptive and personal

The core quality of digital media is that its content is to a certain extent independent from the way it is presented (visual, audio, haptic) and the way it is handled (mouse, keyboard, switch, eye tracking, voice commands...). Only in the moment we access it with devices including ATs device and user dependent media, qualities are put in place. This inclusive power only works, when accessibility and adaptivity are implemented. The disability domain was first in demanding for enhanced adaptability in terms of alternative ways of perception, operability and understandability. Today, due to the need of interaction with ICT in changing contexts with diverse devices, the need for personalisation and adaptiveness is universal. Many accessibility features are entering the mainstream and this trend should lead accessibility to be(come) an integral part of quality and interoperability standards. We can't discuss this for each group of PwD (vision, hearing, motor, cognition, even psycho/emotional). What is important for all domains: Do it at and with the user as the requirements are very personal and singular.

3. Make products and AT more user centred and individual

Disability is also an individual condition (e.g. the WHO ICF classification uses more than 1,500 categories!) and it is important to focus on the individual needs of each user. The trend towards singularity as e.g. 3D printing, personalised medication, "just in time" or "one unit production" in industry 4.0, do support this much more specific orientation towards individual needs and make again persons with disabilities a group which could benefit most from these trends allowing to implement personalised solutions with the participation of the user in the solution design.

4. Support and use the accelerating digitisation

Digital products and services allow for a more self-determined and independent access via HCI and with or even without AT. IoT and WoT connect people and devices in the environment (e.g. coffee machine, washer, TV, video recorder, radio, door opener, windows, shades, heating, tooth brush, atm, shoes, and alarm clock). There are excellent examples of how this improves independent living and participation. Organisations supporting people with disabilities should keep the role of an early adopter of these opportunities as the potential benefits are the highest for people with disabilities. Further disability related service environments are an ideal test and learning bed to make the information society social and usable for all.

5. Accessibility (and AT) is a must

There is societal consensus that accessibility and AT is beneficial for the individual, for service providers and for society as a whole. Accordingly recommendations, guidelines, standards and tools are in place. Political will and programmes are implemented. Legislation in enforced and stronger measures are proposed. What is still lacking is the implementation, not only in the hard to grasp mainstream sectors but even more in social care and inclusive education. Accessibility and AT are still seen as something expected or even imposed from outside and are not integrated parts of management strategies.

Nevertheless taking into account the impact of accessibility legislation in the US (Section 508, ADA), the UNCRPD and the EU directives (EU Web Accessibility Directive), things will have to change.

6. Make AT and Accessibility part of education (curricula)

All the above first of all will provoke fears: How can we manage this exploding complexity? Yes, it is overwhelming, but it is a fact and we can surf the wave or go under water. The first thing to focus on, when we see the potential and the ongoing changes is to bring AT and eAccessibility into education. AT and Accessibility have been on the agenda for more than four decades but still they are not properly integrated into education of care givers, managers, administrators, educators and policy makers in the disability domain. If a strong base is established in this "inner" domain we can demand with much for power that AT and much more Accessibility enter education in mainstream domains. Promoting and facilitating this curriculum shift has to be high on the disability agenda.

7. Make AT and Accessibility your service or part of your service

Technical developments provoke the fear to become obsolete, but the contrary is happening. Disability is and remains first of all as a social issue, full of attribution, stigmatisation and prejudices which are much harder to overcome than pure technical barriers. But ICT, AT and Accessibility give us a tool at hand to better implement the UNCRPD. One even might say the UNCRPD would not have been possible without these tools. Almost all paragraphs of the Convention include or refer to ICT, digitisation, Universal Design, Assistive Technologies and Accessibility. Therefore all the trends in HCI and ICT towards ubiquitousness, personalisation, singularity and digitisation have to be embedded into AT and Accessibility service infrastructures to overcome social exclusion. Services will be different, will go beyond traditional walls of institutions and will include more mainstream domains. It will not be less but much more support and service that is needed. We need change management in organisations of/for disabled people and these organisations must supply mainstream domains with Accessibility, AT and inclusion expertise. This will require new services, new skills and new organisational models.

For further consultation

- Directive (EU) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies.
- Proceedings of the ICCHP conferences. Springer.
- Proceedings of the AAATE conferences. IOS Press.

2.6 (Social) Media

By Evert-Jan Hoogerwerf (AIAS Bologna onlus)

The **digital revolution** has changed the way people consume media content, with print media and broadcasters having to reorganise their traditional delivery and business models, often including additional media channels and "on demand" options. The advancement of broadband Internet and mobile communication has favoured the development of **individual consumption patterns and pathways** and made the interaction with traditional mass media producers more interactive. **Social networks** have further blurred the distinction between news, entertainment and socialisation, allowing users to become contemporarily producers, multipliers, commenters and opinion formers.

Clearly these changes have an impact on the lives of all people. But experiencing barriers in traditional media, for people with disabilities these changes have created important opportunities.

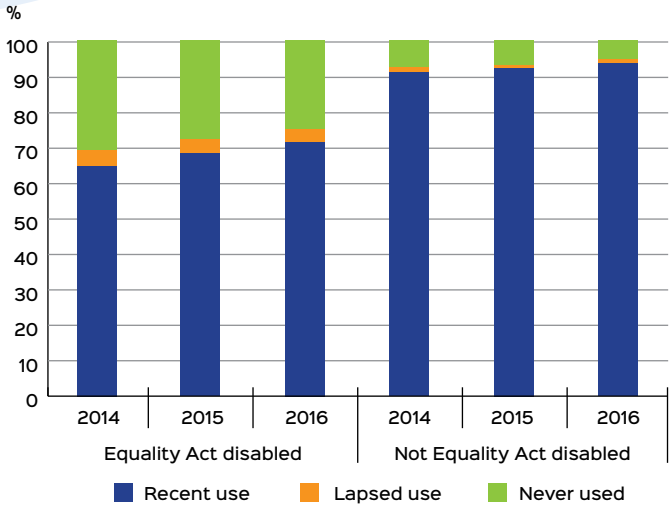
From a technical perspective communication using **multiple channels** and delivering on **different platforms**, **if accessible**, broadens the possibilities to access a wide range of content. More content than ever is available now, in different formats and at any time.

From a social perspective it allows people with disabilities, especially when mobility is an obstacle, to link up and to stay connected with more people, to create social networks and to participate in communities. This allows the sharing of information regarding issues that matter, peer support, a better organisation of personal care, and generally speaking accessing more opportunities. Social media provides people with disabilities with the possibility to step out of the shade, to **self-advocate** and to educate a wider audience about what living with a disability is, to develop **a more realistic picture of disability** and to **deconstruct stereotypes of disability** often created by traditional media discourse. Advocacy and self-advocacy through the media are key components for people with disabilities in order to promote empowerment within the population.

From a political perspective it has allowed people with disabilities, either as an individual or as a group, to actively **engage in political and cultural life** regarding all issues relevant to them. This includes the assessment and evaluation of all programs specifically developed for people with disabilities or mainstream legislation that risks to create barriers instead of removing them. Increasingly **political participation** is based on social media usage allowing people with disabilities to have their voices heard, with or without declaring their disability.

Data from Eurostat show that the number of households in Europe with access to the Internet has reached 83% in 2015.[17] It is expected that the number will continue to increase. In 2006 this percentage was close to 50%. Recent data from the UK Office for National Statistics show that the use of Internet among people with disabilities is much lower compared to people without disabilities. It further shows that age is a factor that impacts on the gap: among the young the difference is less significant compared to the older adults. The data further show that the gap is decreasing with an increase of 6.8% of new Internet users with disabilities between the 2015 and 2016.

Figure 1. Internet use and non-use by disability status, 2014 to 2016, UK



Source: Office for National Statistics (UK).

With the rise of Internet there is increasingly concern about its risks. In the EU-28, the proportion of internet users having experienced certain common security issues over the internet — such as viruses affecting devices, abuse of personal information, financial losses or children accessing inappropriate websites — stood at 25% in 2015. In particular people with intellectual disabilities are more susceptible to exploitation and abuse, and the rise of the Internet only increases their vulnerability.

For further consultation

- Cisco Visual Networking Index: Forecast and Methodology, 2015–2020.
- Ryan, F. (2014). Social media means the voices of the disabled can no longer be ignored by those in power. in: The new Statesman - Science &Tech. 7 August 2014.
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17 Eurostat. Digital economy and society statistics - households and individuals. http://ec.europa.eu/eurostat.

3. Opportunities for full digital inclusion and barriers

By the ENTELIS Consortium Members

Introduction

Digital technologies are transforming society and creating opportunities that were unimaginable only 10 years ago. The innovation continues and continues to transform the way people interact and the choices they make in their daily lives. Many of these opportunities are extremely relevant for people with disabilities as they remove or help to overcome barriers that have hindered participation. Nevertheless not all technology is (immediately) beneficial. Quite often new technology is brought to the market without having taken universal design principles into account or without having solved accessibility issues. In those cases the digital divide will increase.

Case reports

CASE REPORT 1. Living as independently as possible

Four service users of Hft in the UK, ranging in age from 35-50, with a range of intellectual disabilities including early onset dementia wanted to move into a more independent lifestyle. They lived in a large group home. John, George and Susan wanted to live together in their own home. They wanted home-alone time and independence in a variety of ways, including food preparation, self-management and mobility and communication. These three moved into an adapted property that suited their needs. The fourth person, Steve, moved into a shared-ownership property.

The technology included telecare and associated sensors, including flood, smoke and door sensors, easy-to-use mobile phones, big-picture telephones, one-cup kettles, voice-prompts and GPS devices.

All four increased their confidence and abilities to live independently. They all were able to have increased home-alone time, including the individual with early onset dementia, and one individual was able to gain employment and go out alone for the first time.

A study of the economic benefits showed that, without the technology, an additional £90,000 per year of support time would have been required.

CASE REPORT 2. ICT-AT supporting life-changing achievements[18]

Betty is a white female in her early 20s who acquired a traumatic brain injury during a motor vehicle accident while she was in high school. Since her injury, Betty has been dealing with anger management issues.

At the time of her referral to Project Career, Betty was in the third semester of a two-year Applied Arts Associates degree program at a community and technical college. During her first three meetings with the counsellor, she completed the intake, baseline assessment and Matching Person and Technology (MPT) Assessments. All of these (including the personal interview) revealed that Betty was hesitant to use technology. Her technology experiences prior to Project Career had been disappointing, frustrating, and confusing. The information gathered also revealed that her major concerns include: cognitive deficits, anger management issues, time management and classroom management concerns. She self-reports that her biggest concern is extreme irritability and anxiety.

The technology selected with Betty was an iPad2, Internet access and several iPad apps designed to help alleviate her cognitive and academic concerns. Because of Betty's previous issues with technology, the iPad and apps were introduced slowly. During the trial period, Betty found an app that was the turnaround she needed. The confidence gained from the use of this app allowed Betty to feel she could be successful with technology. This confidence gave her the courage to try additional apps.

Between Betty's initial assessment with the MPT Assessments and her six-month follow-up, she saw great improvement in her comfort level with technology. On a scale of 1 to 5, she initially stated her ability to remember where she put things as below average (2). On her follow-up, she indicated above average (4) on the same question. She additionally noted that her ability to manage appointments went from a 4 to a 5 and her ability to pay attention and not get distracted jumped from 2 to 4. Her most significant increase came in being able to remember information about people or events which jumped from a 1 to a 4.

18 The above case is excerpted from Nardone et al (2015). Project Career is an interprofessional project conducted at three USA universities. It provides support and services to 2-year and 4-year college students with a history of traumatic brain injury through a combination of assistive technology on iPads and individualised career counseling services.

CASE REPORT 3. From AAC to Literacy and Digital Literacy[19]

Gregory is a 27 years old young man living with his family in a small city in Cyprus. He has a diagnosis of cerebral palsy (spastic quadriplegia) and is non-verbal, with no additional sensory or intellectual disabilities. Due to his physical disabilities and profound difficulties in verbal communication, he attended a special education unit in the mainstream school, in both primary and secondary education. Until the age of 16 his educators could not define neither his intellectual nor his cognitive abilities. His communication was restricted to YES/NO questions, to which Gregory was responding with eyes and head movement.

At the age of 16, while attending a lower secondary education urban school, Gregory was referred by the Ministry of Education and Culture to an assistive technology assessment. It was only then when educators acknowledged the need for further communication and increase of independence in order to enable him to access information, learning and competence. Excited by the effectiveness of eye control system (MyTobii) and the AAC software (The Grid 2), supported with Widgit symbols, Gregory aimed at changing his life and personal goals completely. With the support of his family and his technology teacher he was able to develop excellent digital skills in very short time and to be become a very effective user of his AAC device for both communication and access.

Hence, led by Gregory himself, the team focused on developing a user-centred communication system that would not only provide alternative communication but also support digital skills. He very quickly got familiar with eye-gaze as an access method, and further moved to the use of symbol supported short phrases for AAC and in a very short time, to independent symbolised phrases and words. As he proved to be a very fast eye-gazer word prediction seemed to be the next step, resulting today in effective use of eye gaze AAC technology for communication, internet, email, Skype and much more.

19 The above case is a summary of case study reported in ENTELIS fact sheets as well as in CSWN Newsletter in May 2016. The case study has also been part of a longitudinal study on Assistive Technology Development in Cyprus (Mavrou, 2011).

CASE REPORT 4. Daniela can't wait

Daniela is 7 years old and she lives with her parents in a country house not far from a big city in the north of Italy. Daniela is very sociable and she likes to play with her two older brothers when they are at home. She has a well developed interest in novelties and she is curious when her brothers and parents tell her what they did during the day. She would like to get out from home more often, but her disability prevents her to do so whenever she wants. Daniela has cerebral palsy, an acquired impairment of the brain which affects her ability to move and speak. In the local AT centre she was supported in choosing electronic communication devices. She moves only with her help of a manual wheelchair usually driven by her parents: having an electronic wheelchair would give her the freedom to move in autonomy at least within her home, but health services are not competent in providing training to children with disabilities in order to let them safely drive a wheelchair in a protected environment. Daniela's disability delayed her enrollment at school. Indeed, this year Daniela was supposed to attend primary school, which would have given her the opportunity to make new friends and interact with more people than when she is at home with her family. However, the school does not have an elevator which can bring her to the floor where usually first year students are placed. Moving the entire class to the ground floor was not possible for organisational reasons. Daniela's parents looked for alternative schools, but the only other option available was too far from home and, moreover, nobody within the teaching staff was prepared to use her electronic communication devices.

Thus, Daniela's parents decided to postpone Daniela's school enrollment to the next year, and asked for an educator to come to their home on a daily basis. They are still waiting an answer from the social services, meanwhile Daniela spends her days with her grandmother waiting for her brothers and parents to come home.

CASE REPORT 5. Nicolas still waits...

Nicolas is 14 years old and he lives with his parents and two sisters in the centre of the capital in Cyprus. Nicolas has a diagnosis of cerebral palsy and has no verbal communication. He is very sociable and he likes to get involved in every activity with his sisters and classmates. He recently graduated from primary education and moved to a secondary mainstream school. Just before leaving primary education Nicolas obtained an AAC eye control device at school, after a number of years of assessments and applications by the family. Though his equipment was provided by the Ministry of Education (quite late as until then his parents acquired their own from other fundraising activities and assessments in the private sector), the government failed to support Nicolas in using his technology at school. Even though a number of meetings and debates took place between the family and the Ministry's officers, including the Minister himself, the latter claim that they do not have the trained educators and staff to train and support the young boy to effectively use his AT at school for communication and learning. It is worth noting that the school staff was also trained in developing and using the particular AAC system (and software) but none of them feels competent to actually implement it. Hence Nicolas goes every day to school having next to him a high-tech device which is never turned on. At home the family was also trained to develop the system further and support Nicolas, but this doesn't seem to be enough for his effective inclusion at school. His parents looked for alternatives in supporting their son in school, but the Ministry insists that they did what they could and unfortunately, even though there are good intentions, there are neither resources nor personnel to do this.

Opportunities and barriers

The following section summarises in table format the main opportunities and barriers for full digital inclusion identified during the ENTELIS project.[20] The items refer either to the personal, community or societal level and are grouped according to the area of public and private interest.

Opportunities

Level	Area of interest	Opportunities
Personal	Education	▸ Technology can help children to develop basic skills, including making choices and expressing consent and dissent. ▸ Technology can enhance learning either by making it accessible or by making it more effective. ▸ Technology can help the learner reaching higher personal development goals. ▸ Effective use of technology for learning will lead to new opportunities.
	Employment	▸ Technology can enable a person to reach higher outcomes at work. Therefore skilled technology users will have easier access to jobs, particularly in the digital economy. Well supported ICT-AT users can be as efficient as other workers and thus focus on being competitive in other domains of competence.
	Independent living	▸ Technology can increase people's level of self-confidence and independence in daily life (self-care and staying safe, communication, mobility, social life, etc.). ▸ Intelligent environments and integrated care solutions will allow for getting as early as desired independence and staying so for as long as possible.

20 Different studies conducted within the ENTELIS project have contributed, among which: Kärki, A. & Sallinen, M. (2016) Present barriers, emergent and future needs in digital society. *http://www.entelis.net/en/node/350* & Kärki, A., Sallinen, M., Hoogerwerf, E.-J-, Desideri, L., Mavrou, K., Kuusinen, J. (2016). Foresight scenarios on the development of the role of technology in the education of vulnerable groups. *http://www.entelis.net/en/node/347*.

Level	Area of interest	Opportunities
Community	Learning communities	▸ Communities will benefit from the knowledge and experience of technology empowered members with disabilities. ▸ By learning together, persons in different conditions will more easily understand alternative viewpoints and integrate these in their own identity and the identity of the community.
	Community development	▸ Communities will benefit from the inclusion of members that are at risk of exclusion. Either through employment or voluntary work more people will contribute to the development of their families and communities, improving the general conditions.
	Community welfare	▸ Technology might make disabled persons less dependent on others, thus reducing the burden of informal care and the costs of formal care. ▸ Technology aided active participation of older adults in community life will contrast frailness and delay the development of medical and social care needs. ▸ Technology can help to build peer networks and link actors in care ecosystems.
	Community access	▸ Technology, such as mobility and prompting devices, can encourage increased access to the community and community services. The more visible people with disabilities are in the community, the more they are understood and accepted.
Societal	Knowledge society	▸ Society as a whole might benefit from the development of technologies that make learning and communication more inclusive. ▸ Universal design in education will allow for wider participation and higher outcomes at system level. ▸ Research into alternative solutions for those currently unable to benefit will lead to innovative solutions and contribute to the development of new paradigms of interaction between humans and technology.
	Employment	▸ Technology enabled participation of people with disabilities might lead to more and better jobs. ▸ Society as a whole might benefit from the labour participation of larger shifts of the population.
	Politics and culture	▸ Societies will benefit from the participation of empowered individuals and groups able to express citizenship through activities at cultural and political level.
	Research	▸ The need for alternative interaction modalities for persons with disabilities with (digital) environments contributes to the development of innovation in mainstream technologies, e.g. Brain computer interaction
	Economy	▸ Technology enabled participation of people with disabilities both as developers, producers and consumers of services and goods will boost new economic sectors and increase the overall volume of the economy.
	Inclusive societies	▸ Inclusive societies can only be built with the active participation of people with disabilities. Technology will enable many of them to pick up responsibilities and leadership.

Barriers

Level	Area of interest	Barriers
Societal	Politics and policy	▸ Lack of an inclusive mainstream approach at all policy levels and in many policy fields. ▸ Lack of collaboration and coordination among public institutions. ▸ Lack of innovative approaches encouraging independence (e.g. commissioning structures that pay based on what is 'wrong' with people and not on personal objectives). ▸ Insufficient or inadequate legislation (e.g. web/media accessibility). ▸ Failure of existing legislation to effectively cover essential aspects of ICT/ICT-AT for PwD. ▸ Lack of policy to systematically address the digital divide with adequate resources. ▸ Lack of priority given to ICT-AT education in the national disability and rehabilitation agenda.
	Culture	▸ Society, including media, often reproduces a stereotyped view of disability. ▸ Prevalence in social and educational settings in many countries of the deficit model of disability, discouraging ICT-AT effective use. ▸ Terminology incompatibilities and discrepancy in awareness and proficiency levels in relation to ICT/ICT-AT policy and practice.
	Usability and accessibility	▸ Inaccessibility of mainstream technology. ▸ Complex and challenging interfaces and user experience. ▸ Lack of awareness and understanding of PwD's needs among product designers and developers. ▸ Lack of interoperability between technologies.
	Financial, economic	▸ The unavailability of specific devices on national markets. ▸ The cost of the technology for the end user and/or for the provider, especially where public funding is not sufficient. ▸ Limitations in the provision of additional resources (e.g. training, add-ons, etc.) ▸ Lack of facilitating resources (e.g. equipped computer labs).

Level	Area of interest	Barriers
Community	Competence/ guidance/ education	▸ Lack of general awareness on the opportunities offered by technology for activities and participation of people with disabilities. ▸ Ineffective information management and organisation of the information among information holders and authorities. ▸ Lack of competence in helping people assessing their needs and matching the needs with the available solutions. ▸ Lack of user-centred and user-driven approaches. ▸ Lack of ICT & ICT-AT competencies and confidence to use technology among professionals, including teachers and educators. Uncertainty about how to use it and to train others in using it. ▸ Lack of sufficient user training and appropriate personal support. ▸ Educational systems are not fully prepared to support learners with disabilities in developing their ICT and ICT-AT skills.
	Services and support	▸ Lack of independent advice and knowledge centres. ▸ Lack of AT specialists in rehabilitation teams. ▸ Lack of interagency collaboration. ▸ Lack of openness to innovation among service providers. ▸ Lack of teamwork among professionals and with the user and his or her informal carers. ▸ Poor timing of interventions (e.g. too late, too early, too slow). ▸ Insufficient administration with difficulties in procuring and managing equipment and services ▸ Inconsistency in the follow-up of technology acquisition. ▸ Lack of support over time.
Personal	Personal motivation	▸ Low self confidence. ▸ Technology perceived as not useful and not responding to actual needs. ▸ Alternative strategies to avoid use of technology. ▸ No time in daily routine. ▸ Fear that technology use might reduce human care or contact.
	Security benefits and challenges	▸ Risks related to safe internet use. ▸ Risks related to personal data treatment. ▸ Fear of losing control over technology.
	Health condition	▸ Objective activity limitations (e.g. dementia).

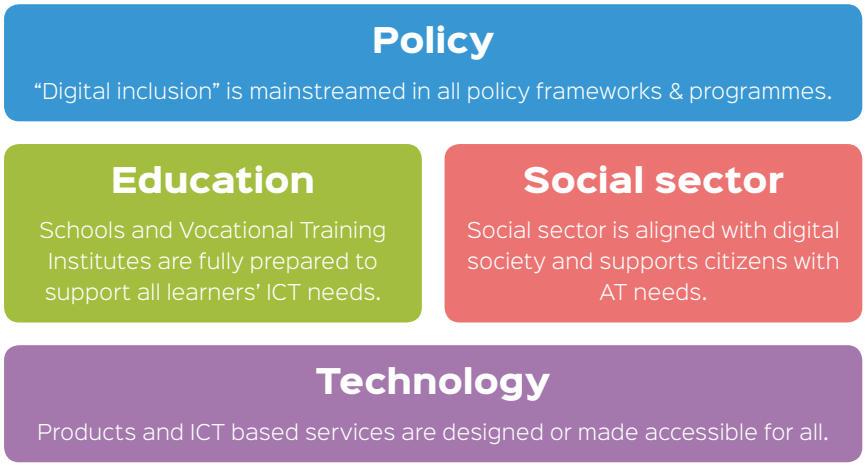
4. Goal setting and roadmaps

Towards the definition of new goals

Full digital inclusion can only be reached when different sectors collaborate and move in the same direction. As mentioned earlier, the lives of people are unique and also life goals will be significantly different between one individual and another. People with disabilities experience more barriers in fulfilling life goals than others and therefore the role of education and support services that empower people are fundamental. Appropriately designed and chosen technology can enable people, while governments at all levels can do a lot more to make sure that technological progress leads to more inclusive societies and that barriers are removed and opportunities are created.

Coherently with the identity of the ENTELIS network, that includes education providers, social care providers and assistive technology experts, the following high level goals could be formulated:

Figure 2. High level ENTELIS goals to support digital inclusion.

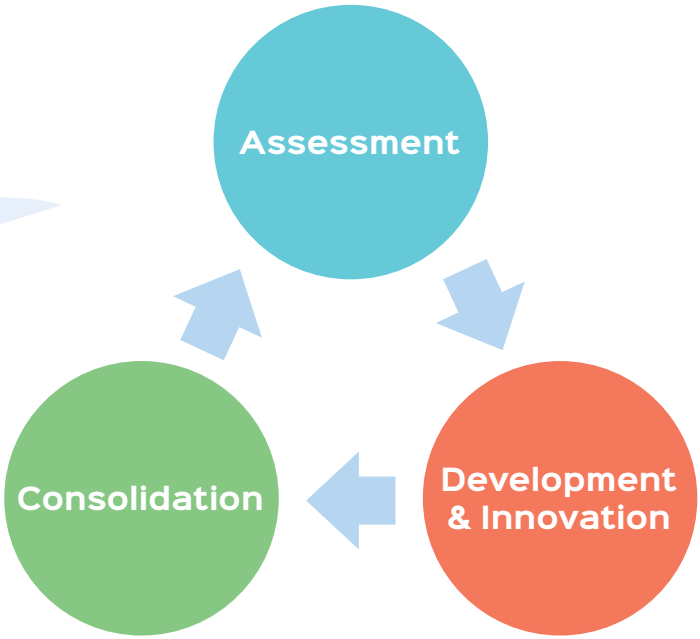


These high level goals are not end goals but "permanent outcomes" or "functional states". Entire sectors, whether it is education, the social sector, ICT industries, or public administration, governance and policy development in all areas, will have to be transformed to a higher level of inclusive functioning. "How a determined policy will impact on the level of inclusiveness in the digital society?" should be the touchstone question for all frameworks and programmes. Only by mainstreaming inclusion can the stigmatisation of non-beneficiaries of innovation be overcome.

Roadmaps

To reach these high level goals the following cyclical processes will have to be set in motion:

Figure 3. The cyclical process that the ENTELIS networks aims to set in motion



Only by assessing the state of the art in a specific area of intervention will it be possible to identify the opportunities and the barriers, as well as the drivers for positive change. A thorough assessment will lead to the definition of intermediate and feasible goals and an action plan to reach these goals.

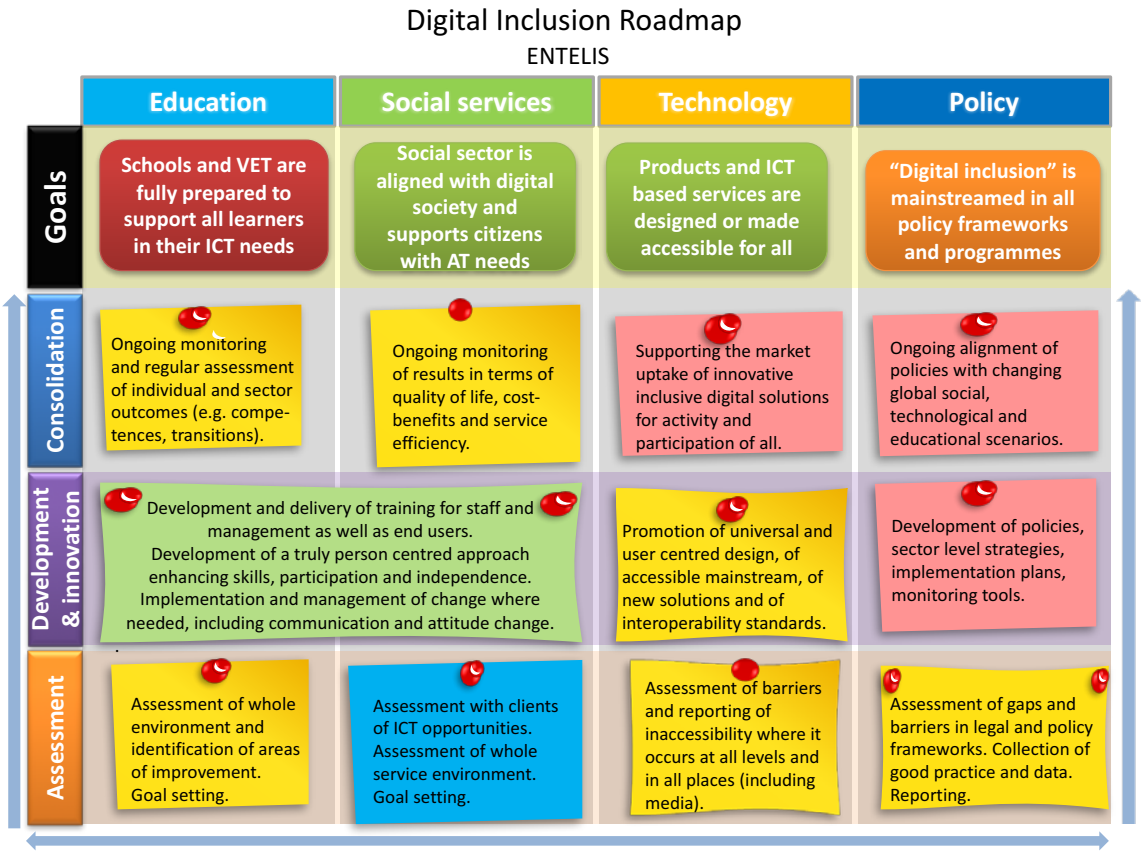
Once the goals are clearly developed, innovation can start. New strategies, methodologies and tools can be developed and tested in real life settings, in order to be disseminated and distributed.

Where results are obtained, these results need to be consolidated and strengthened. Monitoring should take place to assess whether the consolidated results actually bring the high level goals closer. If not the process should start all over again, starting with the assessment of what issue we are trying to overcome.

In all cases the processes should be considered cyclical as the context will change due to external factors, such as the available resources, political priorities, up to even extreme factors such as the predominance of discriminative ideologies.

Applied to ENTELIS the following roadmap elements could be identified.

Figure 4. The ENTELIS Digital Inclusion Roadmap



In the following tables for each of the sectors' objectives, the most imminent needs as resulting from the ENTELIS project are identified and related recommendations are formulated. To what extent these needs are responded to will depend on the available resources and political willingness to address them.

Education

Phase	Objectives	Needs	Recommendations
Assessment	Assessment of the whole educational environment and identification of areas of improvement. Goal setting.	Standards for the assessment of the performance of education providers in the area of ICT and ICT-AT support to learners with disabilities.[19] Time and resources to perform an objective and complete assessment. Vision based decisions regarding reachable goals and priorities.	Standards and assessment tools should take the whole school environment into account, including the declared mission, the educational culture and the relationships established with other stakeholders in education, such as families, further education, transition to employment etc.
Development & Innovation	Development and delivery of training for staff and management as well as for end users.	ICT-AT initial education of teachers and other school staff, as well as lifelong learning opportunities and obligations. Qualified staff to support learners with disabilities in developing digital skills. Curricula and competence frameworks to direct learning. Assessment strategies of the learned. Learning opportunities in AT for family members and informal carers.	Trainers, teachers and educators at all levels and in all types and levels of education should have sufficient competencies and skills to support learners with disabilities in making the best possible use of ICT and ICT-AT for learning and for their effective functioning and participation in the digital society. Generally speaking more opportunities for ICT-AT training should be created and offered, respectful of learning needs and preferences of each learner and taking into account the specificity of the individual (e.g. age, condition, etc.).

21 A self-assessment framework on digital skills development and ICT in inclusive education was developed by ENTELIS network members and can be retrieved from *http://www.entelis.net*.

Phase	Objectives	Needs	Recommendations
Development & Innovation	Development of a truly person centred approach enhancing skills, participation and independence.	Individualised learning plans and pathways including appropriate assessment strategies and tools and adequate use of digital technologies for learning and personal AT equipment, if needed. Educational strategies and implementation plans for increasing the use of AT in and outside the classroom. Opportunities for the independent assessment of AT needs of the single students and regular reviews.	Schools should fully embrace an inclusive approach based on the recognition of the needs of each single learner. Schools should transfer (digital) skills to ensure people with disabilities can meaningfully participate in all realms of life. Therefore tailor-made support should be provided to enable all people with disabilities to ensure learning and participation. Ensuring self-empowerment is the key to create opportunities for full inclusion. Schools serving different age groups should collaborate in the transition of students with disabilities from one institute to another or out of education into employment and collaborate with the families in providing continuity in the digital skills development of the student, including in the selection and use of appropriate assistive technologies that can be used in all life environments, including meaningful employment. Supporting experts in education (e.g. speech and language therapists, psychologists, pedagogists, etc.) should be included in the assessment of needs and consulted when needed.
	Implementation and management of change where needed, including communication and attitude change.	Action plans to implement change, with adequate timing, resources and monitoring strategies.	Where schools do not have the resources internally, external support should be sought in the form of specialised professionals in AT and multidisciplinary teams for the selection and implementation of AT as well as for educating and training staff.
Consolidation	Ongoing monitoring and regular assessment of individual and sector outcomes (e.g. competences, transitions).	Performance indicators for single schools as well as for the entire sector. ICT-AT competence assessment and certification programmes for learners with disabilities.	Educational authorities and school directions should regularly monitor outcomes and adjust policies and practices where needed. To motivate learners, to consolidate learning outcomes and to make ICT-AT competences visible, standardised certification schemes and tools should be developed and implemented.

Social sector

Phase	Objectives	Needs	Recommendations
Assessment	Assessment with clients of ICT opportunities.	Assessment strategies to match the person with the technology.	Assessments should be part of a wider person centred approach, establishing goals related to independence and pathways to reach those goals (including the role of support actors and assistive technology). Assistive technology assessments should start as early as possible and should be repeated as necessary.
	Assessment whole service environment. Goal setting.	Standards for the assessment of the whole service environment. Time and resources to perform an objective and complete assessment, including cost benefit analysis related to the use or non-use of technology to empower service uses. Vision based decisions regarding reachable goals and priorities, taking into account different scenarios and available financial resources. Where needed ensuring additional resources for long term sector innovation.	The social care sector should assess its functioning and level of digitalisation compared to other sectors of the economy and where there are no impediments, adopt technological solutions for reaching the same or higher goals in terms of efficiency, but also quality of life of the assisted. Standards should take the whole social care environment into account, including the declared mission, the goals of care, the culture of care and the relationships established with other stakeholders, such as families, employment services, adult education, etc. Assessments of these standards should take into account the available economic resources.
Development & Innovation	Development and delivery of training for staff and management as well as end users.	Digital skills as part of the initial education of workers in the care sector, as well as lifelong learning opportunities and obligations. Qualified staff to support clients with disabilities in using personal ICT equipment and in developing digital skills. Opportunities for family members and carers to get familiar with the use of AT.	Care workers should have basic ICT skills and be aware of the importance of ICT and ICT-AT for the people they support. In each service there should be staff able to support clients in their ICT-AT use. The important role of family members and care workers in the effective use of ICT-AT and in the prevention of its abandonment should not be overlooked.

Phase	Objectives	Needs	Recommendations
Development & Innovation	Development of a truly person centred approach enhancing skills, participation and independence.	Individualised plans and pathways aiming at empowerment, independence, independent living and de-institutionalisation. Development of models of specialised ICT and ICT-AT service delivery to end users and other stakeholders (e.g. independent assistive technology centres).	The social care sector should find the right balance between human care and technology supported care, aiming at different but non incompatible goals: quality jobs, humanised care, personalised care solutions, care on demand. Persons with disabilities and older service users should be involved in designing and evaluating user-centered AT services.
	Implementation and management of change where needed, including communication and attitude change.	Action plans to implement change, with adequate timing, resources and monitoring strategies.	Developments in ICT towards ubiquity, personalisation, singularisation and digitisation will impact on the type and the way services are designed, delivered and evaluated. These opportunities will have to be embedded into service infrastructures. Services will be different and need new skills, new partnership and management structures, in particular when reaching out beyond traditional organisations into mainstream. Where social care providers do not have the resources internally, external support should be sought in the form of specialised professionals in ICT and ICT-AT and multidisciplinary teams for the selection and implementation of AT as well as for educating and training of staff.
Consolidation	Ongoing monitoring of results in terms of quality of life, cost-benefits and service efficiency.	Performance indicators for the sector as well as for single care providers. Tools for outcome measurement in terms of cost-benefit analysis, client and staff satisfaction, quality of life.	Only by demonstrating outcomes the social care sector will be able to become a driver of the digital economy. Organisations in the social care sector should become role models of ICT and ICT-AT driven inclusion reaching out into all domains of society.

Technology

Phase	Objectives	Needs	Recommendations
Assessment	Assessment of barriers and reporting of inaccessibility where it occurs at all levels and in all places (including media).	Multilingual tools and information channels for the reporting of inaccessible digital environments, products and services. Dialogue with industry to impact on the design of new technologies, making these as accessible as possible.	Both guidelines for web accessibility and monitoring tools are available and in some countries they are used on a permanent basis to assess web accessibility (e.g. the Netherlands). Other countries should follow.
Development & Innovation	Promotion of universal and user centred design and of accessible mainstream products and services.	Information and awareness regarding universal design and accessibility issues towards industry and the trainers of designers and developers.	Designers of products and services should systematically take human/user-centred design guidelines into account. Different guidelines are available and easy to find on the Internet.
	Promotion of the development, testing and diffusion of innovative technological solutions.	Feeding the innovation cycle with good and bad user experiences and with information on missing solutions, products and services. Political support to research and development programs in this field.	Unsolved issues regarding the accessibility of digital environments should be solved by creative innovation driven communities of users and developers. Individual needs should be recorded and used to define requirements that can impact on the accessibility and usability of future ICT systems with or without AT. Human-Machine Interaction (HMI) should be intuitive and interfaces should adapt to the person's needs and preferences. More attention to the whole user experience is needed in the design and development stage of products and services.
	Promotion of interoperability standards.	Awareness raising regarding interoperability issues among developers of hard and software solutions.	Interoperability standards exist and should be taken into account in all cases.

Phase	Objectives	Needs	Recommendations
Consolidation	Supporting the market uptake of innovative inclusive digital solutions for activity and participation of all.	Increased efforts to disseminate knowledge about existing solutions and the conditions for successful use. The creation of independent knowledge hubs to support people with disabilities to choose the most appropriate solutions for their needs and wishes.	

Policy

Phase	Objectives	Needs	Recommendations
Assessment	Assessment of gaps and barriers in legal and policy frameworks. Collection of good practice and data. Reporting.	Regular monitoring of the implementation of the UN Convention, in particular the articles related to universal design, accessibility and assistive technology. Collection of data on participation of people with disabilities in different sectors of public life and of the economy. Assessment strategies to trace the type of barriers to inclusion in different sectors and the potential role of (assistive) enabling technology to enhance inclusion. The systematic collection of outcomes and outcome studies related to policies in a certain area. Constant monitoring of the alignment of policies and laws with the UN Convention and with the digital inclusion agenda.	Governments have a key role in driving the inclusive digital agenda. Without high level support for digital inclusion and adequate policy frameworks, a lot of efforts will result in little effect. Assessment strategies will have to be defined that take into account differences between countries and regions, both in level of inclusiveness of policies and services, as well as in technological development of mainstream society.

Phase	Objectives	Needs	Recommendations
Development & Innovation	Development of policies, sector level strategies, implementation plans, monitoring tools.	Awareness raising among policy makers. Legitimisation of ICT-AT training in education and supported employment settings. Alliances with other stakeholder organisations at European, national, regional and local level. Structural collaboration with disabled people's organisations. Supportive governments, at all levels, particular national government and at a regional level, to help mainstream ICT-AT aided participation of people with disabilities in all realms of life and to develop appropriate strategies, implementation plans and monitoring tools. Advocacy for more appropriate funding schemes for Assistive Technology.	People with disabilities should be actively involved in all decisions regarding them. A core aim of technology adoption should be independence and allowing people to have choice. A comprehensive strategy to bridge the digital divide is needed for all countries and for all administrative levels, taking into account and combatting the different barriers, and investing in the empowerment of people. The strategies should involve organisations with a different focus: policy, education, welfare, employment, technology, research, digital economy, advocacy. Governing bodies (e.g. Ministries of Education, Ministries of Telecommunication, etc.) and local administrators should take the lead and coordinate appropriate action plans, allowing different actors to integrate their contributions to the strategies. Priority should be given to employment as paid and meaningful employment will increase people's wider inclusion in society.
Consolidation	Ongoing alignment of policies with changing global social, technological and educational scenarios.	Ongoing monitoring of the impact of technological development on the digital divide and the inclusive society.	Inclusiveness should be the touchstone for all policies and inspire all policy assessment frameworks.

This project as been funded
with the support from the
European Commission

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